

STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

Proceeding on Motion of the Commission to
Implement a Large-Scale Renewable
and a Clean Energy Standard

Case 15-E-0302

In the Matter of Offshore Wind Energy

Case 18-E-0071

**NYSDERDA COMMENTS ON PETITIONS REQUESTING PRICE
ADJUSTMENTS TO EXISTING CONTRACTS**

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1. Introduction

The New York State Energy Research and Development Authority (NYSERDA) offers these comments to the New York State Public Service Commission (Commission) in response to petitions by Empire Offshore Wind LLC and Beacon Wind LLC (Empire/Beacon), Sunrise Wind LLC (Sunrise), the Alliance for Clean Energy New York (ACE NY) and Clean Path New York LLC (CPNY, and together with Empire/Beacon, Sunrise and ACE NY, the Petitioners) requesting price adjustments to their contracts with NYSERDA for the sale of Renewable Energy Certificates (Petitions).¹

On August 1, 2016, the Commission issued its Order Adopting a Clean Energy Standard (2016 CES Order).² The Clean Energy Standard (CES) was designed to fight climate change, reduce air pollution, and ensure a diverse and reliable low-carbon energy supply. In establishing the CES, the Commission reaffirmed NYSERDA's role as the central clean energy procurement entity for the State of New York.

The Climate Leadership and Community Protection Act³ (Climate Act), which was signed into law in July of 2019, established State clean energy goals including that, among other targets, at least 70% of New York's electricity come from renewable energy sources such as wind and solar by 2030 (70x30) and that the State develop 9,000 megawatts (MW) of offshore wind by 2035 (9x35). Consequently, the CES programs were modified in 2020 via Commission Order⁴ (2020 CES Modification Order) to advance the new targets set forth in the Climate Act. NYSERDA, as administrator of the CES, supports the

¹ See Case 15-E-0302, Proceeding to Implement a Large-Scale Renewable Program and a Clean Energy Standard, Petition of the Alliance for Clean Energy New York to Address Post COVID-19 Impacts on Renewable Development Economics and Contract Considerations (filed June 7, 2023, revised June 12, 2023), Verified Petition for Expedited Approval of Enhanced Offshore Renewable Energy Credits (filed by Empire Offshore Wind LLC and Beacon Wind LLC on June 7, 2023, revised June 30, 2023), Verified Petition of Sunrise Wind LLC for an Order Authorizing the New York State Energy Research and Development Authority to Amend the Offshore Wind Renewable Energy Certificate Purchase and Sale Agreement (filed June 7, 2023) and Petition of Clean Path New York LLC to Address Post-Covid Impacts and Associated Considerations Concerning the Tier 1 Eligible Generation Component of Its Clean Energy Standard Tier 4 Renewable Energy Certificate Contract (filed June 14, 2023).

² Case 15-E-0302, Proceeding to Implement a Large-Scale Renewable Program and a Clean Energy Standard, Order Adopting a Clean Energy Standard (issued and effective August 1, 2016).

³ NYS Senate Bill 2019-S.6599 and NYS Assembly Bill 2019-A.8429; <https://climate.ny.gov/>

⁴ Case 15-E-0302, Proceeding to Implement a Large-Scale Renewable Program and a Clean Energy Standard, Order Adopting Modifications to the Clean Energy Standard (issued and effective October 15, 2020).

advancement of the 70x30 and 9x35 goals through the procurement of Renewable Energy Certificates (RECs) and Offshore Wind Renewable Energy Certificates (ORECs) (collectively, (O)RECs).

NYSERDA offers these comments for the Commission to consider in the context of the Petitions. Although there are differences among the requests sought by the Petitioners, the Petitions are all premised on recent adverse inflationary pressures impacting the global economy as a whole, with acuity in the renewable energy sector. NYSERDA has elected to address the substance of the Petitions filed by Empire/Beacon, Sunrise and ACE NY collectively in these comments as the most comprehensive, cohesive and efficient approach. These comments are not intended to address the Petition submitted by Clean Path New York (CPNY) in detail at this time but do provide some initial consideration of that Petition.⁵

These comments consist of the following:

- Summary of the CES portfolio
- Review of the market issues raised by the Petitioners
- Analysis of Petitioners' requested relief
- Discussion of the potential impacts of no price adjustment being provided
- Analysis of alternative price adjustments based on application of the inflation formulas from NYSERDA's 2022 CES procurements
- Summary of the potential impacts of the scenarios considered
- Additional policy considerations

2. Summary of Clean Energy Standard Portfolio and Group of Petitioners

NYSERDA's Tier 1, Offshore Wind (OSW), and Tier 4 programs under the Renewable Portfolio Standard and CES have awarded (O)REC purchase agreements to 138 projects totaling 15.3 gigawatts (GW), enough to supply 34.5% of New York State's estimated 2030 electric load using the 2020 Clean Energy Standard Order load projection of 151,678 GWh (2030 Statewide Load).⁶ With attrition experienced to date, these programs currently include 120 projects totaling 14.5 GW (33.2% of 2030 Statewide Load). Project details are provided in Appendix A.

It should be noted that attrition is typical in any large-scale renewable generation portfolio and indeed has been considered throughout the history of the CES. NYSERDA defines attrition as the termination of an executed (O)REC agreement or the cancellation or withdrawal of an (O)REC award. Upon establishing the original CES target of 50% renewable electricity by 2030 in the 2016 CES Order, an assumption of 10% attrition was factored into yearly anticipated procurement targets. When adopting the 70x30 target in the 2020 CES Modification Order, the assumption was updated to 20% attrition. To date, the NYSERDA Tier 1 portfolio has experienced approximately 6% attrition on a generation capacity basis. The OSW and Tier 4 programs have not experienced attrition to date.

⁵ Accordingly, unless stated otherwise, references to "Petitioners" and "Petitions" in Sections 3 through 8 below should be read to refer collectively to Empire/Beacon, Sunrise and ACE NY and their Petitions, respectively.

⁶ Large-scale Renewable Projects Reported by NYSERDA: Beginning 2004. <https://data.ny.gov/Energy-Environment/Large-scale-Renewable-Projects-Reported-by-NYSERDA/dprp-55ye>; Totals include projects awarded in Renewable Portfolio Standard (2013-2016) and CES (2017-2021) solicitations and account for the split of 2016 Hecate Energy Greene County 1 into three separate projects and the split of 2017 award Baron Winds into 2 separate projects. The Tier 4 capacity listed is the total capacity of Clean Path New York resources without Tier 1 awards to avoid double-counting.

In its January 2023 Strategic Outlook,⁷ NYSERDA estimated the State’s progress towards the 2030 CLCPA goal, including all existing, contracted, and awarded renewable generation, to be 66% of estimated 2030 Statewide Load. The Petitioners account for 91 projects in the current NYSERDA portfolio totaling 13.5 GW of renewable capacity, which would supply 24.6% of estimated 2030 Statewide Load. This includes the following breakdown: 4 OSW projects totaling 4.23 GW (11.8% of 2030 Statewide Load), 86 Tier 1 projects totaling 7.54 GW (10.0% of 2030 Statewide Load), and 1 Tier 4 transmission project totaling 1.75 GW (2.8% of 2030 Statewide Load).⁸

ACE NY petitioned on behalf of 86 Tier 1 projects in the NYSERDA portfolio, which total 7.54 GW (10.0% of 2030 Statewide Load). Of these, three Tier-1 eligible projects totaling 0.06 GW (0.1% of 2030 Statewide Load) were awarded in 2016 under the Renewable Portfolio Standard during the pendency of the adoption of the CES, 61 Tier 1 projects totaling 5.08 GW (6.9% of 2030 Statewide Load) were awarded under the CES and have fully executed agreements, and 22 Tier 1 projects totaling 2.41 GW (3.0% of 2030 Statewide Load) that were awarded as announced on June 9, 2022 but which as of the date of the ACE NY Petition had not yet fully executed agreements.

3. Review of Market Issues Raised by Petitioners

The Petitions cite an unexpected and unforeseeable rise in inflation and supply chain costs and constraints associated with, among other things, the COVID-19 pandemic and the Russian invasion of Ukraine. Furthermore, the Petitioners state that the increased costs have eroded internal rates of return and have therefore caused many in-development projects with NYSERDA awards to no longer be economically viable under existing contract pricing terms.

The ACE NY petition cites multiple “severe and unforeseeable economic disruptions since fall 2021,” including the COVID-19 pandemic, Russia’s invasion of Ukraine, and intractable supply chain bottlenecks and labor constraints. ACE NY refers to these factors as “Post-COVID impacts” and states they have led to multiple negative economic pressures and eroded the economic viability of projects awarded under previous Tier 1 solicitations. Specifically, ACE NY states in its petition:

- From 2017 to 2021, “overnight capital costs for solar and land-based wind projects were declining and conservative projections by reputable sources demonstrated it would have been reasonable and justifiable for developers to expect this downward trend to continue.” Inflation projections also remained low throughout this time period.
- The resulting Post-COVID Impacts caused inflation (PPI) levels to increase by approx. 10.7% and interest rates to climb to “more than twice as high as the highest annual average [Effective Federal Funds Rate] of 2.2% observed in any year for the ten-year period from 2011-2021.”
- Growing demand for renewable energy projects nationwide “has exacerbated inflation for renewable project cost components relative to broader inflation levels.”

Empire/Beacon similarly states in their petition that inflation has had a material negative impact on project viability for the offshore wind projects they are developing in New York, manifested by materially reduced internal rates of return. The petition states that “the principal drivers of the unforeseeable increases in Project costs are unprecedented global and regional supply chain bottlenecks, on top of the upward pressures on price due to the current global inflationary environment and increases in the cost of

⁷ Toward a Clean Energy Future: A Strategic Outlook 2023-2026 report, NYSERDA (January 2023); <https://www.nyscrda.ny.gov/About/Publications/Program-Planning-Status-Reports/Strategic-Outlook>

⁸ The CPNY Tier 4 project utilizes resources which may also have a Tier 1 contract. Including those resources, the CPNY project total size is 3.36 GW (5.2% of 2030 Statewide Load). However, it would be incorrect to include these resources as part of CPNY for the purposes of this tally as they would be double counted as both Tier 1 and Tier 4.

capital, driven by rising interest rates.” Furthermore, the petition cites public reports indicating increases in CPI and even higher increases in the prices of electrical equipment and increases in onshore wind PPA prices.

Sunrise states in its petition that unanticipated, extraordinary economic events beyond the projects’ control have upended its careful financial development planning including increases in capital costs in part due to increased nameplate capacity, increased component costs, and increased transportation and installation costs, all of which have eroded the internal rate of return for the project under its current contract with NYSERDA. The petition goes on to state that inflation has been significantly higher than the 2% assumed during Sunrise’s bid to NYSERDA and well above historical highs. Additionally, the Sunrise petition states that interest rate hikes have resulted in significant increases to the cost of capital necessary to finance the project and the resulting required financial return for investors. Sunrise states that supply chain disruptions are also impacting project development and that those disruptions, coupled with high demand from other markets, have significantly increased project material and equipment costs.

In summary, the three Petitions cited similar megatrends, including unforeseen inflation and supply chain bottlenecks, as the primary drivers of eroding renewable energy project economics and the underlying justification of the Petitions. This section analyzes the validity of these claims through NYSERDA’s internal analysis, as well as based on the review conducted by Industrial Economics⁹ (IEc) of both inflation and supply chain trends. IEc’s full findings are included in Appendix B of these comments.

3.1 Review of Historical Inflation and Inflation Expectations

The Petitions cite unusually high inflation as the primary reason why adjustments to existing contract terms are warranted. To evaluate this claim, IEc examined three key questions:

1. What was the trend in inflation between 2016 and early 2023 relative to inflation levels typically seen in the United States (i.e., near the Federal Reserve’s target of 2% annually)?
2. To what degree would the Petitioners have been able to anticipate such unusually high inflation based on inflation forecasts available at the time of their proposal submissions?
3. What were the causes of any unusually high inflation over this time period, and are these causes consistent with representations made by the Petitioners?

In conducting its analysis, IEc relied on multiple metrics to review claims pertaining to inflation, including:

- Measures of economy-wide inflation over the 2016-2023 period. These include, but are not limited to, the Gross Domestic Product Implicit Price Deflator (GDP Deflator) published by the Bureau of Economic Analysis (BEA), the Producer Price Index (PPI), and price indices designed to track the costs of labor and of construction projects of which labor is a major cost component.
- Prices specific to renewable energy investments which include commodities and raw materials used specifically in utility scale solar, onshore wind, and offshore wind projects.
- Renewable power purchase agreement (PPA) price trends.

⁹ Industrial Economics, Incorporated (IEc) provides subject matter expert analysis to government decision makers and regulators, corporate strategic partners, trade associations, and other clients. IEc’s qualifications and experience are further discussed in Appendix B. <https://indecon.com/>.

Accordingly, the IEc analysis yields several main conclusions about inflation since 2016 and its impact on renewable energy projects:

- **High inflation was prevalent from mid-2021 through mid-2023 across the renewable energy supply chain and was largely unexpected for projects solicited between 2016 and 2020** – While input prices have stabilized in 2023, they are still higher than what was forecasted prior to the inflationary period. A counterfactual analysis shows that, in early 2023, the actual price level, as measured by the GDP Deflator, was 9% higher than it would have been had inflation remained at 2% between January 2021 and March 2023.
- **Inflation was significantly higher than normal between 2021 and early 2023**– Inflation of goods, services, labor, and key components relevant to solar, onshore wind, and offshore wind projects all increased between 2021 and early 2023 by more than what pre-2021 trends indicated. The main drivers of inflation over this period materialized after a period of severe and unprecedented economic uncertainty; large swathes of the U.S. economy remained locked down throughout 2020 and effective COVID-19 vaccines were distributed in early 2021.
- **Extent of inflation was unforeseeable for project developers** – Given actual inflation data, inflation expectations at the time, and the Federal Reserve’s actions that Petitioners bidding between 2016 and 2020 observed, it is reasonable to conclude that the high and persistent inflation that followed in 2021-2023 was unforeseeable for the solicitations occurring between July 2016 and October 2020. For projects bid in August 2021, based on inflation data in inflation forecasts available at the time, it would have been realistic for developers to expect short-term and long-term levels of inflation that were higher than what could have been reasonably predicted prior to 2021 (i.e., higher than inflation observed between 2016 and early 2021 and higher than the Fed’s target of 2% per year) but lower than the observed price increases that followed after August 2021. The inflation that occurred in late 2021 and through 2022 was significantly higher than what forecasters were predicting as of August 2021.

IEc concludes that its independent analysis is “consistent with the representations made by the Petitioners that the inflation observed between 2021 and 2023 was unpredictably high and persistent.”

3.2 Review of Renewable Energy Supply Chain Dynamics

In agreement with Petitioners’ claims that supply chain bottlenecks are a key contributor to higher renewable energy prices, IEc’s analysis concludes that “supply chain constraints [do] threaten the financial viability of renewable energy projects.” The IEc report attached in Appendix B goes on to explain that:

“Significant tension between two economic forces is pushing renewable energy development prices in opposite directions. On one hand, prices of frontier technologies such as those used in renewable energy generation typically decrease over time, as industries mature, achieve economies of scale, and incentivize competitors to join the market. On the other hand, persistent supply chain constraints and inflationary pressures in renewable energy sectors are pushing prices higher and could potentially offset or outweigh the secular downward trend in prices driven by efficiency gains in these sectors. It is uncertain if supply will keep pace with the heightened global demand for clean energy to alleviate the inflationary pressures specific to solar, onshore wind, and offshore wind development.”¹⁰

¹⁰ Appendix B, page 5 and page 36.

Indeed, power purchase agreements (PPAs) for wind power in North America increased on average by ~142%, and for solar power by ~64%, between the third quarter of 2018 and the second quarter of 2023 according to offer price data compiled by LevelTen Energy and referenced in the IEc report in Appendix B.¹¹ These price increases are partly due to general inflation and other drivers, but another notable contributing factor are supply chain dynamics, which differ across various renewable energy technologies. As described by IEc, “constrained supply chains cannot match the insatiable global demand for renewable energy, resulting in higher costs for solar, onshore wind, and offshore wind projects.”¹²

In the solar industry, solar modules have experienced significant additional headwinds due to module pricing and deliverability uncertainty as a result of trade policy, specifically a U.S. Department of Commerce (DOC) investigation into circumvention of anti-dumping and countervailing duties by suppliers in four Southeast Asian countries, for which the DOC issued its final determination on August 17, 2023, and the detention of modules in U.S. ports of entry as a result of the Uyghur Forced Labor Prevention Act. Both of these actions have increased demand for unaffected modules and source components resulting in higher pricing and extended delivery schedules for solar projects including several Tier 1 projects that commenced construction in 2022. IEc concludes that the “domestic solar industry has had to navigate varying and unpredictable trade policy actions [...] to impose tariffs on imports first from China and then from other Southeast Asian nations,” and describes these issues as potential ongoing headwinds for utility-scale solar development due to the fact that the supply chain of solar components is concentrated and vulnerable to disruptions in China. Seven of the top ten suppliers of polysilicon are based in China and collectively hold 80% of global polysilicon capacity.¹³ The exposure for American developers is particularly worrisome given the ongoing economic disputes between China and the U.S.^{14,15} And while the Inflation Reduction Act of 2022 is intended to provide economic incentives for the United States to create energy independence via the creation of solar supply chain manufacturing, it will likely take several years to stand-up the supply chain required to supply the Tier 1 portfolio due to the amount of the solar supply chain currently controlled by the rest of the world.

The offshore wind industry is witnessing constrained supply chains as well, albeit different from those applicable to the solar industry. IEc researched the supply chain dynamics of offshore wind development and concluded that “the supply chain constraints observed between 2021 and 2023 were unexpected and that these constraints are likely to persist until at least 2030.” In Europe, for example, Russia’s invasion of Ukraine in early 2022 drove several European countries to heighten their energy security and energy independence policies, including the rapid acceleration of renewable energy deployment (e.g. the REPowerEU plan and European Gas Demand Reduction Plan developed by the European Commission in 2022). IEc argues that ambitious and increasing government targets in the U.S. and Europe for clean

¹¹ PPA Price Index Executive Summary North America, Q2 2023. 2023. *LevelTen Energy*.

<https://www.leveltenenergy.com/ppa>

¹² Appendix B, page 37.

¹³ Bettoli, A., et al. (2023, February 17). Renewable-energy development in a net-zero world: Disrupted supply chains. *McKinsey and Company*. <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/renewable-energy-development-in-a-net-zero-world-disrupted-supply-chains>.

¹⁴ Lin, L. (2023, August 11). *China's Options for Retaliation Are Few After U.S. Investment Ban*. The Wall Street Journal. <https://www.wsj.com/articles/chinas-options-for-retaliation-are-few-after-u-s-investment-ban-f539102e?page=1>.

¹⁵ Liang, A., N. Marsh. (2023, August 2). Gallium and germanium: What China’s new move in microchip war means for world. *British Broadcasting Corporation*. https://www.bbc.com/news/business-66118831?at_campaign_type=owned&at_objective=awareness&at_ptr_type=email&at_ptr_name=salesforce&at_email_send_date=20230808&at_send_id=3958514&at_link_title=Type-Article_Name-Gallium+and+germanium+What+Chinas+new+move+in+microchip+war+means+for+world_Sponsor-Undefined_Social-Website_Topic-Semiconductors_Value-Free_Event-Undefined_Language-en_Placement-4_Location-hyperlink&at_bbc_team=crm.

energy generation by the end of the decade have been increasing the demand for offshore wind and that growing global demand for offshore wind is expected to outpace supply of key components and exacerbate existing supply chain constraints. These bottlenecks are evident across the entire offshore wind supply chain, including turbines, vessels and foundations.

At the same time, as further described below, offshore wind Original Equipment Manufacturers (OEMs) are facing severe financial pressures due to the inflationary and supply chain bottlenecks described above and are responding by including some form of inflation adjustment or commodity index in their contracts with developers as a way of hedging manufacturing cost risks.

Since May 2022, there has been considerable coverage of the offshore wind industry's operating challenges and considerable net losses, with a particular focus on the performances of Siemens Gamesa, Vestas, and GE, among others. Reporting on the industry's underwhelming financial performance has come from mainstream media outlets (the New York Times, Washington Post and BBC), financial outlets (including the Financial Times, Bloomberg, CNBC and Barron's), and industry-specific outlets (Windpower Monthly, Recharge and reNews).

Reuters¹⁶ – covering Siemens Energy's announcement that quality issues in Siemens Gamesa's recent wind turbine models are expected to cost the firm at least \$1 billion – noted that Vestas (€1.57 billion euros), GE (€2.05 billion), Siemens Gamesa (€0.94 billion) and Nordex (€0.5 billion) had combined losses exceeding 5 billion euros in 2022. Coverage in The New York Times,¹⁷ CNBC,¹⁸ and Financial Times¹⁹ highlighted how many of the financial headwinds causing Siemens Gamesa, Vestas and GE's sizable losses were industry-wide issues, including rising costs for labor, materials and shipping; supply chain crunches; lengthy project approvals; and increasing competition from China. Highlighting the price-and-demand issues facing offshore wind manufacturers, the Chief Executive of Vestas was quoted by the New York Times²⁰ stating that the company takes an 8% loss on each turbine sold. In looking at major offshore wind manufacturers' 2023 performance to-date and future guidance, many outlets reported on continued negative outlooks. For example, Bloomberg²¹ reported that Siemens Energy expects €4.5 billion in net losses in 2023, driven by the poor performance of Siemens Gamesa, while Windpower Monthly²² reported that continued losses are harming the firm's investment. Similarly, Seeking Alpha²³ covered Vestas' reported net loss of €115 million in Q2 2023 (compared with a net loss of €119 million in

¹⁶ Reuters (July 7, 2023). Analysis: Siemens Energy's turbine troubles rattle wind sector.

<https://www.reuters.com/business/energy/siemens-energys-turbine-troubles-rattle-wind-sector-2023-07-07/>

¹⁷ New York Times (August 7, 2023). Offshore Wind Runs Into Rising Costs and Delays.

<https://www.nytimes.com/2023/08/07/business/offshore-wind-costs-delays.html>

¹⁸ CNBC (April 27, 2023). From GE to Siemens, the wind energy industry hopes billions in losses are about to end.

<https://www.cnbc.com/2023/04/17/from-ge-to-siemens-wind-energy-hopes-its-crisis-is-about-to-end.html>

¹⁹ Financial Times (January 29, 2023). Europe's wind industry flags further weakness in 2023 despite energy demand. <https://www.ft.com/content/74ff8ff7-8009-413a-8f2e-2a3c34695d78>

²⁰ The New York Times (November 22, 2022). Europe's Wind Industry Is Stumbling When It's Needed Most.

<https://www.nytimes.com/2022/11/22/business/wind-power-europe.html>

²¹ Bloomberg (August 7, 2023). Siemens Energy Sees €4.5 Billion Hit, Wind Losses Prompt Review.

<https://www.bloomberg.com/news/articles/2023-08-07/siemens-energy-reviews-wind-business-on-seeing-4-5-billion-loss#xj4y7vzkg>

²² Windpower Monthly (April 25, 2023). Continuing losses 'may derail investments needed for EU wind goals' – Siemens Gamesa. <https://www.windpowermonthly.com/article/1820687/continuing-losses-may-derail-investments-needed-eu-wind-goals-%E2%80%93-siemens-gamesa>

²³ Seeking Alpha (August 9, 2023). Vestas posts Q2 earnings miss but keeps full-year sales guidance.

<https://seekingalpha.com/news/3999925-vestas-posts-q2-earnings-miss-but-keeps-full-year-sales-guidance>

Q2 2022), and reNews²⁴ noted that GE Vernova filed a loss of \$359 million in Q2 2023 (compared with a loss of \$419 million in Q2 2022). In related coverage, Reuters²⁵ noted that GE Vernova’s last profitable quarter was Q3 2020.

In response to continued losses and increasing cost pressures, offshore wind turbine manufacturers – and developers – have begun shifting their pricing structure to be more closely aligned, or even indexed, to inflation. While previous wind turbine orders were not necessarily indexed to inflation (CNBC),²⁶ Reuters²⁷ reported that wind turbine manufacturers have attempted to mitigate the impact of higher inflation by raising prices, noting that Vestas and Siemens Gamesa have increased their average selling prices by 10+ percentage points over the past year²⁸. In Massachusetts, CommonWealth Magazine²⁹ reported that every offshore wind developer and equipment supplier, including Siemens Gamesa, Vestas and GE, advocated in filings with the state’s Department of Energy Resources for the integration of a mechanism to adjust prices in line with inflation and interest rate hikes.

3.3 Review of Interest Rates Expectations

In addition to inflation and supply chain constraints, Petitioners pointed to the sharp increase in interest rates since the time of bid which have led to higher cost of capital to finance projects, and ultimately impact the economic viability of projects. IEC reviewed these claims in Appendix B and concluded the following:

“In our view, it would not have been reasonable for developers to assume stability in interest rates at the time of their bids. In contrast to inflation, which the Fed seeks to keep at or near the 2 percent target, interest rates are subject to change due to both market conditions (e.g., based on the outlook for the U.S. economy) and policy changes by the Fed to manage inflation and keep the economy at or near full employment. The four-year period prior to the COVID-19 pandemic illustrates that interest rates are subject to change over a relatively short period of time [...] [and] are also within historical norms [...] Similarly, the rate at which interest rates recently changed is alsoprecedented, with historical examples including the sharp decline in the Federal Funds rate between July 2007 and November 2008, the decline between December 2000 and December 2001, and the increase in the Federal Funds rate between July 1980 and December 1980.”³⁰

Based on that analysis, it does not appear reasonable for developers to have assumed that a low interest rate environment would persist throughout the period in which their projects were to be financed, given that both the levels of interest rates witnessed today and the rate at which rates recently changed are indeedprecedented.

²⁴ reNews (July 25, 2023). GE Vernova closes Q2 losses at renewables business. <https://renews.biz/87173/ge-vernova-closes-q2-losses-at-renewables-business/>

²⁵ Reuters (January 24, 2023). GE profit forecast disappoints amid troubles at renewable energy business. <https://www.reuters.com/business/ge-forecasts-weak-2023-profit-2023-01-24/>

²⁶ CNBC (July 3, 2023). Wind turbine troubles have sent one stock tumbling. There are fears it could be a much wider issue. <https://www.cnbc.com/2023/07/03/siemens-energy-wind-turbine-problems-could-be-an-industry-wide-issue.html>

²⁷ Reuters (June 23, 2023). Explainer: Why the wind power industry has hit turbulence. <https://www.reuters.com/business/energy/why-wind-power-industry-has-hit-turbulence-2023-06-26/>

²⁸ Reuters (May 5, 2022). Focus: Wind turbine makers struggle to find pricing power. <https://www.reuters.com/business/energy/wind-turbine-makers-struggle-find-pricing-power-2022-05-05/>

²⁹ CommonWealth Magazine (March 13, 2023). Offshore wind industry united on pricing adjustments. <https://commonwealthmagazine.org/energy/offshore-wind-industry-united-on-pricing-adjustments/>

³⁰ Appendix B, page 54.

3.4 Approaches to Economically Challenged Renewable Energy Projects in Other Jurisdictions

In addition to the analysis above, IEC performed a survey of publicly available data to identify other markets in which price relief due to inflationary pressures have been submitted for renewable projects. Their report includes a summary of the inflationary relief sought, cost estimates where available, and the key decisions made by the relevant authorities in each jurisdiction.

Requests for inflationary relief on clean energy projects have been submitted in several jurisdictions across the U.S. including, but not limited to, California, Connecticut, Hawaii, Indiana, Maine, Maryland, Massachusetts, Michigan, New Jersey, New Mexico, and Rhode Island. Affected technologies included offshore wind, solar, and storage. The outcomes of the requests vary across jurisdictions due to the statutory structure under which they were procured and/or contracted. The number of similar requests in other jurisdictions, each with their own unique renewable energy incentive programs and goals, shows the industry-wide impacts of these inflationary pressures and indicates that the Petitions submitted to the Commission are not the result of market conditions that are specific to New York. While project-specific summaries are provided in the attached IEC memo in Appendix B, IEC found in summary that:

- ***Requests for inflationary relief are not unique to New York:*** Requests for inflationary relief on clean energy projects have been submitted in several jurisdictions across the U.S. for a variety of clean energy technologies. Thus, New York's receipt of the Petitions from project developers is unlikely to reflect any characteristics specific to the State's clean energy programs but instead is consistent with contemporaneous requests in other jurisdictions.
- ***Processes and outcomes vary across jurisdictions:*** The requests for relief and subsequent responses of state governing bodies do not follow a consistent pattern across jurisdictions. For example, petitions were approved in some jurisdictions and rejected in others. Similarly, in some jurisdictions the state legislature intervened to provide relief through legislation, while legislatures in other jurisdictions took no action. Factors such as deadlines for reaching renewable energy targets, the amount of relief requested, the flexibility that state decision-making authorities had to change contract terms, and the willingness of these decision-making bodies to let projects be withdrawn played a role in the outcomes seen across jurisdictions.
- ***In some cases, projects have been withdrawn:*** Although outcomes for inflationary relief have varied across projects and jurisdictions, some projects have been withdrawn. This confirms that inflationary pressures, at least in some cases, have adversely affected the economic viability of projects.

In addition to addressing unforeseen inflation of existing contracted projects, some jurisdictions have recognized the unforeseen inflationary environment and implemented an inflation adjustment mechanism for future projects. For example, New Jersey and Ireland have included inflation adjustment mechanisms in their latest offshore wind solicitations launched in 2023. Connecticut and Massachusetts are evaluating inclusion of similar inflation adjustment mechanisms in their upcoming offshore wind solicitations, expected to launch later in the year.

3.5 Conclusion of Market Dynamics Review

In conclusion, review of the Petitioners' claims through NYSERDA's internal analysis with support of the independent information provided by IEC shows that the costs to develop clean energy generation projects have increased materially. These market conditions, driven in large part by increased demand for raw materials, an increased demand for large-scale renewable energy caused primarily by the COVID-19 pandemic and the war in Ukraine, as well as supply chain constraints and bottlenecks, are unprecedented

in recent history, outside of reasonable developer control, and were unforeseeable at the time of each bid. These renewable energy market conditions are global in nature, and their impacts are not unique to New York.

With regards to petitioners' claims that high interest rates were unforeseen, it does not appear reasonable for developers to have assumed that a low interest rate environment would persist throughout the period in which their projects were to be financed, given that the levels of interest rates witnessed today are indeed precedented.

4. Analysis of Petitioners' Requested Relief

This section describes the relief requested in each Petition, along with NYSERDA's analysis of the change in strike prices³¹ that would occur if the relief were approved by the Commission, offered to developers, and implemented in NYSERDA's contracts.³²

In summary, the Petitioners proposed the following adjustments, which are described in further detail below:

- Sunrise requested that an inflation adjustment and interconnection cost adjustment mechanism similar to those included in NYSERDA's third OSW solicitation, ORECRFP22-1 (NY3), be applied to its price. As shown below, the interconnection cost adjustment is estimated to have a significantly smaller impact on price than the inflation adjustment.
- Empire/Beacon requested multiple adjustment mechanisms, namely (i) an inflation adjustment similar to that offered in NY3, but applying higher weighting resulting in a greater adjustment and different milestone adjustment dates, (ii) a CPI-based escalator for the duration of the contract tenor of the Empire Wind 2 and Beacon Wind agreements, (iii) an interconnection cost adjustment similar to that proposed by Sunrise but with a higher weighting, leading to a larger adjustment, and (iv) an extension of the contract term of the Empire Wind 1 agreement. As shown below, these requested adjustments lead to a materially higher increase in price than those requested by Sunrise.
- ACE NY proposed price adjustment mechanisms for solar and onshore wind projects based on changes in technology-specific indices and interest rates. As discussed further below and in subsequent sections, these proposed adjustments result in a significantly greater price adjustment than those that would result if the inflation adjustment formula in the 2022 Tier 1 solicitation, RESRFP22-1 (22T1) were applied.

4.1 Requested Relief – Sunrise Wind

Sunrise Wind proposes amending its agreement with NYSERDA to incorporate inflation and interconnection cost adjustments comparable to those included in NY3. The details of the NY3 inflation adjustment mechanism are described below in Section 6.

³¹ All projects that are the subject of the Petitions use index (O)REC pricing, and therefore the strike price is the variable that would be adjusted by a pricing adjustment.

³² As administrator of the CES, NYSERDA retains authority to modify contracts in a reasonable manner due to issues that arise in the course of project development and implementation. However, the pricing of the contracts was established by a competitive process whose parameters were set forth by Commission orders and given the material implications of the requested relief on pricing, it would be inappropriate for NYSERDA to proceed with offering any material amendments to pricing terms without express authorization from the Commission.

Second, Sunrise Wind proposes allowing for a unitized value representing 75% of the project’s incremental interconnection costs to be added to the OREC strike price. Sunrise Wind references projected interconnection and transmission upgrade costs of \$22 million at the time the project was proposed. Sunrise Wind proposes to use this \$22 million value as the baseline for an interconnection cost adjustment and indicates that the current cost estimate to interconnect the project is \$115 million.

4.2 Requested Relief – Empire/Beacon

Empire/Beacon proposes amending its agreements with NYSEDA for Empire Wind 1, Empire Wind 2 and Beacon Wind to incorporate multiple adjustment mechanisms. First, for all three projects, Empire/Beacon proposes to utilize an inflation adjustment mechanism similar to that in NY3, with the sum of the weights of the index components increased to 100% from 80%, eliminating the 20% fixed component in the NY3 formula:

$$\begin{aligned}
 OREC_{adj} = OREC_{bid} & \\
 & \times \left(0.375 \times \frac{Index_{\tau Labor}}{Index_{\beta Labor}} + 0.3125 \times \frac{Index_{\tau Fabrication}}{Index_{\beta Fabrication}} + 0.125 \times \frac{Index_{\tau Steel}}{Index_{\beta Steel}} \right. \\
 & \left. + 0.125 \times \frac{Index_{\tau ULSD}}{Index_{\beta ULSD}} + 0.0625 \times \frac{Index_{\tau Copper}}{Index_{\beta Copper}} \right)
 \end{aligned}$$

where:

$OREC_{adj}$ is the Index OREC Strike Price after adjustment

$OREC_{bid}$ is the Index OREC Strike Price included in the applicable OREC Agreement

$Index_{\beta}$ (for each commodity or component) is the average of the last six months or two quarters of published data available as of the final request for proposals (RFP) revision prior to the Proposal Submission Deadline

$Index_{\tau}$ (for each commodity or component) will be calculated as the average of the monthly or quarterly values for the six months prior to the date this Petition is filed time of the Petition (for Empire Wind 1 and Empire Wind 2) or the date the Project receives approval of its Construction and Operations Plan (COP) from BOEM (for Beacon Wind)

For Empire Wind 1 and Empire Wind 2, Empire/Beacon proposes to apply the inflation adjustment based on the date of its Petition (June 7, 2023), rather than the average of the three months before and after COP approval as is used for the NY3 mechanism. For Beacon Wind, Empire/Beacon proposes to apply the inflation adjustment based on the date of COP approval, currently expected in 2025. In both cases, Empire/Beacon proposes that the adjustment milestone index values will be calculated as the average of the monthly or quarterly values for the six months prior to the relevant date.

Second, Empire/Beacon proposes to add an annual escalator to the Empire Wind 2 and Beacon Wind agreements that would adjust the OREC strike price each year during the contract tenor based on a CPI escalator:

$$OREC_{Contract Year} = OREC_{Contract Year-1} \times \left(1 + \frac{1}{2} CPI_{Contract Year-1} \right)$$

where:

$OREC_{Contract Year}$ is the Index OREC Strike Price in the current Contract Year

$OREC_{Contract Year-1}$ is the Index OREC Strike Price during the preceding Contract Year

Third, Empire/Beacon proposes to apply the NY3 interconnection cost and savings sharing adjustment mechanisms to all of its three projects. The proposed Interconnection Cost Allocation Baselines are \$48 million for Empire Wind 1, \$358 million for Empire Wind 2 and \$83 million for Beacon Wind. Empire/Beacon provided the following information regarding current estimates of interconnection costs to NYSERDA, emphasizing that these are estimates only and may change: (i) for Empire Wind 1, \$53 million; (ii) for Empire Wind 2, interconnection costs are still quite uncertain but are expected to fall within a range of \$620 million to \$720 million; for Beacon Wind, \$200 million. Empire/Beacon proposes that a unitized value representing 80% of the project’s incremental interconnection costs be added to the OREC strike price.

Fourth, for Empire Wind 1 only, Empire/Beacon proposes to extend the term of the agreement by 5 years, from 25 years to 30 years, while extending the Outer Limit Date in the agreement by 5 years as well.

4.3 Requested Relief – ACE NY

ACE NY’s proposed price adjustment mechanisms are differentiated by technology. Different formulas are proposed for solar and land-based wind.

4.3.1 Requested Relief – ACE NY: Solar Adjustment Mechanism

The proposed solar adjustment mechanism formula is:

$$REC_{adj} = REC_{orig} \times \left(0.40 \times \frac{Index_{T,Mod}}{(1 + MEF) \times Index_{B,Mod}} + 0.17 \times \frac{Index_{T,EPSTM}}{Index_{B,EPSTM}} + 0.20 \times \frac{Index_{T,Steel}}{Index_{B,Steel}} + 0.23 \times \frac{Index_{T,Construction}}{Index_{B,Construction}} \right) \times Adj_{IDC} \times Adj_{TL}$$

where:

REC_{adj} is the Index REC Strike Price after adjustment

REC_{orig} is the Index REC Strike Price included in the applicable REC Agreement

$Index_B$ (for each commodity or component) is the average of the last six months of published data available prior to the Bid Proposal Submission Deadline

$Index_T$ (for each commodity or component) will be calculated as the average of the monthly values for the six-month period comprising the three months prior to and following the commencement of Construction Activities

MEF is the Module Expectation Factor

ADJ_{IDC} is the adjustment factor for interest during construction

ADJ_{TL} is the adjustment factor for term loan interest

This formula applies an adjustment to 100% of the initial strike price using a composite of indices specified by ACE NY. The following table identifies the publicly available index or market price that would be used for each commodity or component.

Table 1. ACE NY Solar Price Adjustment Components

Component	Full Title and Source
Module (Mod)	Annual photovoltaic module shipments, average value (dollars per peak watt). Form EIA-63B, Table 3
EPSTM	Electric power and specialty transformer mfg (PCU335311335311) Bureau of Labor Statistics, PPI Industry Data
Steel	Steel product mfg from purchased steel (PCU3312--3312--) Bureau of Labor Statistics, PPI Industry Data
Construction	New nonresidential building construction, Northeast (PCU2365002365001) Bureau of Labor Statistics, PPI Industry Data

Additionally, ACE NY has proposed that the module index should be further adjusted to account for the difference between how much bidders expected that the index would decrease in the future at the time of each solicitation. ACE NY provided values for this “Module Expectation Factor” in the 2017, 2019 and 2021 solicitations in the Petition and provided values for the other solicitations to NYSERDA. The factor for each solicitation is listed below:

Table 2. Module Expectation Factors by Solicitation

Solicitation	Module Expectation Factor
3257	-35%
RESRFP17-1	-45%
RESRFP18-1	-44%
RESRFP19-1	-45%
RESRFP20-1	-37%
RESRFP21-1	-20%

Finally, ACE NY proposes the inclusion of two adjustment factors based on interest rates, as indicated by the Effective Federal Funds Rate (“EFFR”). The following formulas are derived from paragraph 65 of the PA Affidavit.

$$Adj_{IDC} = 1 + 0.7 \times (Index_{T,EFFR} - Index_{B,EFFR})$$

$$Adj_{TL} = 1 + 1.3 \times (Index_{T,EFFR} - Index_{B,EFFR})$$

For purposes of the $Index_T$ and $Index_B$ values for the EFFR, NYSERDA calculated the average of the daily rates during the six-month averaging periods as published by the Federal Reserve Bank of New York.³³

4.3.2 Requested Relief – ACE NY: Land-Based Wind Adjustment Mechanism

The proposed land-based wind adjustment mechanism formula is:

³³ Federal Reserve Bank of New York. (2023, August). *Effective Federal Funds Rate*. The Federal Reserve. <https://www.newyorkfed.org/markets/reference-rates/effr>

$$REC_{adj} = REC_{orig} \times \left(0.52 \times \frac{Index_{T,EPSTM}}{Index_{B,EPSTM}} + 0.19 \times \frac{Index_{T,Steel}}{Index_{B,Steel}} + 0.15 \times \frac{Index_{T,Turbine}}{Index_{B,Turbine}} + 0.08 \times \frac{Index_{T,Construction}}{Index_{B,Construction}} + 0.06 \times \frac{Index_{T,Cement}}{Index_{B,Cement}} \right) \times Adj_{IDC} \times Adj_{TL}$$

where:

REC_{adj} is the Index REC Strike Price or Fixed OREC Price after adjustment

REC_{orig} is the Index REC Strike Price or Fixed OREC Price included in the applicable REC Agreement

$Index_B$ (for each commodity or component) is the average of the last six months of published data available prior to the Bid Proposal Submission Deadline

$Index_T$ (for each commodity or component) will be calculated as the average of the monthly values for the six-month period comprising the three months prior to and following the commencement of Construction Activities

ADJ_{IDC} is the adjustment factor for interest during construction

ADJ_{TL} is the adjustment factor for term loan interest

This formula also applies an adjustment to 100% of the initial strike price using a composite of indices specified by ACE NY and is similar to the proposed solar adjustment mechanism, with a different technology-specific composite of indices and without the Module Expectation Factor adjustment. The following table identifies the publicly available index or market price that would be used for each commodity or component.

Table 3. ACE NY Wind Price Adjustment Components

Component	Full Title and Source
EPSTM	Electric power and specialty transformer mfg (PCU335311335311) Bureau of Labor Statistics, PPI Industry Data
Steel	Steel product mfg from purchased steel (PCU3312--3312--) Bureau of Labor Statistics, PPI Industry Data
Turbine	Turbine and turbine generator set units mfg (PCU333611333611) Bureau of Labor Statistics, PPI Industry Data
Construction	New nonresidential building construction, Northeast (PCU2365002365001) Bureau of Labor Statistics, PPI Industry Data
Cement	Cement and concrete product manufacturing (PCU3273—3273--) Bureau of Labor Statistics, PPI Industry Data

4.4 Impact of Requested Relief on Strike Prices

Set forth below is NYSERDA’s analysis of the impact on strike prices of the relief requested by Sunrise, Empire/Beacon, and ACE NY, including a description of the methodology and assumptions used to calculate these results.

4.4.1 Requested Relief Strike Price Estimates: Methodology and Assumptions

Based on the information presented in the Petitions, NYSERDA calculated the impact on strike prices of implementing the requested relief described above based on the latest publicly available data for each

applicable index. For Empire Wind 1 and Empire Wind 2, the analysis below assumes adjustment as of the Petition date, as proposed by Empire/Beacon. For the other agreements (whose proposed milestone adjustment dates have not yet occurred), the analysis presented below utilizes the average of the values for the most recent six months of available data for each applicable index as a proxy for the assumed value of the index as of the adjustment date.

The price adjustment mechanisms requested by the Petitioners are linked to commodity index trends, and they therefore can result in either an increase in the strike price or a decrease in the strike price, depending on whether the composite index is higher or lower at the adjustment milestone than at the time of bid submission. In all cases - except for Empire/Beacon's proposal regarding Empire Wind 1 and Empire Wind 2 - the milestone adjustment dates have not yet occurred. If the indices decrease below the baseline values, the strike prices would decrease from their original values, further benefiting ratepayers. Inversely, to the extent that these indices increase, the strike prices would increase (which would increase ratepayer cost commensurate with commodity index changes but would help protect project economics and allow projects to develop as planned).

Historically, the indices have moved up and down, as shown in the following figures. The ACE NY solar composite index figure does not include the effect of the Module Expectation Factor, and the interest rate adjustments index is shown separately.

Figure 1. Offshore Wind Indices in Requested Relief

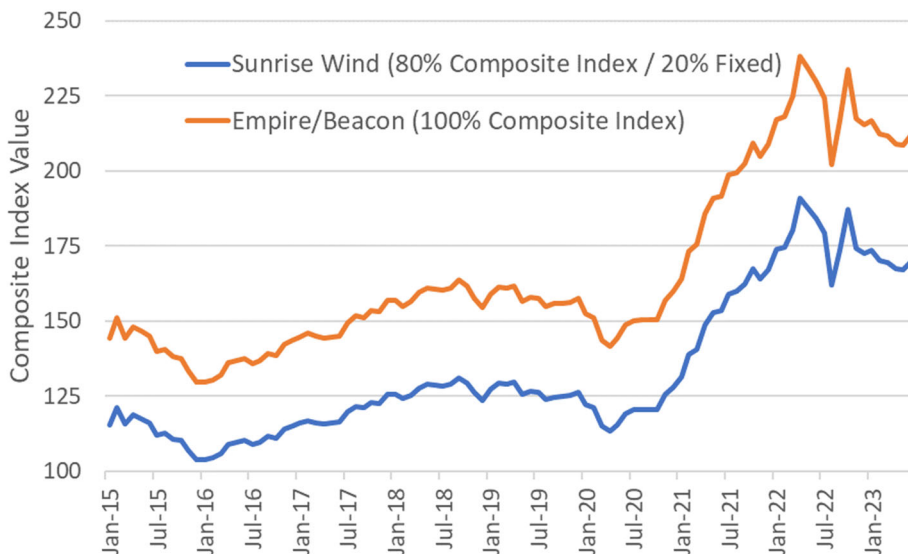


Figure 2. ACE NY Solar Composite Index

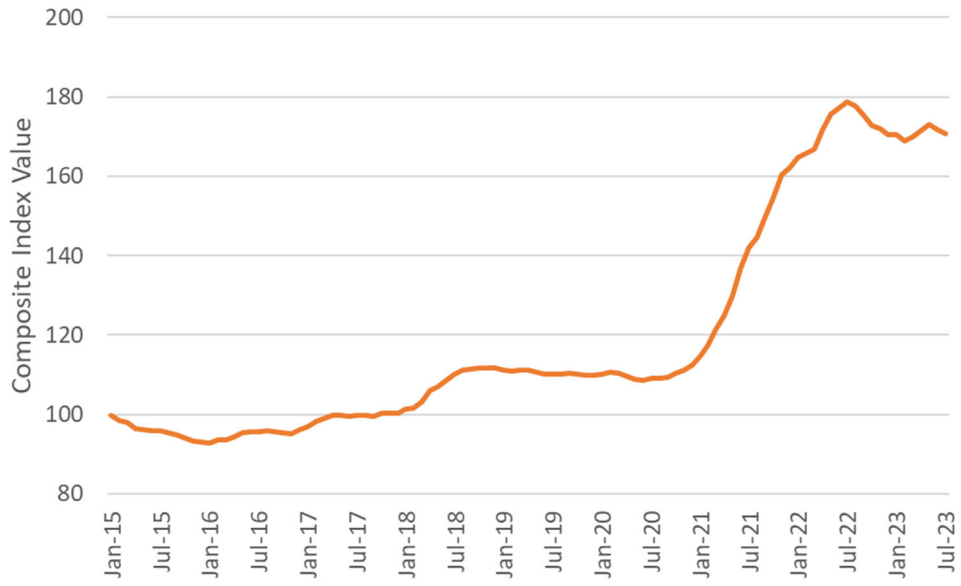


Figure 3. ACE NY Wind Composite Index

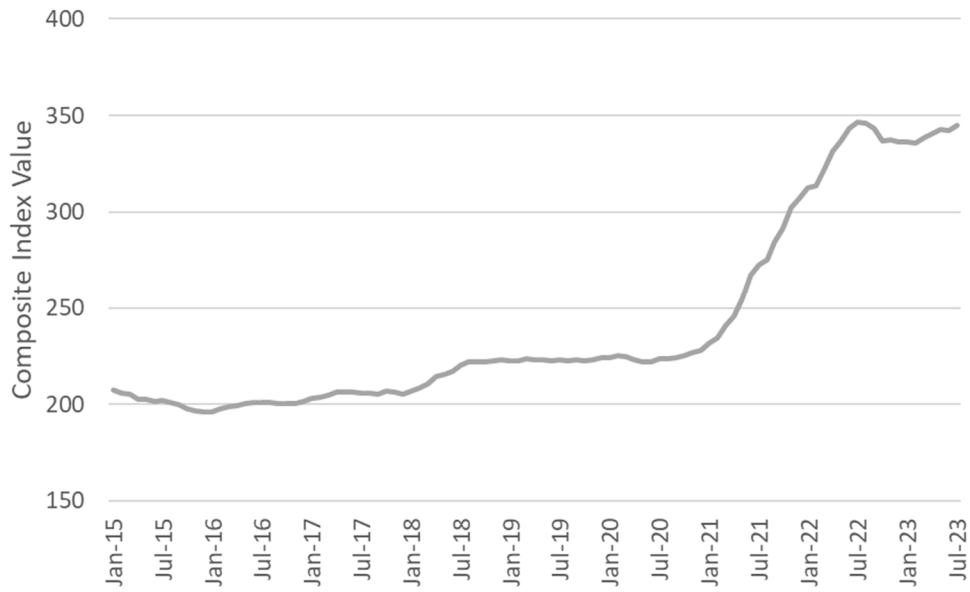
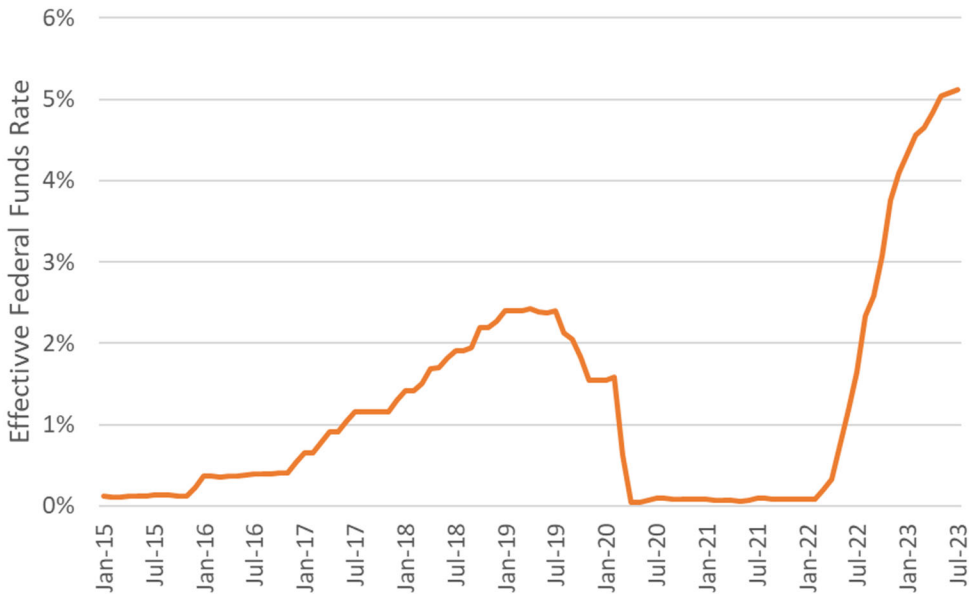


Figure 4. Effective Federal Funds Rate



The following table presents the baseline index averaging period for each solicitation. For current index values, the averaging period of February through July 2023 is used for monthly series and January through June 2023 is used for quarterly series. The exception is ACE NY’s module index, which is only available through May 2023, therefore the current index value is the average of December 2022 through May 2023.

Table 4. Baseline Index Averaging Periods for each Solicitation

Solicitation	Baseline Index Averaging Period
ORECRFP18-1	Empire Wind 1: July through December 2018 Sunrise Wind: August 2018 through January 2019
ORECRFP20-1	March through August 2020 (monthly series), January through June 2020 (quarterly series)
3257	November 2015 through April 2016
RESRFP17-1	March through August 2017
RESRFP18-1	February through July 2018
RESRFP19-1	March through August 2019
RESRFP20-1	April through September 2020
RESRFP21-1	February through July 2021

For purposes of evaluating the offshore wind Petitioners’ requested interconnection cost sharing adjustments, NYSERDA estimated the cost adders based on the following calculation:

$$\begin{aligned}
 \text{ICSA} &= \text{Interconnection Cost Sharing Adder (Nominal \$/MWh)} \\
 &= \frac{\text{AICSR}}{\text{AOQ}_{P50}} \\
 \text{AOQ}_{P50} &= \text{P50 Annual OREC Exceedance (MWh/year)} \\
 \text{AICSR} &= \text{Annual Interconnection Cost Sharing Recovery (Nominal \$/year)} \\
 &= \text{NSIC} \times \text{AF}(\text{NDR}, \text{CT}) \\
 \text{AF}(\text{NDR}, \text{CT}) &= \text{Annuity factor using a nominal discount rate of 5.98\% and a 25-year Contract Tenor} \\
 \text{NDR} &= \text{Nominal discount rate}
 \end{aligned}$$

CT	= Contract Tenor
NSIC	= NYSERDA Share of Interconnection Cost paid through the ICSA (Nominal \$) = $0.8 \times (ICA - ICAB)$
ICA	= Interconnection Cost Allocation (Nominal \$)
ICAB	= Interconnection Cost Allocation Baseline (Nominal \$)

Functionally, this formula determines the amount of interconnection costs that would be borne by NYSERDA in the form of an adder to the OREC price as the difference between expected and actual interconnection costs. This amount is then annuitized to determine how much would need to be recovered in each year of the Contract Tenor and then divided by the number of ORECs expected to be delivered annually. For Empire Wind 2, where Empire/Beacon provided a range as the current estimated interconnection costs, NYSERDA used the midpoint, \$670 million, to calculate the estimated adder.

To estimate the cost associated with Empire/Beacon’s proposed annual escalator for the Empire Wind 2 and Beacon Wind projects, NYSERDA assumed an annual CPI value of 2%, resulting in an escalator of 1%.

The following tables present the estimated adjusted strike prices associated with the Petitioners’ proposed mechanisms using the methodology described above.

4.4.2 Impact of Requested Relief on Strike Prices: Offshore Wind

The following table shows the adjusted strike prices that would result from implementation of each OSW Petitioner’s requests.

Table 5. OSW Estimated Levelized Strike Prices and Strike Price Increases Based on Petitioners’ Requests

Project	Original Strike Price (\$/MWh)	Adjusted Strike Price (\$/MWh)	Strike Price Increase
Sunrise Wind	\$110.37	\$139.99	+27%
Empire Wind 1	\$118.38 ³⁴	\$159.64 ³⁵	+35%
Empire Wind 2	\$107.50	\$177.84	+66%
Beacon Wind	\$118.00	\$190.82	+62%
Empire/Beacon portfolio (Wtd. Avg.)	\$114.43	\$176.36	+54%
Portfolio (Wtd. Avg.)	\$113.40	\$167.25	+48%

In summary, based on the estimates and assumptions described in Section 4.4.1, Sunrise’s request is equivalent to a 27% increase to its existing strike price based on current index values.³⁶ Application of Empire/Beacon’s request would result in a 54% increase on average across its portfolio of projects. All in all, the impact on the totality of the offshore wind portfolio of implementing the Petitioners’ requests would be to increase weighted average strike prices by 48%.

³⁴ Levelized over the 25-year contract term, the Year 1 strike price is \$99.08/MWh with a 2% annual escalator.

³⁵ The adjusted Year 1 strike price is \$130.37/MWh.

³⁶ In its Petition, Sunrise estimates an inflation adjustment of 23% and an interconnection cost sharing adder of \$1.50/MW. The difference between Sunrise’s 23% inflation adjustment estimate and NYSERDA’s 26% inflation adjustment estimate appears to be due primarily to variance in the estimate of current index value due to the averaging period and new data since the Petition was filed.

The following table shows, with further specificity, the impact of each component of the relief requested by Sunrise and Empire/Beacon.

Table 6. Strike Price Adjustments Requested by Offshore Wind Petitioners (\$/MWh)

Requested Adjustment Component	Sunrise Wind	Empire Wind 1	Empire Wind 2	Beacon Wind	Portfolio
Original Strike Price	\$110.37	\$118.38	\$107.50	\$118.00	\$113.40
Inflation Adjustment	+\$28.17	+\$37.28	+\$51.27	+\$55.37	+\$43.24
Interconnection Cost Sharing Adjustment	+\$1.45	+\$0.11	+\$4.23	+\$1.52	+\$1.89
Annual Escalator Adjustment	N/A	N/A	+\$14.84	+\$15.92	+\$7.95
Contract Term Extension Adjustment	N/A	+\$3.87	N/A	N/A	+\$0.77
Adjusted Strike Price	\$139.99	\$159.64	\$177.84	\$190.82	\$167.25

Table 7. Relative Impact of Strike Price Adjustments Requested by Offshore Wind Petitioners (\$/MWh)

Requested Adjustment Component	Sunrise Wind	Empire Wind 1	Empire Wind 2	Beacon Wind	Portfolio
Inflation Adjustment	+26%	+32%	+48%	+47%	+38%
Interconnection Cost Sharing Adjustment	+1%	+0%	+4%	+1%	+2%
Annual Escalator Adjustment	N/A	N/A	+14%	+14%	+7%
Contract Term Extension Adjustment	N/A	+3%	N/A	N/A	+1%
Total Strike Price Increase	+27%	+35%	+66%	+62%	+48%

Tables 6 and 7 break down the various components of the requested relief. The inflation adjustment components constitute the largest increase. The interconnection cost sharing adjustments are estimated to result in a 1% to 4% strike price increase, the annual escalator adjustment suggested for Empire Wind 2 and Beacon Wind would lead to a 14% strike price increase for each project, and the contract term extension adjustment requested for Empire Wind 1 is estimated to result in a 3% increase in that project's strike price.

4.4.3 Impact of Requested Relief on Strike Prices: ACE NY

The relief requested by ACE NY leads to varying strike price adjustments for solar and wind, which also vary across solicitation vintage year as summarized in Table 8 below. In summary, based on the estimates and assumptions described in Section 4.4.1, implementation of ACE NY's requested relief would result in a 63% average strike price increase for solar projects and a 71% average strike price increase for wind

projects. All in all, the impact of implementing ACE NY’s requested relief on the totality of the Tier 1 portfolio would be an increase in weighted average strike prices of 64%.³⁷

Table 8. Tier 1 Estimated Strike Prices and Strike Price Increases Based on Petitioner’s Request

Solicitation	Technology	Number of Projects	Original Strike Price (\$/MWh)	Adjusted Strike Price (\$/MWh)	Strike Price Increase
3257	Solar	3	\$83.15	\$127.52	+53%
RESRFP17-1	Solar	10	\$77.52	\$131.88	+70%
	Wind	2	\$66.49	\$118.09	+78%
RESRFP18-1	Solar	14	\$68.26	\$112.71	+65%
	Wind	2	\$67.12	\$112.48	+68%
RESRFP19-1	Solar	17	\$66.26	\$110.17	+66%
	Wind	1	\$71.59	\$113.89	+59%
RESRFP20-1	Solar	15	\$53.03	\$94.50	+78%
RESRFP21-1	Solar	22	\$63.08	\$94.25	+49%
Portfolio (Wtd. Avg.)	Solar	81	\$62.79	\$102.22	+63%
	Wind	5	\$67.63	\$115.66	+71%
	All	86	\$63.56	\$104.36	+64%

The following table shows, with further specificity, the manner in which inclusion of the Module Expectation Factor and the interest rate adjustments impact the adjusted weighted average strike price of the portfolio. The Module Expectation Factor results in an estimated 21% weighted average strike price increase for the solar projects, while the interest rate adjustments lead to an estimated 12% weighted average strike price increase. The inflation adjustment component constitutes the largest share of ACE NY’s requested relief.

Table 9. Strike Price Adjustments Requested by ACE NY (\$/MWh)

Requested Adjustment Component	Solar Portfolio	Wind Portfolio	Full Portfolio
Original Strike Price	\$62.79	\$67.63	\$63.56
Inflation Adjustment	+\$18.36	+\$40.48	+\$21.88
Module Expectation Factor	+\$13.31	N/A	+\$11.19
Interest Rate Adjustments	+\$7.76	+\$7.55	+\$7.73
Adjusted Strike Price	\$102.22	\$115.66	\$104.36

³⁷ ACE NY’s Petition estimates the REC price impacts of its requested adjustments as of 2022 Q4 ranges from 43% to 73%, depending on the solicitation and technology. NYSERDA’s estimates are generally consistent with ACE NY’s estimate, with differences explained by changes in index values over the intervening months.

Table 10. Relative Impact of Strike Price Adjustments Requested by ACE NY (\$/MWh)

Requested Adjustment Component	Solar Portfolio	Wind Portfolio	Full Portfolio
Inflation Adjustment	+29%	+60%	+34%
Module Expectation Factor	+21%	N/A	+18%
Interest Rate Adjustments	+12%	+11%	+12%
Total Strike Price Increase	+63%	+71%	+64%

4.5 Policy Considerations Associated with Petitioners' Requested Relief

As further discussed in Section 8 below, applying a price adjustment to existing contracts would deviate from the primary method established by the Commission for establishing pricing of CES contracts, which is through competitive solicitations. Such a step should be taken only in appropriate circumstances and with care to design an adjustment that properly reflects those circumstances and fairly allocates foreseeable risks to developers. Overall, the price adjustment mechanisms proposed by the Petitioners, particularly Empire/Beacon and ACE NY, appear to shift risks from developers to ratepayers in a manner that goes beyond, and in some cases does not appear tied to, the extraordinary market circumstances that underly the requests.

Specifically, as can be seen from the discussion above, the relief requested by the Petitions includes a number of distinct components, each of which has an individual impact on strike price. Some of those components appear less appropriate to include in an adjustment.

First, the requests from Sunrise and Empire/Beacon to apply an interconnection cost sharing term appear designed to make those projects whole for changes (whether or not related to inflation) to one particular aspect of project costs, rather than to address the market-wide, unforeseeable inflationary pressures that have affected all aspects of projects. Further, the increases in interconnection costs would be at least partially addressed through the inflation adjustment formula itself. Similarly, the application of a CPI-based adjuster during the contract term requested by Empire/Beacon does not appear to be tied to the market-wide inflationary pressures that have affected the cost of building a project; rather this CPI mechanism would increase the strike price each year CPI increases during the term of the contract, which is a remedy that is not well-connected to the circumstances underpinning the request. The same goes for Empire/Beacon's request for a contract term extension; this request does not seem to be connected to the market circumstances described in the Petitions. Finally, the change to the weighting factor of the inflation adjuster from 80% to 100% proposed by Empire/Beacon exposes ratepayers to inflation's entire effects, whereas it could be more appropriate for at least some of inflation's effects to be borne by developers.

NYSERDA also observes that there are aspects of the formulas proposed by ACE NY that appear to be less correlated to project costs and the market-wide inflationary pressures and may not reflect appropriate risk allocation to developers. First, the inclusion of a Module Expectations Factor in the solar formula proposed by ACE NY is proposed as a means of incorporating the decreases in solar module pricing that had been forecasted at the time of submitting their bids. Only modules are assigned a factor of this nature, leading to a potential meaningful mismatch with the formula's treatment of other project components, whose price developers may have expected to increase. Especially given this inconsistency, it is not clear that it is appropriate for the formula to adjust not only for increased module prices compared with reasonably-expected inflation, but for pricing compared with an optimistic decreasing price forecast at the time of bids.

Second, the weighting of certain indices in the wind formula proposed by ACE NY does not appear to match the cost exposure faced by projects. In particular, the weighting of the Electric Power & Specialty

Transformer Manufacturing index at 52% appears to be significantly higher than the actual share of costs that equipment constitutes in a typical onshore wind project.

Third, similar to Empire/Beacon's request above, the 100% weighting of the entire formula exposes ratepayers to inflation's entire effects, whereas it could be more appropriate for at least some of these effects to be borne by developers.

Fourth, an adjuster that shifts the economic impact of increased interest rates onto ratepayers may not reflect appropriate risk allocation between developers and ratepayers. As noted in Section 3 above, the increases in interest rates cited by the ACE NY petition are not unprecedented, and it would not have been reasonable for developers to assume that the low interest rate environment would persist. The risk of variation in interest rates may be more appropriately allocated to developers than ratepayers, as developers have multiple avenues to obtain financing and the ability to adjust their financing sources as interest rates rise and fall and alternative sources of financing become available (such as from the Department of Energy's Loan Program Office, as further noted in Section 8 below).

Lastly, it is worth noting that the relief proposed by ACE NY appears designed to provide the economic basis to enable 100% of projects to move forward, whereas, as noted in Section 2 above, the 2020 CES Modification Order included an expected attrition factor of 20%. Because attrition can occur for numerous reasons beyond project economics, though, it is impossible to predict what percentage of the projects would nonetheless fail to come to fruition even with an adjustment of this magnitude.

5. Potential Impacts of No Price Adjustment Being Provided

The Petitioners posit that if the Commission were to provide no price adjustment, NYSERDA-awarded projects that are under development would not be economically viable and would be unable to proceed to construction and operation under their existing pricing.³⁸

Specifically, ACE NY contends that without a price adjustment, projects would be forced to cancel their existing contracts and either terminate development altogether or seek new contracts with higher pricing, either with NYSERDA or elsewhere. ACE NY further predicts that those projects that are able to successfully rebid into future NYSERDA solicitations would reach commercial operation much later than would occur with an adjustment.³⁹

Similarly, Sunrise contends that "without incorporating inflation and interconnection cost adjustments mechanisms into the OREC Agreement, Sunrise Wind believes it would not be able to obtain a final investment decision (FID) allowing it to fully construct the Project".⁴⁰ Sunrise estimates that this would

³⁸ NYSERDA's contracts provide that projects would forfeit contract security in the event that contracts are terminated for this reason, but projects could have opportunity to bid into future solicitation. In addition, it is worth noting that NYSERDA's offshore wind contracts do not provide an unfettered right for developers to unilaterally terminate without NYSERDA's consent.

³⁹ ACE NY Petition, Page 5. ("existing awards necessarily will be tendered back, detrimentally impacting New York's climate change initiatives. While, at best, some developers may be able to offer these or new projects into future solicitations, these future proposals, by definition, must necessarily be based on strike prices that reflect the higher project costs. These projects also may well be different in size, configuration and location, and if awarded, will reach operation much later. At worst the developers of some Awarded Projects will not be able to submit new proposals in New York, and thus, a subset of Awarded Projects will be permanently cancelled.").

⁴⁰ Sunrise Wind LLC Petition at 3.

likely result in the project being delayed for several years and in higher eventual prices for replacement ORECs.⁴¹

Empire/Beacon make a similar argument in their petition, stating that the proposed adjustment in pricing would “restore the Projects’ ability to attract the capital required for them to move forward.”⁴²

If taken at face value that the renewable energy projects that are the subject of the Petitions are not economically viable under current conditions, providing no price adjustment whatsoever would result in a large amount of renewable energy generation needing to be re-procured in future solicitations (either from existing projects re-bidding or from new projects). This would significantly slow progress towards meeting the CLCPA targets due to project delays, cancellations, and increased uncertainty, even if existing projects elect to re-bid into future solicitations. NYSERDA also believes that these dynamics create the risk of further increasing costs to projects and to ratepayers. In addition, the delays and cancellations would result in missed opportunities for reliability and resiliency benefits associated with new renewable energy generation, prolong the State’s reliance on harmful fossil fuels for energy production, delay delivery of associated economic benefits of such projects and hurt New York’s ability to tap the scarce OSW supply chain. More detailed discussion of each of these potential impacts is set forth in the remainder of this Section.

5.1 Project Delays and Increased Risks of Missing Climate Act Goals

As noted above, the Petitioners (including CPNY) account for 91 projects totaling 13.5 GW of renewable capacity and are expected to supply 24.6% of New York State’s estimated 2030 Statewide Load. In the event that no adjustment is provided and these projects are unable to proceed with their existing pricing, this might not necessarily mean that such projects would not proceed at all; they could still re-bid and, if successful at a future solicitation, proceed on the basis of a new NYSERDA award. However, this could result in significant delays and thus impact the State’s progress towards achieving the Climate Act goal of serving 70% of the State’s electric load with renewable energy by 2030. It is also possible that some projects may elect to export their energy and/or RECs to a neighboring control area.

Delays could occur not only as a result of the time associated awaiting and participating in the next NYSERDA solicitation. Further delays could occur related to other obstacles in project development, including interconnection and land use agreements as further discussed below.

Renewable project development is performed at risk to the developer until the project is ultimately constructed, but historically there have been limits to the activities developers will perform without an offtake agreement. For example, 22 of the 25 projects that rejected cost allocations in the NYISO 2021 Class Year did not have NYSERDA agreements, indicating that developers are generally unwilling to provide the required financial security for what is typically the single largest non-construction capital project expense without the assurance of a NYSERDA agreement. This can have serious delay implications for rebidding projects that fail to be awarded in future NYSERDA solicitations since the average duration for the last two Class Years has been 21 months.

⁴¹ Sunrise Wind LLC Petition at 41-42 (“If the Sunrise Wind Project were cancelled, and New York State were to procure a replacement offshore wind project from Sunrise Wind or Ørsted (which may or may not be a reconfiguration in Sunrise Wind’s BOEM lease area), that project would necessarily start from scratch, would not start producing energy until years after the Project’s estimated 2025 commercial operation date, and would almost certainly need to sell its ORECs for a higher price than under the amended OREC Agreement as proposed in the Petition.”).

⁴² Empire Offshore Wind LLC and Beacon Wind LLC Petition at 2.

In addition to delays related to projects needing to find a replacement offtaker, project delays can have negative impacts to project viability by impacting timelines associated with real property options and interconnection process milestones. For example, projects delayed beyond the original terms of land use option agreements will be required to renegotiate new agreements. Where this is possible, the renegotiated agreements will likely be at higher rates due to inflation, property value increases, and increased landowner leverage. If a landowner no longer wants to make its property available to the project, the developer may have to choose between downsizing and/or redesigning the project, the latter of which may require resubmission of permit applications. In addition, the NYISO Open Access Transmission Tariff requires that projects reach commercial operation within 4 years of either the completion of the appropriate Class Year or the tendering of the draft interconnection agreement. Delays beyond 4 years require approval by the NYISO, and failure to receive this approval without a waiver requires the project to start over with a new interconnection request.

This information, combined with expected commercial operation dates, average Tier 1 solicitation durations, and potential re-awarding scenarios, indicates a risk of an average project delay of 2.5 years if Tier 1 projects do not move forward under current pricing and re-bid into future solicitations, with projected delays ranging from roughly 1 to 4 years by project. OSW projects risk delays of 3 years or longer if projects do not move forward under current pricing, due to the constrained access to adequate ports, vessels and primary components, a longer procurement cadence and uncertainty relating to the implications of delay on federal permitting processes.

Through New York's 2018 and 2020 OSW solicitations, NYSERDA awarded 4 projects totaling 4.2 GW of capacity, 47% of the 9 GW by 2035 goal, with the expectation that all 4 projects would be operational by 2030. In total, the CES Whitepaper anticipated that approximately 5.8 GW of offshore wind (including projects awarded from the NY3 solicitation) would be operational by 2030. A steady cadence of procurements was developed to allow NYSERDA to select the best projects in a particular round and to help to ensure development timelines can be met by the limited supply chain and rapidly expanding and evolving permitting queue in the U.S. A consistent OSW procurement cadence also sends a key signal to the offshore wind workforce and supply chain manufacturers, which could yield economic and environmental justice benefits for decades into the future.

As indicated in the Sunrise and Empire/Beacon petitions, all four contracted OSW projects are at risk of not being completed if no price adjustment whatsoever is provided, which would result in NYSERDA effectively restarting the OSW procurement process. The CES Modification Order anticipated no attrition from the OSW portfolio. Under this scenario and based on the particular development stages of projects bidding into the NY3 solicitation, there is a significant risk that not all potential NY3 awarded projects would be operational by 2030. Further, even if previously contracted OSW projects were to submit proposals and be selected in an OSW solicitation held in 2024, it is unlikely they would continue to advance their projects, making capital investments absent an offtake agreement. Additionally, it is unclear how access to key infrastructure (limited vessels, port space etc.) or supply chain contracts would be affected, or how such a delay would be viewed by the federal regulatory authorities. As a result, it is highly uncertain that OSW projects procured in a future solicitation, regardless of previously contracted status, would be in commercial operation by 2030. However, they would be expected to provide support to reach the Climate Act's target of 9 GW of offshore wind by 2035.

5.2 Risk of Increased Costs

As discussed above, providing no relief whatsoever to the Petitioners could lead many projects to elect to not complete development at their current costs and thus seek to terminate their contracts with NYSERDA. This contract termination would not on its own result in increased costs for ratepayers, because NYSERDA is not obligated to pay for (O)RECs until projects are operational. However, to the

extent this occurs, additional projects (either new projects or the same projects re-bidding into future solicitations) would need to be procured by NYSERDA in future solicitations to achieve the Climate Act targets. Ratepayer costs would therefore increase to the extent that the (O)RECs from replacement projects are procured, on average, at higher prices.

While it is impossible to predict future bid prices accurately, a number of factors indicate that average bid pricing in future solicitations is likely to be relatively high compared with prior solicitations. Further comparisons between future bid pricing and potential price adjustment options are discussed in Section 7.

First of all, NYSERDA can confirm that the bid prices from proposals received in the 2022 Tier 1 solicitation (22T1) and NY3 are significantly higher than in prior solicitations.⁴³ These bid prices, which were submitted to NYSERDA on April 12, 2023, in 22T1 and August 24, 2023, in NY3, establish where the market currently stands.

These latest solicitations have seen a robust level of competition and participation. NYSERDA received a robust response in NY3, with more than 100 total proposals for eight new projects from six offshore wind developers – representing a record-setting level of competition among East Coast states.⁴⁴ In response to 22T1, NYSERDA received 65 bids comprised of 35 solar, wind and hydroelectric projects, representing more than 4,400 megawatts of renewable energy.⁴⁵ This level of participation is comparable to prior Tier 1 solicitations. For both offshore wind and Tier 1, the robust level of participation provides confidence that the data collected provides an updated view on renewable energy market prices.

This pricing also represents NYSERDA’s best estimate of potential pricing in future bids if the cost of building projects were to remain at current levels. As can be seen from the issues described above, there is no way to know for certain whether the cost of building projects will increase or decrease. However, the work conducted by IEC illustrates the risk of higher costs being maintained in the near to medium term, with a relatively low likelihood for deflationary market dynamics that would lead to lower bid prices in that time frame.

With respect to inflation generally, the IEC report states that “forecasts indicate that inflation will moderate, but remain positive, over the next ten years: Inflation projections show that the GDP Deflator and the Consumer Price Index will stabilize slightly above the Federal Reserve’s 2% inflation target between 2024 and 2033. Economic analysts are not projecting that price deflation (a sustained drop in the general price level) will occur in the next ten years. Forecasts indicate that the price level in the U.S. will nearly double by 2033 relative to the end of 2020. Labor costs are also expected to increase, but at slower rates. Historical relationships between general measures of inflation and commodity prices indicate that the latter, despite peaks and troughs, will follow an upward trend over the next ten years.”⁴⁶

IEC goes on to explain that “the decline in inflation observed in recent months does not imply that costs for renewable projects have also started to decline. The reduction in inflation simply means that prices are no longer rising as rapidly as they had been in 2021 through mid-2023. For prices to fall back to levels observed prior to the recent bout of inflation, there would need to be a period of sustained and significant

⁴³ NYSERDA does not publicly disclose bid price information, as doing so would harm bidders and undermine the competitive tension of future solicitations. Accordingly, quantitative bid price details are provided in Appendix C, which is redacted.

⁴⁴ Offshore Wind. (n.d.). *Closed Solicitation, ORECRFP22-1*. NYSERDA. <https://www.nyserdera.ny.gov/All-Programs/Offshore-Wind/Focus-Areas/Offshore-Wind-Solicitations/2022-Solicitation>

⁴⁵ Clean Energy Standard. (n.d.). *RESRFP22-1 Step Two Bid Proposal Response*. NYSERDA. <https://www.nyserdera.ny.gov/All-Programs/Clean-Energy-Standard/Renewable-Generators-and-Developers/RES-Tier-One-Eligibility/Solicitations-for-Long-term-Contracts>

⁴⁶ See Appendix B: IEC Report

deflation across the U.S. economy. Deflation in the U.S. is historically associated with periods of significant economic uncertainty, weak output growth, and high unemployment, such as the Great Depression in the 1930s.”⁴⁷

With respect to renewable energy projects in particular, the IEc report summarizes its findings as follows: “Supply chain constraints threaten the financial viability of renewable energy projects: Significant tension between two economic forces is pushing renewable energy development prices in opposite directions. On one hand, prices of frontier technologies such as those used in renewable energy generation typically decrease over time, as industries mature, achieve economies of scale, and incentivize competitors to join the market. On the other hand, persistent supply chain constraints and inflationary pressures in renewable energy sectors are pushing prices higher and could potentially offset or outweigh the secular downward trend in prices driven by efficiency gains in these sectors. It is uncertain if supply will keep pace with the heightened global demand for clean energy to alleviate the inflationary pressures specific to the solar PV, onshore wind, and offshore wind development.”⁴⁸

The IEc report goes on to provide the following summary of its findings with respect to expected renewable energy project costs going forward:

“Renewable energy project costs will remain above pre-2022 levels until sometime during the 2025-2030 period, with the exact year dependent on the technology type: Optimistic forecasts prepared by the National Renewable Energy Laboratory suggest that solar PV project costs will not reach their historically low levels observed in 2019 and 2020 until the end of the decade. The onshore wind industry is expected to recover faster, with project costs returning to 2021 levels as early as 2025. Though technology and efficiency gains are lowering costs for offshore wind development over the long term, recent press reports and industry analyses provide strong evidence that supply of key components will not keep pace with global demand for offshore wind generation, which will increase costs in the sector through 2030.”⁴⁹

In addition, the project delay dynamics described in Section 5.1 above would also be reasonably expected to increase project costs. For example, delay could require renegotiation of land option agreements and re-entry into interconnection processes with higher attendant costs. Furthermore, the constraints in the offshore wind and onshore renewable energy supply chain described elsewhere in these comments, from equipment to construction labor, would be further exacerbated by a delay in project development, leading to even further upward pressure on the costs of these inputs. Finally, the need to procure more projects on a compressed timeline would require NYSERDA to award more projects in each procurement, which could lead to awarding more expensive projects that would not have been awarded in that solicitation had NYSERDA not needed to award as many projects.

In aggregate, when combining NYSERDA’s latest market insights with the various analysis shared above, the findings support the conclusion that there is a substantial risk that bid pricing will not decrease significantly in the near to medium term, which is the critical period during which the bulk of Tier 1 and OSW procurements will need to be held.

5.3 Risks of Foregone Reliability and Health Benefits

As discussed above, the potential inability of projects to move forward under existing pricing would risk projects being delayed on average by 2.5 years for Tier 1 projects and 3 years or more for OSW projects. Such delayed deployment of renewable resources would result in missed opportunities for both system

⁴⁷ See Appendix B: IEc Report

⁴⁸ See Appendix B: IEc Report

⁴⁹ *Id.*

reliability and public health benefits, including contributions to resource adequacy, reductions in greenhouse gas (GHG) emissions, and improvements in air quality.

Renewable resources benefit both the geographic and resource diversity of New York’s generation mix. Delayed deployment of those resources would reduce, or at best delay growth of, generation diversity.

Geographically diverse generation portfolios are less susceptible to common-cause outages and are therefore better able to withstand shocks to the electric system, whereas resource diversity reduces vulnerability to supply constraints for any given fuel type. Both geographic and resource diversity also provide a smoothing effect across variable renewable resources. Preliminary results of the *Fuel and Energy Security Study* (FES)⁵⁰ being conducted by the Analysis Group on behalf of the New York Independent System Operator (NYISO) reinforce the value of a diverse generation portfolio, noting that renewable buildout provides reliability support and that delays in renewable buildout can exacerbate loss of load events.

Recent NYISO planning reports have identified declining reliability⁵¹ margins across New York State, indicating that there could be insufficient power supply to serve expected future demand under certain system conditions. The *2022 Reliability Needs Assessment* (2022 RNA) noted that, “[r]esource adequacy and transmission security margins are tightening across the New York State Bulk Power Transmission Facilities from Buffalo to Long Island.”⁵² In particular, the 2022 RNA found that Long Island transmission security margins could be deficient by approximately 300 MW in 2023 and nearly 600 MW by 2032 if there are delays in the buildout of local generation,⁵³ and identified potential deficiencies in New York City if demand were to increase by as little as 60 MW in 2025.⁵⁴ The *2023 Quarter 2 Short-Term Assessment of Reliability* (2023 Q2 STAR) further highlighted the New York City constraint through the identification of a reliability need due to a deficient transmission security margin of up to 446 MW starting in summer 2025.⁵⁵ The 2023 Q2 STAR also found that large load additions planned for western and central New York could result in a deficiency of the statewide system margin of 145 MW in 2025.⁵⁶

Addressing these reliability needs will require the integration of new resources before existing resources (e.g., “peakers”) can be phased out. Because new resources would need to contribute to Climate Act goals to be successfully permitted, the reliability contribution of renewables will be a key factor in ensuring the continued reliability of the grid. It is worth noting that the majority of under development projects identified in the Petitions were not included in the NYISO’s 2022 RNA or 2023 Q2 STAR analyses because they have not yet met the NYISO’s inclusion rules, meaning that their expected reliability contributions are not reflected in the results. The reliability contributions of under development projects are expected to be particularly impactful in constrained downstate regions. As shown in Table 11,

⁵⁰ Analysis Group. (2023, August 8). *Fuel and Energy Security Study Preliminary Results*. Presented to the NYISO Installed Capacity (ICAP) Working Group.

⁵¹ Reliability criteria for the power system include resource adequacy and transmission security requirements. Resource adequacy is the ability of the power system to supply customer demand at all times, taking into account reasonably expected outages of system components, and is assessed using probabilistic analysis to determine the likelihood of loss of load events. Transmission security is the ability of the power system to withstand disturbances and is assessed using deterministic analysis of credible combinations of stressed system conditions.

⁵² New York Independent System Operator. (2022, November 15). *2022 Reliability Needs Assessment* at 91

⁵³ *Id.* at 68.

⁵⁴ *Id.* at 8.

⁵⁵ New York Independent System Operator. (2023, July 14). *Short-Term Assessment of Reliability: 2023 Quarter 2* at 20.

⁵⁶ *Id.* at 27.

NYSERDA-contracted OSW projects are expected to provide significant contributions to transmission security and resource adequacy in New York City and on Long Island.

Table 11. Expected Reliability Contributions of Offshore Wind

Region	OSW Capacity (MW)	Transmission Security ⁵⁷		Resource Adequacy ⁵⁸	
		Summer Dispatch (MW)	Winter Dispatch (MW)	Summer UCAP (MW)	Winter UCAP (MW)
NYC (Zone J)	2,046	205	307	716	1,105
LI (Zone K)	2,184	218	328	764	1,179

Delays in deployment of large-scale renewables, including offshore wind, would also result in fewer environmental and health benefits for New Yorkers due to increased emissions of GHG and other pollutants that impact air quality, such as fine particulate matter (PM_{2.5}), nitrogen oxides (NO_x), toxics, and other pollutants, as electric demand that would have been served by clean renewable energy is instead served by increasingly less efficient fossil fuel generators (in New York State and imported). The integration analysis conducted for the Climate Action Council Scoping Plan identified reductions in PM_{2.5} concentrations as the strongest driver of health benefits,⁵⁹ with avoided fossil fuel generation contributing approximately 25% of the related health benefits associated with economywide decarbonization, excluding the benefits of avoided wood combustion.⁶⁰ Accordingly, it would be reasonable to expect that important and substantial health benefits would be foregone if no pricing adjustments are made.

NYSERDA developed an estimate of increased GHG emissions, consistent with Climate Act accounting, independent of the estimates cited in the Petitions. NYSERDA estimates that approximately an additional 47.5 million metric tons of carbon dioxide equivalent (CO_{2e}) would be released into the atmosphere if no price adjustment is provided for the under-development projects. On an annual basis, this is equivalent to approximately 33% of New York State’s 2020 GHG emissions associated with the electricity sector.⁶¹ The total damages-based value of the estimated increase in GHG emissions is approximately \$4.7 billion in 2020 dollars, accounting only for the climate damage value of GHG, excluding the aforementioned co-pollutant emission reductions and ensuing health impacts. Estimated increases in GHG emissions and associated damaged-based values by program and individual GHG are included in Table 12 and Table 13, respectively. It should be noted that NYSERDA’s estimates are conservative and that the amount of increased GHG emissions resulting from no pricing adjustment being provided could be higher.

⁵⁷ Offshore wind is dispatched to a set percentage of nameplate capacity for transmission security assessments. See New York Independent System Operator. (2022, November 15). *2022 Reliability Needs Assessment* at 69.

⁵⁸ Contributions to resource adequacy are quantified using Unforced Capacity (UCAP) values, which are a percentage of resources’ nameplate capacities. For offshore wind UCAP percentages, see “Offshore Wind Profile Development – Summary,” presented to the NYISO Installed Capacity (ICAP) Working Group, February 7, 2023.

⁵⁹ New York State Climate Action Council. (2021, December). *Appendix G: Integration Analysis Technical Supplement to the New York State Climate Action Council Scoping Plan*. Section II at 33.

⁶⁰ *Id.* Figure 7 at 34.

⁶¹ Eastern Research Group. (2022) *Energy Sector Greenhouse Gas Emissions under the New York State Climate Act: 1990–2020*. NYSERDA. www.nyserdera.ny.gov/About/Publications

Table 12. Estimated Increase in GHG Emissions

Program	CO ₂ (metric tons)	CH ₄ (metric tons)	N ₂ O (metric tons)	CO ₂ e (metric tons)
Tier 1	12,508,337	69,158	88	18,340,891
OSW	19,886,010	109,949	140	29,158,725
Total	32,394,347	179,107	228	47,499,616

Table 13. Damages-Based Value of Estimated Increase in GHG Emissions

Program	CO ₂ (million 2020\$)	CH ₄ (million 2020\$)	N ₂ O (million 2020\$)	Total (million 2020\$)
Tier 1	1,601.1	200.6	4.0	1,805.6
OSW	2,545.4	318.9	6.3	2,870.6
Total	4,146.5	519.4	10.3	4,676.2

NYSERDA’s estimate was developed assuming that the foregone clean energy production expected to result from delayed deployment of Tier 1 and OSW generation would be replaced by gas-fired power generation within New York State. The increase in GHG emissions from gas-fired power generation was calculated using annual average full fuel cycle short-run marginal emission factors published by NYSERDA in August 2022⁶² and 20-year global warming potential (GWP) values for carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) consistent with those used by DEC for Climate Act accounting.⁶³ Damages-based values were calculated following DEC guidelines for establishing a value of carbon.⁶⁴ The full set of input assumptions used to develop NYSERDA’s estimated increase in GHG emissions and associated damages-based value are included in Table 14 and Table 15, respectively.

Table 14. Input Assumptions for Estimated Increase in GHG Emissions

Program	Estimated Annual Foregone Clean Energy (GWh/yr)	Estimated Delay in Deployment (yr)	Gas Replacement Emissions Factor (metric tons/MWh) ⁶⁵			
			CO ₂	CH ₄	N ₂ O	CO ₂ e
Tier 1	15,140	2.5	0.33	1.83×10 ⁻³	2.33×10 ⁻⁶	0.48
OSW	17,920	3	0.37	2.05×10 ⁻³	2.61×10 ⁻⁶	0.54

Table 15. Input Assumptions for Damages-Based Values

GHG	Social Cost ⁶⁶ (2020\$/metric ton)
CO ₂	128

⁶² New York State Energy Research and Development Authority. (2022). *Projected Emission Factors for New York State Grid Electricity*. Report Number 22-18. www.nysERDA.ny.gov/publications

⁶³ New York State Department of Environmental Conservation. (2022). *2022 Statewide GHG Emissions Report*. Table 2 at 6.

⁶⁴ New York State Department of Environmental Conservation. (2022). *Establishing a Value of Carbon*.

⁶⁵ Calculated using annual average full fuel cycle short-run marginal emissions factors for 2024, which largely represent gas on the margin. Later year marginal factors include increasing amounts of renewable generation on the margin, which would not be the case in this scenario in which renewable deployment is delayed. Statewide and downstate emissions factors were assumed for Tier 1 and offshore wind replacement, respectively.

⁶⁶ Cited values are for 2024, consistent with the marginal emissions factors utilized to estimate increased GHG emissions.

CH ₄	2,900
N ₂ O	45,000

NYSERDA’s estimate of increased GHG emissions is conservative for two reasons. First, it is unlikely that forgone clean energy would be entirely replaced by gas-fired power generation on the margin as represented in NYSERDA’s model. Rather, it would be replaced by a mix of increasingly less efficient New York gas-fired power generation and fossil generation imported from neighboring regions. As such, the assumption that all forgone clean energy would be replaced by marginal emitters results in a more conservative estimate of increased GHG emissions. Second, applying the 2024 value of GHG emissions represents a lower bound, as the value of GHG emissions increases over time.

5.4 Risks of Delayed Economic Benefits and Labor Bottlenecks

The project delays that are likely to occur in connection with the cancellation of many of the 91 contracts mentioned above are likely to have negative reverberations throughout the nascent green energy economy, potentially slowing down the transition to cleaner energy and the associated economic benefits. In addition to delaying or potentially losing associated economic benefits, a large industry-wide cancellation of contracts in New York could result in forcing a re-procurement of replacement resources with tighter timeframes. Attempting to procure project components on a rushed timeline is likely to exacerbate an already existing and observable supply chain bottleneck. Many projects built to date have elected to fill a portion of their economic benefits requirements using New York’s skilled labor trade unions. For example, eight Project Labor Agreements have been signed with New York State labor unions associated with offshore wind projects. To prepare for expected jobs, labor unions have begun scaling up their training facilities and investing in equipment to ensure their members are properly trained for this industry in a timeframe that matches construction needs. Steady growth, without large gaps in project construction, is more conducive to maintaining sustainable job growth in skilled trades than construction activity that vacillates between high and low demand cycles due to large waves of delayed projects on similar construction cycles. For Tier 1, delays related to rebidding could result in the need to construct 2-3 GW of capacity per year over the course of 2027-2030 to achieve Climate Act goals, which may not be possible without a massive expansion in the contractor and labor pool and/or increased use of non-New York State labor.

5.5 Risks of Further Offshore Wind Supply Chain Constraints

Having access to an offshore wind supply chain is vital to developing projects that deliver timely and cost-effective results. The components needed to build OSW projects are unique in their scale which necessitates access to suitable ports, vessels, and specialized skilled labor. The National Renewable Energy Laboratory, in a 2023 report, estimates that half of the U.S. offshore wind projects currently under development are at risk of being delayed beyond 2030 because of limited port and vessel infrastructure alone.⁶⁷ The scarcity of these resources means that scheduling and contracting orders well in advance is necessary. Delays in individual projects can result in a cascading delay to other projects, or loss of access to one or more of these resources necessary for construction which further extends delays. The demand for offshore wind development in Europe has increased substantially in recent years, in part due to the war in the Ukraine. It has become increasingly challenging for a U.S. project to lean on the European supply chain for major components. Investors considering building a supply chain, including primary components in the U.S., are seeking offtake agreements with offshore wind developers to provide certainty for a return on their investments. Inability of projects to proceed erodes confidence, potentially limiting investment and exacerbating supply chain development constraints. This, in turn, limits future

⁶⁷ National Renewable Energy Laboratory. (2023, January). *A Supply Chain Roadmap for Offshore Wind Energy in the United States*. (NREL Publication TP-5000-84710). U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. <https://www.nrel.gov/docs/fy23osti/84710.pdf>

cost-reduction pathways and potentially increases costs of more near-term projects as more projects seek to make use of an already constrained supply chain in a shorter period of time.

The renewable energy projects currently under contract with NYSERDA are actively investing in New York's infrastructure to support their project development. The OSW portfolio has five ports in active development, including an offshore wind manufacturing facility at the Port of Albany; a cutting-edge staging and assembly facility and an operations and maintenance hub at the South Brooklyn Marine Terminal; prefabricated advanced foundation components at the Port of Coeymans; and service and operations bases for Ørsted and Eversource's regional assets at Montauk Harbor and Port Jefferson in Long Island.⁶⁸ Together, the investments total in the hundreds of millions of dollars of ongoing or near-term work that are jobs for New Yorkers, many of which are from disadvantaged communities.

In addition to port development work, there is also pending work awarded for the transmission and interconnection components of the OSW projects. For example, Long Island-based contractor Haugland Energy Group LLC (an affiliate of Haugland Group LLC), is contracted to install the underground duct bank system for Sunrise Wind's onshore transmission line in Brookhaven, Suffolk County, New York. This more than \$200 million scope of work will be completed by more than 400 Long Island skilled tradesmen and women, including heavy equipment operators, electricians, and line workers⁶⁹.

It is likely that investments in these activities would be substantially delayed, if not terminated, if the currently-contracted OSW projects are unable to proceed, resulting in at least near-term layoffs and disruptions in the construction sites. Cancellation of contracts for work supporting OSW development may also reduce confidence that future OSW contracts will be advanced to completion, potentially leading to risk premiums being included in future bids to support the industry and a lingering long-term cost impact on similar work in the future.

6. Analysis of Alternative Price Adjustments Based on Inflation Formulas from 2022 Solicitations

To illustrate the effects of applying a price adjustment formula other than the ones requested by Petitioners, NYSERDA analyzed applying the formulas that were included in the 2022 OSW and Tier 1 solicitations (NY3 and 22T1, respectively) to the existing portfolio. This section describes how those formulas were established and analyzes the impact on strike prices that would result if the formulas were implemented.⁷⁰

6.1 NY3 and 22T1 Formulas – Design and Stakeholder Input

In response to observing and recognizing the unique inflationary market dynamics in the renewable energy industry, NYSERDA engaged in a robust public stakeholder process to design an appropriate inflation adjustment approach. In the course of designing the optional inflation adjustment mechanisms included in 22T1 and NY3, NYSERDA obtained stakeholder feedback through public requests for information (RFIs). Through these public RFIs, NYSERDA acknowledged that inflation risks may result

⁶⁸ NYSERDA. (2023, August). NYSERDA Contracted Offshore Wind Projects. <https://www.nysERDA.ny.gov/All-Programs/Offshore-Wind/Focus-Areas/NY-Offshore-Wind-Projects#:~:text=NYSERDA%20Contracted%20Offshore%20Wind%20Projects,renewable%20energy%20to%20New%20Yorkers>

⁶⁹ Sunrise Wind LLC. (2023, April 24). Eversource and Ørsted Announce Record \$200 Million New York Offshore Wind Supply Chain Award to Long Island-Based Haugland Group for Sunrise Wind's Onshore Transmission System Construction. <https://sunrisewindny.com/news/2023/04/eversource-and-orsted-announce-record-200-million-usd-new-york-offshore-wind-supply-chain-award>

⁷⁰ As noted later in these comments, one potential benefit of applying the formulas used in NY3 and 22T1 would be the consistency it would provide across the portfolio of CES projects.

in avoidable price premiums and requested stakeholder feedback on which indices to utilize in an inflation adjustment mechanism, whether the indices should be differentiated by technology, what percentage of the bid price should be subject to the adjustment and whether that percentage should be fixed or set by the bidder, how the starting values for the adjustment should be determined and what the adjustment milestone should be.

The 2022 OREC Solicitation RFI (ORECRFI22-2) received a robust response of 27 unique submissions including from affiliates of Sunrise and Empire/Beacon and numerous other offshore wind project developers, with support for allowing optional inflation-adjustment bids and specific feedback on appropriate indices to use, weightings of indices, and appropriate baseline index and milestone adjustment timing. Based on this feedback and additional internal analysis, NYSERDA utilized an inflation adjustment mechanism based on specific commodity indices (labor, fabrication, steel, ultra low sulfur diesel – ULSD – and copper) and weights, an 80% adjustment factor, an average of the six months prior to bid submission for setting the starting value, and an average of the three months before and after COP approval to set the milestone value. The full NY3 formula is:

$$\begin{aligned}
 OREC_{adj} = OREC_{bid} & \\
 & \times \left(0.2 + 0.3 \times \frac{Index_{T,Labor}}{Index_{B,Labor}} + 0.25 \times \frac{Index_{T,Fabrication}}{Index_{B,Fabrication}} \right. \\
 & \left. + 0.10 \times \frac{Index_{T,Steel}}{Index_{B,Steel}} + 0.10 \times \frac{Index_{T,ULSD}}{Index_{B,ULSD}} + 0.05 \times \frac{Index_{T,Copper}}{Index_{B,Copper}} \right)
 \end{aligned}$$

where:

$OREC_{adj}$ is the Index OREC Strike Price or Fixed OREC Price after adjustment

$OREC_{bid}$ is the Index OREC Strike Price or Fixed OREC Price as submitted with the Proposal

$Index_B$ (for each commodity or component) is the price or unitless index at the time of the Proposal Submission Deadline

$Index_T$ (for each commodity or component) is the price or unitless index at the time of the Project's COP approval

For each commodity or component, $Index_B$ is the average of the last six months or two quarters of published data available as of the final RFP revision prior to the Proposal Submission Deadline. $Index_T$ for each commodity or component will be calculated as the average of the monthly or quarterly values for the six-month period comprising the three months prior to and following the COP approval.

The following table identifies the publicly available index or market price that will be used for each commodity or component.

Table 16. NY3 Inflation Adjustment Commodities

Commodity or Component	Units, Frequency	Data Source
Labor	Unitless index, quarterly	U.S. BLS, Employment Cost Trends, Data Series CIU2020000000000I, Wages and salaries for Private industry workers in All industries and occupations, Index, not seasonally adjusted https://beta.bls.gov/dataViewer/view/timeseries/CIU2020000000000I
Fabrication and machinery materials	Unitless index, monthly	U.S. BLS, PPI, Data Series PCU811310811310, Commercial machinery repair and maintenance https://beta.bls.gov/dataViewer/view/timeseries/PCU811310811310
Steel	Unitless index, monthly	U.S. BLS PPI, Data Series PCU331110331110, Iron and steel mills and ferroalloy mfg, not seasonally adjusted https://beta.bls.gov/dataViewer/view/timeseries/PCU331110331110
New York Harbor Ultra-Low Sulfur No 2 Diesel Spot Price	\$/gal, daily	U.S. Energy Information Administration, Petroleum & Other Liquids Data https://www.eia.gov/dnav/pet/PET_PRI_SPT_S1_D.htm , daily price for last trading day of the month
Copper	Cents per lb, daily	COMEX, spot price on last trading day of month for prompt month https://comexlive.org/copper/

The 22T1 RFI received a robust response of 24 unique submissions, including from ACE NY and numerous individual renewable energy project developers, with support for allowing optional inflation-adjustment bids and specific feedback on the appropriate index to use and appropriate baseline index and milestone adjustment timing. Based on this feedback and additional internal analysis, NYSERDA utilized an optional inflation adjustment mechanism based on PPI All Commodities, applying the adjustment to 75% of the bid price, an average of the six months prior to bid submission for setting the starting value, and an average of the three months before and after the commencement of Construction Activities to set the milestone value. The RES eligible technologies include land-based and offshore wind, solar, hydroelectric as well as other technologies, and the adjustment factor approximated inflationary impacts to all eligible technologies. The full 22T1 inflation adjustment formula is:

$$REC_{adj} = REC_{bid} \times \left(0.25 + 0.75 \times \frac{Index_T}{Index_B} \right)$$

where:

REC_{adj} is the Index REC Strike Price or Fixed REC Price after adjustment

REC_{bid} is the Index REC Strike Price or Fixed REC Price as submitted with the Bid Proposal

$Index_B$ is the value of the PPI All Commodities index (U.S. BLS PPI Series ID WPU00000000, PPI Commodity data for All commodities, not seasonally adjusted, <https://beta.bls.gov/dataViewer/view/timeseries/WPU00000000>) established prior to the Bid Proposal Submission Deadline

$Index_T$ is the value of the PPI All Commodities index established at the commencement of Construction Activities

0.75 is the share of the Index REC Strike Price or Fixed REC Price to which the inflation adjustment will be applied. The remainder of the Index REC Strike Price or Fixed REC Price (25%) will not be adjusted.

Index_B will be the average of the last six months or two quarters of published data available prior to the Bid Proposal Submission Deadline. Index_T will be calculated as the average of the monthly or quarterly values for the six-month period comprising the three months prior to and following the commencement of Construction Activities.

6.2 Impact of Applying 2022 Adjustment Formulas on Strike Prices

NYSERDA calculated the impact on strike prices of implementing the NY3 and 22T1 adjustment formulas requested relief described above based on the latest publicly available data for each applicable index. For those agreements whose proposed milestone adjustment dates have not yet occurred, that is, all except for those Tier 1 projects which have already commenced Construction Activities, the analysis presented below does not examine how each of the indices will trend going forward.

The following table presents the baseline index averaging period for each solicitation. For current index values, the averaging period of February through July 2023 is used for monthly series and January through June 2023 is used for quarterly series.

Table 17. Baseline Index Averaging Periods for each Solicitation using 2022 Adjustment Formulas

Solicitation	Baseline Index Averaging Period
ORECRFP18-1	July 2018 through December 2018
ORECRFP20-1	March through August 2020 (monthly series), January through June 2020 (quarterly series)
3257	November 2015 through April 2016
RESRFP17-1	March through August 2017
RESRFP18-1	February through July 2018
RESRFP19-1	March through August 2019
RESRFP20-1	April through September 2020
RESRFP21-1	February through July 2021

The following tables present the estimated adjusted strike prices associated with the Petitioners' proposed mechanisms using the methodology described above.

Table 18. OSW Estimated Levelized Strike Prices and Strike Price Increases Based on NY3 Formula

Project	Original Strike Price (\$/MWh)	Adjusted Strike Price (\$/MWh)	Strike Price Increase
Sunrise Wind	\$110.37	\$138.22	+25%
Empire Wind 1	\$118.38 ⁷¹	\$148.26 ⁷²	+25%
Empire Wind 2	\$107.50	\$147.79	+37%
Beacon Wind	\$118.00	\$162.23	+37%
Portfolio (Wtd. Avg.)	\$113.40	\$149.14	+31%

Table 19. Tier 1 Estimated Strike Prices and Strike Price Increases Based on 22T1 Formula

	Technology	# of Projects	Original Strike Price (\$/MWh)	Adjusted Strike Price (\$/MWh)	Strike Price Increase
3257	Solar	3	\$83.15	\$107.86	+30%
RESRFP17-1	Solar	10	\$77.52	\$96.62	+25%
	Wind	2	\$66.49	\$82.66	+24%
RESRFP18-1	Solar	14	\$68.26	\$82.08	+20%
	Wind	2	\$67.12	\$80.56	+20%
RESRFP19-1	Solar	17	\$66.26	\$79.83	+20%
	Wind	1	\$71.59	\$86.24	+20%
RESRFP20-1	Solar	15	\$53.03	\$66.57	+26%
RESRFP21-1	Solar	22	\$63.08	\$70.36	+12%
Portfolio (Wtd. Avg.)	Solar	81	\$62.79	\$74.55	+19%
	Wind	5	\$67.63	\$82.72	+22%
	All	86	\$63.56	\$75.85	+19%

Both the 22T1 and NY3 inflation adjustment formulas are linked to the actual commodity index trends, and they therefore can result in either an increase in the strike price or a decrease in the strike price, depending on whether the single (for 22T1) or composite (for NY3) index is higher or lower at the adjustment milestone than at the time of bid submission. For all projects, the milestone adjustment dates that would apply using the 2022 solicitations' formulas have not yet occurred. If the applicable indices decrease from current values prior to the milestone date, the strike price increases would be lower than those presented here, to the benefit of ratepayers. If the indices decrease below the baseline values, the strike prices would decrease from their original values, further benefiting ratepayers. Inversely, to the extent that these indices increase, the strike prices would increase (which could help protect project economics and allow projects to develop as planned).

Historically, the indices have moved up and down, as shown in the following figures.

⁷¹ Levelized over the contract term, the Year 1 strike price is \$99.08/MWh with a 2% annual escalator.

⁷² Estimated adjusted Year 1 strike price is \$124.08/MWh.

Figure 5. PPI All Commodities Index History (22T1 Index)

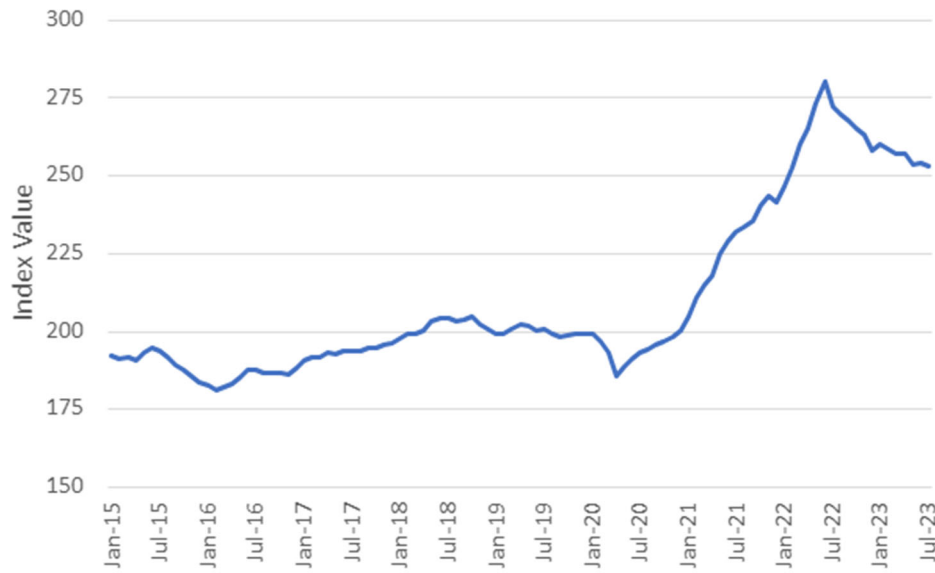
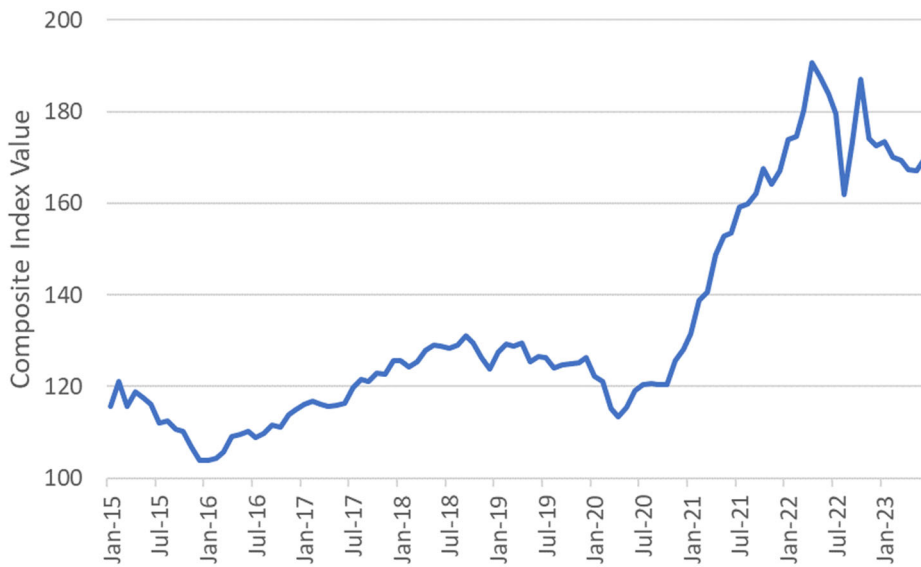


Figure 6. NY3 Composite Index History



As can be seen from the above analysis and further illustrated in Section 7 below, application of the 22T1 and NY3 formulas would provide a significantly smaller price adjustment than the relief requested by Petitioners. Accordingly, there is a material risk that applying these formulas would result in a number of projects being unable to complete development even at adjusted pricing, causing those projects to be subject to the dynamics described in Section 5 above.

6.3 Impact of Applying a 100% Adjustment Factor to the 2022 Adjustment Formulas

The NY3 inflation adjustment formula includes a total weighting coefficient of 80% applied to the entire formula, and the 22T1 inflation adjuster formula includes a 75% coefficient.

NYSERDA analyzed an alternate option where the NY3 and 22T1 formulas were revised to apply a 100% coefficient, instead of 80% and 75%, respectively. The resulting strike prices would be higher compared to using the standard NY3/22T1 formulas if there is a net increase across the index or indices and lower if there is a net decrease across the index or indices. The resulting adjusted strike prices calculated at current index levels are shown in the following tables. When comparing these results of a 100% coefficient versus the standard 2022 formulas, the former approach leads to an 8% and 7% additional increase to the weighted average strike prices of the OSW and Tier 1 portfolios respectively.

Table 20. OSW Estimated Levelized Strike Prices and Strike Price Increases Based on NY3 Formula at 100%

Project	Original Strike Price (\$/MWh)	Adjusted Strike Price (\$/MWh)	Strike Price Increase
Sunrise Wind	\$110.37	\$145.18	+32%
Empire Wind 1	\$118.38 ⁷³	\$155.72 ⁷⁴	+32%
Empire Wind 2	\$107.50	\$157.87	+47%
Beacon Wind	\$118.00	\$173.29	+47%
Portfolio (Wtd. Avg.)	\$113.40	\$158.08	+39%

Table 21. Tier 1 Estimated Strike Prices and Strike Price Increases Based on 22T1 Formula at 100%

	Technology	Number of Projects	Original Strike Price (\$/MWh)	Adjusted Strike Price (\$/MWh)	Strike Price Increase
3257	Solar	3	\$83.15	\$116.10	+40%
RESRFP17-1	Solar	10	\$77.52	\$102.98	+33%
	Wind	2	\$66.49	\$88.05	+32%
RESRFP18-1	Solar	14	\$68.26	\$86.68	+27%
	Wind	2	\$67.12	\$85.04	+27%
RESRFP19-1	Solar	17	\$66.26	\$84.35	+27%
	Wind	1	\$71.59	\$91.13	+27%
RESRFP20-1	Solar	15	\$53.03	\$71.09	+34%
RESRFP21-1	Solar	22	\$63.08	\$72.79	+15%
Portfolio (Wtd. Avg.)	Solar	81	\$62.79	\$78.47	+25%
	Wind	5	\$67.63	\$87.74	+30%
	All	86	\$63.56	\$79.95	+26%

6.4 Policy Considerations Associated with Alternative Formulas

As can be seen in the above analysis and further illustrated in Section 7 below, the application of the 22T1 and NY3 formulas results in significantly smaller strike price increases than Petitioners' requested relief. If the weighting coefficient is increased to 100%, the difference becomes somewhat smaller based on current index values, but the formulas and outcomes still differ from Petitioners' requests.

Accordingly, if either of these alternative formulas, or some alternative price adjustment, is offered to developers, there is a material risk that some developers may conclude that the offered formula does not

⁷³ Levelized over the contract term. The contract's Year 1 strike price is \$99.08/MWh, which escalates at a fixed factor of 2% per year.

⁷⁴ Estimated adjusted Year 1 strike price is \$130.33/MWh.

sufficiently improve their economics to allow them to proceed. To the extent this happens, the same dynamics described in Section 5 would apply.

While NYSERDA cannot predict with accuracy how many projects would accept one price adjustment versus another, NYSERDA does believe that the amount of renewable generation that would need to be re-procured could be materially higher if the 22T1 and NY3 formulas were applied than if the Petitioners' requested relief were granted.

On the other hand, one potential benefit of applying the formulas used in 22T1 and NY3 is the consistency it would provide across the portfolio of CES projects. Applying only a single Tier 1 and a single OSW price adjustment formula for all vintages of projects would be administratively efficient, and, with respect to future price index changes, would put existing projects on a level footing with any projects utilizing inflation adjustment that are awarded in 22T1 and/or NY3.

7. Summary of Potential Impacts of Scenarios Considered

The previous sections presented four different scenarios. Section 4 analyzed the Petitioners' relief requests; Section 5 presented expected outcomes of not providing a price adjustment, including the effect of projects potentially re-bidding in future solicitations; and Section 6 described the effects of applying the inflation adjustment formulas in NYSERDA's latest solicitations to the projects that are the subject of the Petitions, along with an alternate approach that would apply a modified version of those formulas using a 100% weighting coefficient.

This section summarizes and compares the potential strike price changes, resulting ratepayer impacts, and potential project attrition outcomes of these various scenarios. Note that this analysis is intended to produce insights as to the relative cost impacts of the various scenarios examined.

7.1 Strike Price Impacts of Price Adjustment Scenarios

The following tables present the estimated adjusted strike prices associated with the Petitioners' proposed mechanisms and the NY3/22T1 mechanisms, based on the methodology described in Sections 4 and 6.

In summary, Sunrise Wind's requested adjustment results in a 27% increase in strike price, compared to a 26% increase if the NY3 formula were applied, or a 32% increase if the NY3 formula is applied to 100% of the strike price. Empire/Beacon's requested adjustment, on the other hand, results in a 55% average strike price increase across its portfolio of three projects, compared to a 33% adjustment using the NY3 formula, and a 41% increase if the NY3 formula is applied to 100% of the strike prices. ACE NY's requested relief results in a 64% average increase in strike price across the Tier 1 portfolio, compared to a 19% increase were the 22T1 formula to be applied, and a 26% increase if the 22T1 formula is applied to 100% of the strike prices.

Further detail comparing the impacts on a project-by-project basis for OSW and based on vintage and technology for Tier 1 are set forth in Tables 22-25 below.

Table 22. OSW Estimated Levelized Adjusted Strike Prices (\$/MWh)

Project	Original Strike Price	Petitioner's Requested Adjustment	NY3 Adjustment	NY3 Adjustment @ 100%
Sunrise Wind	\$110.37	\$139.99	\$138.22	\$145.18
Empire Wind 1	\$118.38	\$159.64	\$148.26	\$155.72
Empire Wind 2	\$107.50	\$177.84	\$147.79	\$157.87
Beacon Wind	\$118.00	\$190.82	\$162.23	\$173.29
Portfolio	\$113.40	\$167.25	\$149.14	\$158.08

Table 23. OSW Estimated Levelized Strike Price Increases

Project	Petitioner's Requested Adjustment	NY3 Adjustment	NY3 Adjustment @ 100%
Sunrise Wind	+27%	+25%	+32%
Empire Wind 1	+35%	+25%	+32%
Empire Wind 2	+66%	+37%	+47%
Beacon Wind	+62%	+37%	+47%
Portfolio	+48%	+31%	+39%

Table 24. Tier 1 Estimated Levelized Adjusted Strike Prices (\$/MWh)

	Technology	Number of Projects	Original Strike Price	Petitioner's Requested Adjustment	22T1 Adjustment	22T1 Adjustment @ 100%
3257	Solar	3	\$83.15	\$127.52	\$107.86	\$116.10
RESRFP17-1	Solar	10	\$77.52	\$132.08	\$96.62	\$102.98
	Wind	2	\$66.49	\$118.09	\$82.66	\$88.05
RESRFP18-1	Solar	14	\$68.26	\$112.82	\$82.08	\$86.68
	Wind	2	\$67.12	\$112.48	\$80.56	\$85.04
RESRFP19-1	Solar	17	\$66.26	\$110.17	\$79.83	\$84.35
	Wind	1	\$71.59	\$113.89	\$86.24	\$91.13
RESRFP20-1	Solar	15	\$53.03	\$94.50	\$66.57	\$71.09
RESRFP21-1	Solar	22	\$63.08	\$94.25	\$70.36	\$72.79
Portfolio (Wtd. Avg.)	Solar	81	\$62.79	\$102.25	\$74.55	\$78.47
	Wind	5	\$67.63	\$115.66	\$82.72	\$87.74
	All	86	\$63.56	\$104.39	\$75.85	\$79.95

Table 25. Tier 1 Estimated Levelized Strike Price Increases

	Technology	Number of Projects	Original Strike Price	Petitioner's Requested Adjustment	22T1 Adjustment	22T1 Adjustment @ 100%
3257	Solar	3	\$83.15	+53%	+30%	+40%
RESRFP17-1	Solar	10	\$77.52	+70%	+25%	+33%
	Wind	2	\$66.49	+78%	+24%	+32%
RESRFP18-1	Solar	14	\$68.26	+65%	+20%	+27%
	Wind	2	\$67.12	+68%	+20%	+27%
RESRFP19-1	Solar	17	\$66.26	+66%	+20%	+27%
	Wind	1	\$71.59	+59%	+20%	+27%
RESRFP20-1	Solar	15	\$53.03	+78%	+26%	+34%
RESRFP21-1	Solar	22	\$63.08	+49%	+12%	+15%
Portfolio (Wtd. Avg.)	Solar	81	\$62.79	+63%	+19%	+25%
	Wind	5	\$67.63	+71%	+22%	+30%
	All	86	\$63.56	+64%	+19%	+26%

7.2 Ratepayer Impacts of Price Adjustment Scenarios

The estimated levelized ratepayer impacts associated with these strike price adjustments are shown in the following tables, on both a percent (%) bill increase, and \$/month for residential customers basis. These estimated values are calculated based on current commodity index values, as well as estimates of future statewide load and electricity spending consistent with the methodology used in prior ratepayer impact estimates conducted by NYSERDA. Noting that these estimates are used to illustrate variances between the three price adjustment approaches, the analysis reflects applying each price adjustment to all projects for which relief has been requested and does not make any assumptions on attrition.

Sunrise Wind’s requested relief would increase the project’s ratepayer impacts by 0.33% and residential monthly bill impact by \$0.40/month, compared to 0.31% and \$0.37/month if the NY3 adjustment formula were applied, and 0.38% and \$0.47/month if the NY3 formula were applied with a coefficient of 100%. The difference in impacts between the first two options for Sunrise Wind is small because the only additional relief requested beyond the NY3 formula is inclusion of interconnection cost sharing which effectuates a 1% increase in strike price.

Empire/Beacon’s requested relief would increase the projects’ ratepayer impacts by a total of 2.20% and \$2.69/month, compared to 1.37% and \$1.69/month if the NY3 formula were applied, and 1.72% and \$2.11/month if the NY3 formula were applied with a 100% coefficient.

ACE NY’s requested relief would increase the Tier 1 portfolio’s ratepayer impacts by 1.48% and \$1.57/month, compared to an increase of 0.45% and \$0.47/month using the 22T1 formula, and 0.59% and \$0.64/month using the 22T1 formula with a 100% coefficient.

Table 26. OSW Estimated Bill Impacts Associated with Strike Price Increases

Project	Petitioner’s Requested Adjustment	NY3 Adjustment	NY3 Adjustment @ 100%
Sunrise Wind	+0.33%	+0.31%	+0.38%
Empire Wind 1	+0.39%	+0.31%	+0.39%
Empire Wind 2	+0.88%	+0.50%	+0.63%
Beacon Wind	+0.93%	+0.56%	+0.70%
Portfolio (Total)	+2.53%	+1.68%	+2.10%

Table 27. OSW Estimated Monthly Residential Bill Impacts Associated with Strike Price Increases (\$/month)

Project	Petitioner’s Requested Adjustment	NY3 Adjustment	NY3 Adjustment @ 100%
Sunrise Wind	+\$0.40	+\$0.37	+\$0.47
Empire Wind 1	+\$0.48	+\$0.38	+\$0.48
Empire Wind 2	+\$1.08	+\$0.62	+\$0.77
Beacon Wind	+\$1.14	+\$0.69	+\$0.86
Portfolio (Total)	+\$3.10	+\$2.06	+\$2.58

Table 28. Tier 1 Estimated Bill Impacts Associated with Strike Price Increases

T1 Solicitation	Petitioner's Requested Adjustment	22T1 Adjustment	22T1 Adjustment @ 100%
3257	+0.01%	+0.01%	+0.01%
RESRFP17-1	+0.27%	+0.09%	+0.12%
RESRFP18-1	+0.28%	+0.09%	+0.11%
RESRFP19-1	+0.25%	+0.08%	+0.10%
RESRFP20-1	+0.31%	+0.10%	+0.14%
RESRFP21-1	+0.36%	+0.08%	+0.11%
Portfolio (Total)	+1.48%	+0.45%	+0.59%

Table 29. Tier 1 Estimated Monthly Residential Bill Impacts Associated with Strike Price Increases (\$/month)

T1 Solicitation	Petitioner's Requested Adjustment	22T1 Adjustment	22T1 Adjustment @ 100%
3257	+\$0.01	+\$0.01	+\$0.01
RESRFP17-1	+\$0.29	+\$0.09	+\$0.13
RESRFP18-1	+\$0.29	+\$0.09	+\$0.12
RESRFP19-1	+\$0.27	+\$0.08	+\$0.11
RESRFP20-1	+\$0.33	+\$0.11	+\$0.15
RESRFP21-1	+\$0.37	+\$0.09	+\$0.12
Portfolio (Total)	+\$1.57	+\$0.47	+\$0.64

7.3 Comparison of Overall Impacts of Studied Scenarios

As discussed in Section 5, providing no relief to Petitioners could lead many projects to elect to not complete development at their current costs and seek to terminate their NYSERDA contracts and re-bid into future solicitations. While it is impossible to predict future bid prices accurately, NYSERDA can confirm that median bid prices from proposals received in 22T1 and NY3 are significantly higher than in prior solicitations. And given the analysis that predicts higher bid prices being maintained in the near and medium term, and the low likelihood for deflationary market dynamics to lead to cheaper bid prices in that timeframe, it is reasonable to assume that the higher pricing levels observed in the latest solicitations represent the best available estimate of general pricing trends in future bids.⁷⁵

From the analysis presented earlier, it is also clear that in comparing the various price adjustment options (as illustrated in the table below) that the relief requested by ACE NY and Empire/Beacon represent the highest increase to strike prices of the potential adjustments reviewed, but the greatest potential relative to the number of projects able to complete development without further delays due to project economics. The 22T1/NY3 formulas would increase strike prices and ratepayer costs less than the other options presented, but with the expectation that fewer projects would proceed in comparison to the more

⁷⁵ As noted in Section 5, NYSERDA does not publicly disclose bid price information, and any quantitative presentation of expected strike price and ratepayer cost impacts would be tied to that bid price. Accordingly, quantitative potential strike price and ratepayer cost impact details are included in Appendix C, which is redacted.

expensive relief requests. The 22T1/NY3 formulas with a 100% coefficient would incur a relatively higher increase in strike prices and ratepayer costs in comparison to the standard 22T1/NY3 formulas but could further limit attrition. It is relevant to note that these estimates are directional, and it is important to underline the uncertainty of the cost impacts and attrition outcomes of the 22T1/NY3 formulas (standard and 100% coefficient). That uncertainty is driven by two factors: the exact number of projects that would not be able to proceed with an inflation adjuster offer is uncertain, and the exact prices that these projects would rebid at in the future, should they so choose, is uncertain as well.

Table 30. Illustrative Comparison of Price Adjustment Scenarios Analyzed

Scenario	Strike Price and Ratepayer Cost	Projects Able to Move Forward
Relief Requested by Petitioners	\$\$\$ Highest cost of adjustment	+++ Presumably enables all projects to move forward
Application of 22T1 and NY3 formulas	\$ Lowest cost of adjustment	+ Some projects expected to not move forward
Application of 22T1 and NY3 formulas with 100% coefficient	\$\$ Higher cost adjustment than 22T1/NY3 formulas, lower than relief requested	++ More projects may move forward than 22T1/NY3 formulas, but less than relief requested

7.4 Synthesis and Discussion: Key Considerations

As noted in Section 4 above, applying a price adjustment to existing contracts would deviate from the primary method established by the Commission for establishing pricing of CES contracts, which is through competitive solicitations. Such a step should be taken only in appropriate circumstances and with care to design an adjustment that properly reflects the applicable issues and fairly allocates foreseeable risks to developers.

The Commission has previously ordered an adjustment to the pricing of existing CES contracts under the index REC conversion process, in which the Commission authorized NYSERDA to offer index REC pricing to projects that had been selected competitively based on fixed REC price bids.⁷⁶ Under index REC pricing, ratepayers benefit through lower REC prices when energy and capacity prices are high. The conversion was designed with the goal of reducing total cost to ratepayers by targeting strike prices expected to be, on the portfolio level, lower than the sum of energy and capacity prices plus the fixed REC prices that were in place prior to the conversion. While the conversion process by its nature reallocated some material economic risks related to energy and capacity market prices, the Commission nonetheless determined that the step was appropriate and in the best interests of ratepayers.

⁷⁶ Case 15-E-0302, Proceeding to Implement a Large-Scale Renewable Program and a Clean Energy Standard, Order Authorizing Voluntary Modification of Certain Tier 1 Agreements (issued and effective November 20, 2020).

In the current circumstances, a price adjustment of some degree to the CES contracts at issue in the Petitions could also be warranted for five reasons:

First, certain market-wide developments and macroeconomic issues described in Section 3 were material and unforeseeable, meaning that they could not have reasonably been built into the prices bid into prior solicitations. Accordingly, applying an adjustment designed to adjust specifically for those matters would not undermine the competitiveness of prior solicitations or harm non-awardees in prior solicitations, nor would it be expected to provide a windfall to developers given that a well-designed price adjustment would correlate with actual cost exposures faced by projects.

Second, as described in Section 5, if no price adjustment is made, progress to Climate Act targets would be slowed, opportunities to realize earlier grid reliability and health benefits, as well as substantial economic development, would be missed.

Third, as described in Sections 5 and 7, there is a significant risk that the portfolio of renewable energy generation that would need to be re-procured in the event that projects are unable to move forward could be priced higher than the pricing of existing projects after applying a price adjustment (depending on the specific price adjustment applied).

Fourth, the nature of a price adjuster that is based on dynamic indices is that it is designed to adjust based on market dynamics moving forward, which strengthens project viability and benefits to ratepayers. The inclusion of a price adjustment formula would insulate projects from future inflation, meaning that projects would not need to petition the Commission for similar issues in the future. Inversely, the adjustment formula would allow ratepayers to benefit if inflationary trends reverse going forward.

Fifth, inflation adjustment mechanisms were included in the 22T1 and NY3 solicitations, so the application of a price adjustment that implements similar principles would be consistent with the approach taken in the most recent iteration of CES solicitations.

Sections 4, 6 and 7 describe potential price adjustment mechanisms that could be applied. As noted in those sections, the mechanisms proposed by the developers appear designed to allow all projects to move forward with their as-adjusted pricing. However, as further set forth in Section 4, there are aspects of the proposed mechanisms that may be less appropriate. Another approach could be to apply the 22T1 and NY3 inflation formulas, but applying those would risk some project attrition. Applying the 22T1 and NY3 inflation formulas but with a 100% weighting coefficient would reduce project attrition but also would shift more inflation risks to ratepayers than were contemplated in the design of those formulas.

8. Additional Policy Considerations

8.1 Method for Providing a Price Adjustment

If the Commission concludes that an adjustment should be provided, NYSERDA suggests that the Commission's orders should enumerate any required terms that NYSERDA should include as conditions to offered contract amendments that implement the adjustment, to provide critical certainty to the market and avoid the need for further substantive negotiation.

Once the Commission issues orders on these matters that clearly states the path forward, regardless of what path the Commission settles upon, each project's developer will have much-needed clarity that should enable them to continue development apace or take other steps such as project sale or termination if the developer concludes that it cannot build and operate the project economically in light of the Commission's decision. This clarity will also enable developers that conclude they are unable to proceed

with certain projects under existing pricing to prepare their bids into future NYSERDA solicitations, should they so choose.

8.2 Eligibility Considerations

It could be reasonable to implement an eligibility screen that would make any Project that already issued full notice to proceed⁷⁷ to construct the facility (and therefore had locked in its costs) prior to the recent inflationary pressures described in the Petitions and above ineligible for a price adjustment, as the adjustment mechanisms under discussion are based upon comparison of select indices at the time of bid and at the time of issuing full notice to proceed to construct the facility. NYSERDA therefore suggests that, if the Commission approves an adjustment and determines that such an eligibility screen is appropriate, that the Commission set forth in the order for an adjustment a specific cut-off date which would exclude any project that issued full notice to proceed to construct the facility prior to that date from an adjustment.

Further, in defining appropriate price adjustment eligibility should it elect to do so, the Commission could consider contract status as a factor. As described above, the awardees of the Tier 1 2021 solicitation had not signed their contracts at the time the Petitions were filed, and thus differing consideration may be warranted.

8.3 Potential Additional Contract Terms

If the Commission elects to provide an adjustment to existing contracts, it could be reasonable for the adjusted contracts to be modified to include additional terms that protect ratepayers and reflect current market conditions. While NYSERDA can formulate appropriate specifics of these terms, it would be helpful for the Commission to enumerate a list of terms that should be included in these contract modifications, to provide clarity to both NYSERDA and its counterparties. This clarity could help limit the risk of drawn-out negotiations that would delay implementation of Commission policy and potentially undermine the purpose of an adjustment authorized by the Commission.

The below list comprises terms that the Commission may wish to consider instructing NYSERDA to include in a contract modification if the Commission decides to approve a price adjustment. Roughly the level of specificity set forth below could be appropriate to include in Commission orders.

- A. Updated Milestone Deadlines. A major purpose of a price adjustment would be to ensure that projects can continue to be developed and built on schedule to ensure Climate Act goals are met, GHG emissions are reduced, reliability benefits are achieved and supply chain bottlenecks are mitigated. Accordingly, the Commission could require NYSERDA to include updates to project development milestones that are both achievable and consistent with these goals. These milestones could include both deadlines for reaching commercial operation and, where appropriate, additional deadlines for interim project development milestones to ensure that projects remain on schedule.
- B. Increased Contract Security. When entering into contracts with NYSERDA, developers are required to post contract security in the form of cash, letters of credit, and, for certain types of projects, corporate guaranties. NYSERDA's contracts provide that this contract security will be forfeited if project development milestones are not met. The amount of contract security was set at the time

⁷⁷ "Full notice to proceed" for this purpose can be defined as means an unequivocal authorization from the Seller (project owner), or its representative, to its general contractor (or in the event that there is no general contractor to all material third party contractors) to construct the entire Bid Facility (at a minimum of 80% of the Bid Capacity), as opposed to a limited notice to proceed with only a subset of the work such as site preparation and/or site civil work.

solicitations were issued, and the amounts were set in part to avoid overly burdening developers and increasing bid prices and costs to ratepayers. In the current context, however, increasing contract security could be an appropriate step to ensure that developers are adequately incentivized to continue development apace. The exact amount of increased contract security could be determined by NYSERDA in consultation with DPS staff based on a review of practices in other jurisdictions and consideration of appropriate economic incentives in the New York context (the nature of the increase for Tier 1 projects could, but may not necessarily, differ from the increase for OSW projects).

- C. Sharing of Federal Support. As further discussed below, numerous new opportunities for renewable energy projects to access federal support (including tax credits) have been introduced recently, but the ability of projects to qualify for this support remains subject to substantial uncertainty. In light of this, it could be appropriate to include a provision that would share the benefits of this potential but currently uncertain federal support with ratepayers.

Many federal incentives for renewable energy projects were already available and known at the time bid prices were formulated and committed to in past solicitations. However, recent developments at the federal level, including passage of the Inflation Reduction Act, have created new types of support that were not previously contemplated. This support can be substantial. For example, the IRA added two new “bonus” provisions to the investment tax credit available to renewable energy projects, each of which, if qualified for, would provide an additional tax credit equal to 10% of the project’s total qualifying investment.

However, despite recent issuance of guidance on these additional bonuses by the IRS, the ability of projects to qualify is still not clear in many circumstances. For example, a project may not know at this stage whether it will be able to incorporate adequate domestic content into its project procurement to qualify for the domestic content bonus. As another example, some projects could potentially qualify for the energy community bonus if their sites meet the Inflation Reduction Act’s definition of a brownfield, but because this definition is very fact-specific and refers to environmental assessments that may not yet have been carried out, many projects reasonably do not yet know whether they will qualify.

In light of this remaining uncertainty, the 2022 OSW solicitation included a new “qualifying federal support” provision which provided that any federal support provided through future legislation, as well as federal support provided under the domestic content and energy communities bonuses established by the Inflation Reduction Act, would be subject to a sharing mechanism in which a portion of the benefits of such support would be applied to a reduction in the contract price. The Commission could require NYSERDA to include a similar provision to be added to existing contracts in conjunction with a price adjustment, and NYSERDA could tailor the provision to current market circumstances. The provision would likely differ between Tier 1 and OSW but would be designed to achieve the same fundamental purpose.

In addition, both Tier 1 and OSW projects could potentially be eligible for low-cost financing from the Department of Energy’s Loan Program Office (LPO). With the increase in interest rates in recent years, low-cost financing from the LPO could potentially benefit some projects significantly. In conjunction with an adjustment that the Commission authorizes NYSERDA to offer, the Commission could require that provisions be added to the affected contracts that would share the benefits of low-cost LPO financing with ratepayers on a similar basis as described above and to require developers to take reasonable steps to pursue low-cost LPO financing and report on progress.

The purpose of these provisions would be to ensure that a reasonable portion of any support provided by the federal government that was not already built into projects' expectations would be applied to reduce projects prices and thus mitigate the increase in prices effected by a price adjustment.

- D. Adjusted Economic Benefits. The same inflationary pressures that have impacted costs as described above also apply to the quantum of economic benefits provided to New York State. As with pricing, economic benefits commitments were submitted by bidders in nominal dollars, based on their projections of costs at that time. If the Commission concludes that a price adjustment is warranted, it would be logical for the nominal amount of committed economic benefits to be adjusted as well, in recognition of inherent increased spending amounts. The adjustment may not be a 1:1 match with a price adjustment, however, given that some of the increased costs stem from prices for equipment and goods that are sourced outside of New York State. Imposing too high an increase in minimum economic benefits could further burden project economics, potentially undermining the purpose of granting an price adjustment. Accordingly, in conjunction with authorization of an adjustment, the Commission could order NYSERDA to determine an appropriate, but not overly burdensome, adjustment in minimum economic benefits that would be applied to projects in a certain category (for example, the nature of the adjustment for Tier 1 projects could, but may not necessarily, differ from the adjustment for OSW projects).
- E. MWBE and SDVOB Provisions. The 22T1 and NY3 solicitations included new requirements to maximize opportunities for minority and women owned business enterprises (MWBEs) and service-disabled veteran owned businesses (SDVOBs) and to document these efforts, as well as other related reporting requirements, in ongoing progress reports. The Commission could require that analogous provisions be incorporated in a price adjustment offer.
- F. Offshore Wind Interconnection Savings Sharing. Recognizing the dynamic nature of offshore wind interconnection plans and costs, this provision would require that a portion of savings compared with the expected costs of interconnection for offshore wind projects be applied to a reduction in the contract price. This provision was already included in the 2022 offshore wind solicitation, so it could be adapted for this purpose. For clarity, this provision is distinct from the requested interconnection cost-sharing provisions requested by the Sunrise and Empire/Beacon Petitions.

8.4 Interaction with Capacity Accreditation Petition

On June 29, 2023, NYSERDA filed a Petition Regarding Capacity Accreditation with the Commission (Capacity Accreditation Petition).⁷⁸ In the Capacity Accreditation Petition, NYSERDA proposes a revision to the Reference Capacity Price formula included in existing and future OSW and Tier 1 agreements to account for changes to long-term capacity revenue expectations associated with revisions to the Market Administration and Control Area Services Tariff proposed by NYISO and approved by FERC to adopt a marginal capacity accreditation market design. In conjunction with the change to the Reference Capacity Price formula, NYSERDA also proposes a methodology for adjusting the Index (O)REC Strike Prices of existing agreements and agreements awarded in response to pending RFPs based on a comparison of submitted UCAP Production Factors relative to proposed technology-specific default UCAP Production Factors. The Index (O)REC Strike Price adjustments would be an adder (or subtractor) based on the difference in the levelized Reference Capacity Price using the respective UCAP Production Factors and are not a function of the initial Index (O)REC Strike Prices. If both a price adjustment (in response to the Petitions) and a capacity accreditation adjustment are implemented, NYSERDA proposes

⁷⁸ See Case 15-E-0302, Proceeding to Implement a Large-Scale Renewable Program and a Clean Energy Standard, Petition Regarding Adjustment to Index REC and Index OREC Formulas for New Capacity Accreditation Rules, (filed June 29, 2023).

to apply the inflation adjustment first, because it is a function of the initial Index (O)REC Strike Price, and then to apply the capacity accreditation adjustment:

$$(O)REC_{Adj} = (O)REC_{AdjIA} + (O)REC_{AdderCA}$$

where:

$(O)REC_{Adj}$ is the Index (O)REC Strike Price after both any price adjustment and the capacity accreditation adder have been applied

$(O)REC_{AdjIA}$ is the Index (O)REC Strike Price after any price adjustment has been applied in accord with Commission action in response to the Petitions

$(O)REC_{AdderCA}$ is the adder or subtractor associated with Commission action in response to the Capacity Accreditation Petition

This avoids applying the price adjustment multiplier to the capacity accreditation adder or subtractor, which is not related to inflation but only to the change in NYISO market rules.

8.5 Approach to Clean Path New York

On June 14, 2023, CPNY submitted a petition requesting relief analogous to that requested by ACE NY with respect to CPNY's generation portfolio (the petition does not request any adjustment associated with the costs of the associated new transmission line). As stated in that petition, CPNY's generation portfolio consists of resources that either have Tier 1 contracts with NYSERDA or are eligible to be awarded contracts in future Tier 1 solicitations. Accordingly, CPNY's generation portfolio is subject to the same dynamics described above. Additionally, to the extent that Tier 1 projects are provided a price adjustment and no adjustment is provided to CPNY, those generation projects would no longer have an economic incentive to remain part of CPNY's portfolio.

The petition further states that any adjustment provided to CPNY should be designed to avoid negative additional impacts on ratepayers. According to CPNY's petition, this can be achieved because, without an adjustment, the Tier 1 generators would be paid an increased Tier 1 price for their entire generation, whereas if CPNY is adjusted as well, those generators would simply divide their generation between Tier 1 and CPNY. With no adjustment being provided to the transmission component of CPNY's Tier 4 REC price, ratepayers should in theory be indifferent between the generator being paid the adjusted generation price by CPNY and the adjusted Tier 1 price.

While an understandable argument in theory, the mechanism to effectuate the results described above cannot be designed or evaluated until the Commission's decision with respect to the ACE NY petition is known. For this reason and due to the additional complexity inherent in the CPNY project (which is further described in NYSERDA's Capacity Accreditation Petition), how any potential adjustment to the CPNY price could be effectuated is dependent on the outcome of ACE NY's Petition and should be proposed to the Commission for consideration after the Commission has issued its decision on that Petition.

8.6 Future Solicitations

NYSERDA is carefully monitoring market conditions and examining recent enhancements to Tier 1 and OSW solicitations, including the optional inflation adjusters discussed previously, to assess their efficacy in mitigating uncertain market conditions and attracting the most economical bids possible. Additional adjustments in future solicitations may also be warranted based on the continued evolution of market conditions, the effectiveness of recent enhancements and the Commission's decisions with respect to the

Petitions and the lessons learned from them. Accordingly, NYSERDA is working with and will continue to work with DPS staff to evaluate what adjustments should be made to future solicitations.

Appendix A: Tier 1 Awarded Projects

Project Name	Solicitation Name	Renewable Technology	NYISO Zone	Project Status	Bid Capacity (MW)	Bid Quantity (MWh)
Buffalo BioEnergy	2554	Biogas - ADG	West	Operational	1.24	4,750
Arkwright Summit	2985	Land Based Wind	West	Operational	75.58	229,873
Jericho Rise	2985	Land Based Wind	North	Operational	73.81	206,272
Ball Hill	3084	Land Based Wind	West	Under Development	100	269,877
Fulton Unit 2	3084	Hydroelectric	Central	Operational	0.45	3,819
Lyons Falls Mill Hydro	3084	Hydroelectric	Mohawk Valley	Cancelled	5.23	27,409
Morgan Stanley Headquarters	3084	Fuel Cell	New York City	Operational	0.75	6,324
NYC Biogas	3084	Biogas - ADG	New York City	Cancelled	9.12	10
Belfort Unit 3	3257	Hydroelectric	Mohawk Valley	Operational	0.34	1,975
Coeymans Solar	3257	Solar	Capital	Under Development	20	36,084
Eight Point Wind	3257	Land Based Wind	Central	Operational	101.2	313,825
Fulton Unit 1	3257	Hydroelectric	Central	Operational	0.87	6,968
Glen Park	3257	Hydroelectric	Mohawk Valley	Operational	6.82	32,166
Greene County 1	3257	Solar	Hudson Valley	Under Development	20	36,084
Greene County 2	3257	Solar	Hudson Valley	Under Development	10	18,042
Hecate Energy Greene County 1 ⁷⁹	3257	Solar	Hudson Valley	Cancelled	47.49	85,699
North Division Street Dam Hydroelectric Facility	3257	Hydroelectric	Mohawk Valley	Operational	0.55	1,959
Number Three Wind Farm	3257	Land Based Wind	Mohawk Valley	Operational	105.8	278,500
Regen DG Project	3257	Fuel Cell	Dunwoodie Hudson	Operational	1	6,442
Swinging Bridge	3257	Hydroelectric	Valley	Operational	2.07	4,794

⁷⁹ Hecate Energy Greene County 1 was replaced by a phased project consisting of Coeymans Solar, Greene County 1 and Green County 2, consistent with the projects' interconnection and permitting processes.

Tannery Island - Tannery Island Hydro		3257 Hydroelectric	Mohawk Valley	Operational	0.16	827
Alle-Catt Wind Farm	RESRFP17-1	Land Based Wind	West	Under Development	339.78	977,474
Baron Winds ⁸⁰	RESRFP17-1	Land Based Wind	Central	Cancelled	272	748,174
Baron Winds I	RESRFP17-1	Land Based Wind	Central	Operational	121.8	354,417
Baron Winds II	RESRFP17-1	Land Based Wind	Central	Under Development	112.5	272,706
Blue Stone Solar	RESRFP17-1	Solar	Hudson Valley	Cancelled	19.99	27,493
Bluestone Wind	RESRFP17-1	Land Based Wind	Mohawk Valley	Under Development	121.8	392,644
Branscomb Solar	RESRFP17-1	Solar	Capital	Operational	19.99	38,472
Darby Solar	RESRFP17-1	Solar	Capital	Operational	19.99	36,774
Double Lock Solar	RESRFP17-1	Solar	Capital	Cancelled	19.39	32,103
East Point Energy Center	RESRFP17-1	Solar	Capital	Under Development	50	109,631
Flint Mine Solar	RESRFP17-1	Solar	Hudson Valley	Under Development	100	174,412
Greene County Energy Properties	RESRFP17-1	Solar	Hudson Valley	Under Development	19.9	26,149
Grissom Solar	RESRFP17-1	Solar	Capital	Operational	19.99	33,972
High River Energy Center	RESRFP17-1	Solar	Capital	Under Development	90	167,141
Janis Solar	RESRFP17-1	Solar	Central	Operational	19.99	35,898
Java Solar Energy Center	RESRFP17-1	Solar	West	Cancelled	1.53	2,039
Little Pond Solar	RESRFP17-1	Solar	Hudson Valley	Under Development	19.99	37,649
Lyons Falls Mill Redevelopment	RESRFP17-1	Hydroelectric	Mohawk Valley	Cancelled	3.28	20,062
Magruder Solar	RESRFP17-1	Solar	Hudson Valley	Cancelled	19.99	35,022
Pattersonville	RESRFP17-1	Solar	Capital	Under Development	19.99	40,503
Puckett Solar	RESRFP17-1	Solar	Central	Operational	19.99	33,271
Regan Solar	RESRFP17-1	Solar	Capital	Operational	19.99	35,548
Rising Solar	RESRFP17-1	Solar	Hudson Valley	Cancelled	20	32,184
Rock District Solar	RESRFP17-1	Solar	Capital	Under Development	19.99	33,884
Shepherd's Run Solar	RESRFP17-1	Solar	Capital	Under Development	60	111,164

⁸⁰ Baron Winds as awarded was replaced by a phased project comprised of Baron Winds I and Baron Winds II, consistent with permitting outcomes.

Sky High Solar	RESRFP17-1	Solar	Central	Under Development	19.99	36,248
Sunny Knoll Solar	RESRFP17-1	Solar	Capital	Cancelled	19.39	32,613
Tayandenega Solar	RESRFP17-1	Solar	Capital	Under Development	19.99	37,106
Bakerstand Solar 1	RESRFP18-1	Solar	West	Under Development	19.99	27,703
Canisteo Wind & Storage ⁸¹	RESRFP18-1	Land Based Wind	Central	Cancelled	290	894,221
ELP Stillwater Solar	RESRFP18-1	Solar	Capital	Under Development	19.99	32,396
Excelsior Energy Center - Solar + Storage 2	RESRFP18-1	Solar	Genesee Hudson Valley	Under Development	280	591,615
Hannacroix Solar Facility	RESRFP18-1	Solar	Genesee Hudson Valley	Cancelled	4.99	10,342
Heritage Wind	RESRFP18-1	Land Based Wind	Genesee	Under Development	147	393,100
High Bridge Wind and Battery	RESRFP18-1	Land Based Wind	Mohawk Valley	Under Development	99	308,737
Horseshoe Solar	RESRFP18-1	Solar	Genesee	Under Development	180	368,971
Manchester Solar	RESRFP18-1	Solar	Central	Under Development	19.99	40,223
Mohawk Solar	RESRFP18-1	Solar	Capital	Under Development	90.5	200,321
Morris Ridge Solar	RESRFP18-1	Solar	Central	Under Development	177	319,920
Roaring Brook Wind	RESRFP18-1	Land Based Wind	Mohawk Valley	Operational	77.7	229,329
SED Dog Corners Solar	RESRFP18-1	Solar	Central	Under Development	19.99	37,999
SED Hills Solar	RESRFP18-1	Solar	Mohawk Valley	Under Development	19.99	37,999
SED Skyline Solar	RESRFP18-1	Solar	Mohawk Valley	Under Development	19.99	35,022
SED Watkins Road Solar 1	RESRFP18-1	Solar	Mohawk Valley	Under Development	19.99	37,999
Silver Lake Solar	RESRFP18-1	Solar	Central	Under Development	24.99	38,200
SunEast Clay Solar	RESRFP18-1	Solar	Central	Cancelled	19.99	35,022
Trelina Solar Energy Center	RESRFP18-1	Solar	Central	Under Development	80	156,629

⁸¹ NYSERDA and NYPA (RFP Q17-6164MH) issued simultaneous solicitations for the purchase of renewable energy certificates or renewable energy, capacity, and certificates, respectively. On January 30, 2019, NYPA's Trustees approved the award of a 20-year power purchase agreement to 290 MW Canisteo Wind Energy LLC for energy, capacity and renewable energy certificates and the project elected to proceed under that award. Accordingly, this project is not included in CES project attrition.

Watkins Glen Solar Energy Center	RESRFP18-1	Solar	Central	Under Development	50	106,784
Bald Mountain Solar	RESRFP19-1	Solar	Capital	Under Development	19.99	33,446
Cohocton Wind Project	RESRFP19-1	Land Based Wind	Central	Operational	35.75	97,083
ELP Ticonderoga Solar	RESRFP19-1	Solar	Capital	Under Development	19.99	36,798
Garnet Energy Center Storage 1	RESRFP19-1	Solar	Genesee	Under Development	200	453,768
Greens Corners Solar	RESRFP19-1	Solar	Mohawk Valley	Under Development	120	194,472
Martin Rd Solar	RESRFP19-1	Solar	West	Under Development	19.99	33,096
North Side Energy Center	RESRFP19-1	Solar	North	Under Development	180	367,394
Prattsburgh Wind Farm	RESRFP19-1	Land Based Wind	Central	Under Development	145	449,651
Sandy Creek Solar	RESRFP19-1	Solar	Mohawk Valley	Under Development	19.99	37,649
South Ripley Solar and Storage	RESRFP19-1	Solar	West	Under Development	270	404,449
Steel Winds Wind Farm	RESRFP19-1	Land Based Wind	West	Operational	4.78	14,362
Steel Winds Wind Farm 2	RESRFP19-1	Land Based Wind	West	Operational	2.57	7,707
SunEast Fairway Solar	RESRFP19-1	Solar	Mohawk Valley	Under Development	19.99	36,248
SunEast Flat Hill Solar	RESRFP19-1	Solar	Mohawk Valley	Under Development	19.99	36,423
SunEast Grassy Knoll Solar	RESRFP19-1	Solar	Mohawk Valley	Under Development	19.99	36,949
SunEast Highview Solar	RESRFP19-1	Solar	West	Under Development	20	31,361
SunEast Hilltop Solar	RESRFP19-1	Solar	Capital	Under Development	19.99	38,175
SunEast Limestone Solar	RESRFP19-1	Solar	Capital	Under Development	19.99	36,073
SunEast Tabletop Solar	RESRFP19-1	Solar	Capital	Under Development	80	145,066
SunEast Valley Solar	RESRFP19-1	Solar	Central	Under Development	19.99	37,124
West River Solar	RESRFP19-1	Solar	Capital	Under Development	19.99	33,446
Alabama Solar Park	RESRFP20-1	Solar	Genesee	Cancelled	130	258,508
Chasm Falls	RESRFP20-1	Hydroelectric	North	Operational	1.6	5,999
Cider Solar Farm	RESRFP20-1	Solar	West	Under Development	500	928,560

Clear View Solar	RESRFP20-1	Solar	Central	Cancelled	19.99	40,822
Dolan Solar	RESRFP20-1	Solar	Capital	Under Development	19.99	40,276
Great Gully Solar Farm (formerly Delight Farm)	RESRFP20-1	Solar	Central	Cancelled	16.8	31,052
Harvest Hills Solar (Formerly Milliken Solar)	RESRFP20-1	Solar	Central	Under Development	200	394,200
Hatchery Solar	RESRFP20-1	Solar	Central	Cancelled	19.99	40,626
Hawthorn Solar	RESRFP20-1	Solar	Capital	Under Development	19.99	39,400
Highbanks Solar	RESRFP20-1	Solar	Central	Cancelled	19.99	43,603
Homer Solar Energy Center	RESRFP20-1	Solar	Central	Under Development	90	168,718
Mill Point Solar	RESRFP20-1	Solar	Mohawk Valley	Under Development	250	497,130
Moraine Solar Energy Center	RESRFP20-1	Solar	Central	Under Development	93.55	183,568
Orleans Solar	RESRFP20-1	Solar	Genesee	Cancelled	200	381,936
Rutland Center Solar 1	RESRFP20-1	Solar	Mohawk Valley	Under Development	110.2	208,516
Somers Solar	RESRFP20-1	Solar	Capital	Under Development	19.99	37,649
SunEast Augustus Solar	RESRFP20-1	Solar	Mohawk Valley	Under Development	19.99	39,225
SunEast Flat Creek Solar	RESRFP20-1	Solar	Capital	Under Development	200	415,224
SunEast Flat Stone Solar	RESRFP20-1	Solar	Mohawk Valley	Under Development	19.99	38,175
SunEast Kingbird Solar	RESRFP20-1	Solar	West	Under Development	19.99	38,875
SunEast Transit Solar	RESRFP20-1	Solar	West	Under Development	19.99	41,502
Tracy Solar Energy Center	RESRFP20-1	Solar	Mohawk Valley	Under Development	119	236,634
Alfred Oaks Solar	RESRFP21-1	Solar	Central	Under Development	100	183,960
Bear Ridge Solar	RESRFP21-1	Solar	West	Under Development	100	181,332
Columbia Solar Energy Center	RESRFP21-1	Solar	Mohawk Valley	Under Development	350	646,926
Easton Solar Farm	RESRFP21-1	Solar	Capital	Under Development	20	38,369
ELP Rotterdam Solar	RESRFP21-1	Solar	Capital	Under Development	19.99	41,327
ELP Stuyvesant Solar	RESRFP21-1	Solar	Capital	Under Development	19.99	35,898

Foothills Solar Farm	RESRFP21-1	Solar	Capital	Under Development	40	75,336
Fort Covington Solar Farm	RESRFP21-1	Solar	North	Under Development	250	473,040
Fort Edward Solar Farm	RESRFP21-1	Solar	Capital	Under Development	100	192,720
Harvest Hills Solar 2	RESRFP21-1	Solar	Central	Under Development	100	202,356
Mill Point Solar 2	RESRFP21-1	Solar	Mohawk Valley	Under Development	100	197,100
Moss Ridge Solar	RESRFP21-1	Solar	Mohawk Valley	Under Development	60	86,198
Newport Solar Farm	RESRFP21-1	Solar	Mohawk Valley	Under Development	130	244,842
Rich Road Solar Energy Center	RESRFP21-1	Solar	Mohawk Valley	Under Development	240	456,221
Ridge View Solar Energy Center	RESRFP21-1	Solar	West	Under Development	350	665,322
Roosevelt Solar	RESRFP21-1	Solar	North	Under Development	19.9	39,397
Scotch Ridge Solar	RESRFP21-1	Solar	Capital	Under Development	20	40,296
Stern Solar	RESRFP21-1	Solar	Capital	Under Development	19.99	41,700
SunEast Flat Creek Solar II	RESRFP21-1	Solar	Capital	Under Development	100	193,596
SunEast Scipio Solar	RESRFP21-1	Solar	Central	Under Development	18	32,167
Yellow Barn Solar	RESRFP21-1	Solar	Central	Under Development	160	299,886
York Run Solar	RESRFP21-1	Solar	West	Under Development	90	174,520
134 Projects					9,652	20,602,431

Appendix B: Industrial Economics Report

(Attached)



2023 New York Large Scale Renewables Inflation Petitions Analytical Support

August 25, 2023

INDUSTRIAL ECONOMICS, INCORPORATED

Prepared for:

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1.1 Background

Pursuant to New York's Clean Energy Standard and the Climate Leadership and Community Protection Act (CLCPA), the New York State Energy Research and Development Authority (NYSERDA) is working with utilities, community organizations, and local governments to accelerate the State's renewable energy development. Under the CLCPA, New York must generate 70 percent of its electricity from renewable sources by 2030 and 100 percent by 2040. Consistent with these goals, the CLCPA also requires the State to acquire 6 GW of solar resources by 2025, 3 GW of energy storage resources by 2030, and 9 GW of offshore wind resources by 2035.¹ To meet these objectives, the Clean Energy Standard requires utilities in New York to procure renewable energy certificates (RECs) associated with new renewable energy facilities.

To secure the renewable energy capacity required under the Clean Energy Standard and the CLCPA, NYSEDA has held a series of solicitations for large-scale renewable facilities through a competitive bid process. Winning bidders receive RECs for the renewable energy that they produce, which they can then sell to utilities serving New York electricity customers. NYSEDA conducts separate solicitations for RECs and offshore wind RECs. Initially, these procurements were for fixed price RECs, whereby the winning bidders received a fixed price for their RECs throughout the life of the contract. The procurement process has since evolved such that bidders have the option of proposing either fixed price REC contracts or index REC contracts. Under the latter, the bidder proposes a fixed strike price for the duration of the contract that is compared monthly against a reference price (e.g., the wholesale market price of electricity). The difference between the strike price and the reference price yields the monthly REC price that is either paid to the bidder (if the reference price is less than the strike price) or paid by the bidder to NYSEDA (if the reference price exceeds the strike price). NYSEDA's 2022 request for proposals (RFP) for Tier 1 eligible RECs also included an inflation adjustment that allows for a Producer Price Index (PPI) based adjustment to the index REC strike price or the fixed REC price.^{2,3}

Table 1-1 summarizes the solicitations held by NYSEDA over the 2016-2021 period, including the number of projects and generation capacity awarded for each solicitation.

¹Climate Leadership and Community Protection Act (CLCPA). SUNY. <https://www.suny.edu/sustainability/goals/clcpa/>

² Tier 1 RECs are produced by generators using new renewable energy resources that entered commercial operation on or after January 1, 2015.

³ New York Tier 1 RESRFP22-1 Proposers' Webinar. NYSEDA. <https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Clean-Energy-Standard/RESRFP221-Proposers-Webinar.pdf>

Table 1-1. Summary of New York Large Scale Renewable Solicitations

Solicitation	REC Type	Proposal Due Date	Projects Awarded	Capacity Awarded (MW)
Pre-2016 RPS	REC	Various (2013-2015)	8	266
2016 RPS (RFP 3257)	REC	July 2016	12	269
RESRFP17-1	REC	September 2017	27	1,339
RESRFP18-1	REC	August 2018	20	1,661
ORECRFP18-1/NY-1	OREC	February 2019	2	1,740
RESRFP19-1	REC	September 2019	21	1,278
RESRFP20-1	REC	October 2020	22	2,111
ORECRFP18-1/NY-2	OREC	October 2020	2	2,490
Tier 4 REC	Tier 4 REC	April 2021	2	1,750
RESRFP21-1	REC	August 2021	22	2,408
Total			138	15,312

Source: OpenNY⁴

1.2 Petitions for Inflation Adjustment

In June 2023, the New York State Public Service Commission (the Commission) received four petitions from project developers seeking adjustments to the REC pricing terms in established contracts with NYSERDA, citing an unexpected rise in inflation associated with (among other factors) the COVID-19 pandemic and the Russian invasion of Ukraine. These include petitions from (1) the Alliance for Clean Energy New York (ACE NY), (2) Sunrise Wind, (3) Empire Offshore Wind and Beacon Wind, and (4) Clean Path New York. The requests included in these petitions are summarized as follows:

- The ACE NY petition requests an adjustment mechanism based on price/inflation indices for inputs on renewable projects, with separate adjustment mechanisms for solar photovoltaic (PV) projects and land-based wind. The adjustment mechanisms, as requested, would apply to 86 projects for a total of 7,536 MW of capacity.⁵

⁴ Large-scale Renewable Projects Reported by NYSERDA: Beginning 2004. <https://data.ny.gov/Energy-Environment/Large-scale-Renewable-Projects-Reported-by-NYSERDA/dprp-55ye>; Totals include projects awarded in RPS (2013-2016) and CES (2017-2021) solicitations and account for the split of 2016 award Hecate Energy Greene County 1 into three separate projects and the split of 2017 award Baron Winds into 2 separate projects. The Tier 4 capacity listed is the total capacity of Clean Path New York resources without Tier 1 awards to avoid double-counting.

⁵ Petition of The Alliance for Clean Energy New York to Address Post COVID-19 Impacts on Renewable Development Economics And Contract Considerations. <https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7b909B9788-0000-C53F-9145-808CE763D4A1%7d>

- Sunrise Wind, a joint venture of Ørsted and Eversource, filed a petition to incorporate inflation and interconnection cost adjustment mechanisms to offset inflation and supply chain delays. The 924 MW offshore wind project's developers request adjustments similar to those included in NYSERDA's 2022 Offshore Wind RFP.⁶
- Empire Offshore Wind and Beacon Wind filed a joint petition for inflation adjustments to three offshore wind projects that total to 3,306 MW of capacity. The requested adjustments include four components—an inflation adjustment mechanism that is larger than that in NYSERDA's 2022 Offshore Wind RFP, an interconnection cost adjustment mechanism, a yearly consumer price index (CPI) based adjustment to the strike price, and an extension of the contract term for one of the projects.⁷
- Clean Path New York's (CPNY) petition requests an adjustment to the agreed upon generation strike price commensurate with the adjustment granted to ACE NY.⁸

The petitioners requested action by the Commission by October 2023.

1.3 Purpose of Report

The purpose of this report is to inform NYSERDA's recommendations concerning the Commission's response to the petitioners. To that end, this report provides a historical assessment of inflation and inflation forecasts between 2016 and the present, summarizes available forecasts of inflation over the next 10 years, and reviews petitions for inflationary relief received by jurisdictions other than New York. This information is presented in the following chapters:

- **Chapter 2: Review of Historical Inflation and Inflation Expectations between 2016 and 2023:** This chapter examines the degree to which inflation has been unusually high during between 2016 and early 2023 based on multiple metrics of inflation. In addition, this chapter examines inflation forecasts published during this period to assess whether the petitioners could have reasonably expected such increases in inflation during this period. As part of this assessment, this chapter also reviews the factors contributing to inflation during this period, based on studies published in the literature.
- **Chapter 3: Forecast of Future Inflationary Pressures on Renewable Energy Project Development:** Following the historical review of inflation and inflation forecasts, this report reviews existing forecasts of inflation to evaluate when, if at all, costs for renewable projects might return to levels seen prior to the recent bout of inflation. We evaluate forecasts for CPI, producer price index (PPI), Gross Domestic Product Implicit Price Deflator (GDP deflator), individual input prices, and labor costs and examine forecasts of capital expenditures by type of renewable, comparing current and prior forecasts.⁹ This chapter

⁶ Verified Petition of Sunrise Wind LLC for an Order Authorizing The New York State Energy Research and Development Authority to Amend The Offshore Wind Renewable Energy Certificate Purchase and Sale Agreement.

<https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7b90E79688-0000-CC36-A816-67B1C2522CE8%7d>

⁷ Verified Petition for Expedited Approval of Enhanced Offshore Renewable Energy Credits.

<https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7b60159788-0000-C2DD-8465-ECBBC3514C48%7d>

⁸ Petition Of Clean Path New York LLC to Address Post-Covid Impacts and Associated Considerations Concerning The Tier 1 Eligible Generation Component of Its Clean Energy Standard Tier 4 Renewable Energy Certificate Contract.

<https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7bD036BB88-0000-CC18-B110-C88E89E14F84%7d>

⁹ Detailed definitions for the CPI, PPI, and GDP deflator are provided in Chapter 2.

also reviews data related to supply chain pressures that might affect pricing for renewable energy projects over the next 10 years.

- **Chapter 4: Survey of Renewable Energy Inflationary Pressures and Relief Requests in Other Jurisdictions:** This chapter surveys jurisdictions outside of New York State where petitioners have sought inflationary adjustments on existing contracts for renewable energy projects. Projects from Massachusetts, New Jersey, California, Hawaii, New Mexico, Maine, Indiana, and Michigan faced similar inflationary pressures and requested relief in various forms. We detail the projects seeking inflationary relief, the type of relief requested, the decision of the jurisdiction's governing party, and the outcome of these requests.

1.4 Summary of Conclusions

As described in further detail in the chapters that follow, the main conclusions of our analysis are as follows:

- **High inflation was prevalent from mid-2021 through mid-2023 across the renewable energy supply chain and was largely unexpected for projects solicited between 2016 and 2020:** While input prices have stabilized in 2023, they are still higher than what was forecasted prior to the inflationary period. A counterfactual analysis shows that, in early 2023, the actual price level, as measured by the GDP Deflator, was nine percent higher than it would have been had inflation remained at two percent between January 2021 and March 2023.
- **Inflation was significantly higher than normal between 2021 and early 2023:** Inflation of goods, services, labor, and key components relevant to solar PV, onshore wind, and offshore wind projects all increased between 2021 and early 2023 by more than what pre-2021 trends indicated. The main drivers of inflation over this period (e.g., large fiscal stimulus, energy price shocks, war in Ukraine) materialized after a period of severe and unprecedented economic uncertainty; large swathes of the U.S. economy remained locked down throughout 2020 and effective COVID-19 vaccines were distributed in early 2021.
- **Extent of inflation was unforeseeable for project developers:** Given actual inflation data, inflation expectations at the time, and the Fed's actions that petitioners bidding between 2016 and 2020 observed, it is reasonable to conclude that the high and persistent inflation that followed in 2021-2023 was unforeseeable for the solicitations occurring between July 2016 and October 2020. For projects bid in August 2021, based on inflation data and inflation forecasts available at the time, it would have been realistic for developers to expect short-term and long-term levels of inflation that were higher than what could have been reasonably predicted prior to 2021 (i.e., higher than inflation observed between 2016 and early 2021 and higher than the Fed's target of 2 percent per year) but lower than the observed price increases that followed after August 2021. The inflation that occurred in late 2021 and through 2022 was significantly higher than what forecasters were predicting as of August 2021.
- **Forecasts indicate that inflation will moderate, but remain positive, over the next ten years:** Inflation projections show that the GDP Deflator and the CPI will stabilize slightly above the Federal Reserve's (the Fed's) two percent inflation target between 2024 and 2033. Economic analysts are not projecting that price deflation (a sustained drop in the

general price level) will occur in the next ten years. Forecasts indicate that the price level in the U.S. will nearly double by 2033 relative to the end of 2020. Labor costs are also expected to increase, but at slower rates. Historical relationships between general measures of inflation and commodity prices indicate that the latter, despite peaks and troughs, will follow an upward trend over the next ten years.

- **The decline in inflation observed in recent months does not imply that costs for renewable projects have also started to decline.** The reduction in inflation simply means that prices are no longer rising as rapidly as they had been in 2021 through mid-2023. For prices to fall back to levels observed prior to the recent bout of inflation, there would need to be a period of sustained and significant deflation across the U.S. economy. Deflation in the U.S. is historically associated with periods of significant economic uncertainty, weak output growth, and high unemployment, such as the Great Depression in the 1930s.
- **Supply chain constraints threaten the financial viability of renewable energy projects:** Significant tension between two economic forces is pushing renewable energy development prices in opposite directions. On one hand, prices of frontier technologies such as those used in renewable energy generation typically decrease over time, as industries mature, achieve economies of scale, and incentivize competitors to join the market. On the other hand, persistent supply chain constraints and inflationary pressures in renewable energy sectors are pushing prices higher and could potentially offset or outweigh the downward trend in prices driven by efficiency gains in these sectors. It is uncertain if supply will keep pace with the heightened global demand for clean energy to alleviate the inflationary pressures specific to solar PV, onshore wind, and offshore wind development.
- **Renewable energy project costs will remain above pre-2022 levels until sometime during the 2025-2030 period, with the exact year dependent on the technology type:** Optimistic forecasts prepared by the National Renewable Energy Laboratory (NREL) suggest that solar PV project costs will not reach their historically low levels observed in 2019 and 2020 until the end of the decade. The onshore wind industry is expected to recover faster, with project costs returning to 2021 levels as early as 2025. Though technology and efficiency gains are lowering costs for offshore wind development over the long term, recent press reports and industry analyses provide strong evidence that supply of key components will not keep pace with global demand for offshore wind generation, which will increase costs in the sector through 2030.
- **Requests for inflationary relief are not unique to New York:** Requests for inflationary relief on clean energy projects have been submitted in several jurisdictions across the U.S. for a variety of clean energy technologies. Thus, New York's receipt of inflationary relief petitions from project developers is unlikely to reflect any characteristics specific to the State's clean energy programs but instead is consistent with contemporaneous requests in other jurisdictions.
- **Processes and outcomes vary across jurisdictions:** The requests for relief and subsequent responses of state governing bodies do not follow a consistent pattern across jurisdictions. For example, petitions were approved in some jurisdictions and rejected in others. Similarly, in some jurisdictions the state legislature intervened to provide relief through legislation, while legislatures in other jurisdictions took no action. Factors such as deadlines for

reaching renewable energy targets, the amount of relief requested, the flexibility that State decision-making authorities had to change contract terms, and the willingness of these decision-making bodies to let projects be withdrawn played a role in the outcomes seen across jurisdictions.

- **In some cases, projects have been withdrawn:** Although outcomes for inflationary relief have varied across projects and jurisdictions, some projects have been withdrawn. This confirms that inflationary pressures, at least in some cases, have adversely affected the economic viability of projects.

CHAPTER 2 | Review of Historical Inflation and Inflation Expectations between 2016 and 2023

The petitions received by the Commission cite unusually high inflation as one of the primary reasons why adjustments to existing contract terms are warranted. To evaluate this claim, this chapter examines three key questions:

1. What was the trend in inflation between 2016 and early 2023 relative to inflation levels typically seen in the United States (i.e., near the Fed's target of 2 percent annually)?
2. To what degree would the petitioners have been able to anticipate such unusually high inflation based on inflation forecasts available at the time of their bid proposal submissions?
3. What were the causes of any unusually high inflation over this time period, and is this consistent with representations made by the petitioners?

Focusing on various inflation metrics relevant to solar PV, onshore wind, and offshore wind projects between January 2016 and May 2023, the analysis presented in this chapter shows that inflation accelerated in early 2021, remaining unusually high through mid-2023. The magnitude of inflation over this period of more than two years was widespread across multiple sectors of the renewable energy development supply chain, and largely unforeseen based on available data and forecasts at the time of NYSERDA's solicitations for large-scale renewable (LSR) projects between 2016 and 2020.

The inflationary environment in August 2021, when the last Tier 1 bid considered in this report was due, was more complex. General measures of inflation and commodity prices increased rapidly and consistently throughout 2021, but policymakers' statements and available inflation forecasts did not conform with inflation readings until the end of the year. Mismatches between actual and forecasted inflation reflects the significant global economic uncertainty impacting analysts' inflation projections and also renewable energy developers' capital budgeting and decision making. In our view, in August 2021 it would have been realistic to expect levels of inflation that were higher than what could have been reasonably predicted prior to 2021 but lower than the observed price increases that followed in 2022-2023.

Data available through the first half of 2023 indicate that the rate of price increases for both general inflation and commodities has moderated relative to peak inflation rates observed in 2022. However, this slowdown is distinct from price deflation, and the overall price level remains higher than what trends and forecasts made between January 2016 and August 2021 would have indicated. The degree and persistence of inflation between 2021 and the present would have been difficult to anticipate prior to the recalibration of inflation expectations among economic analysts and policymakers that occurred at the end of 2021.

Economists continue to debate the contributions of specific factors to inflation between 2021 and mid-2023. Our review of the literature on this topic indicates that the confluence of strong aggregate demand, supply and demand imbalances, supply chain constraints and shortages of commodities (exacerbated by the war in Ukraine beginning in February 2022), and overheated labor markets explains much of the rapid and persistent growth in inflation that began in 2021.

The sections that follow provide additional detail related to the questions and summary of findings presented above. We begin with a primer on the inflation indices included in our analysis. We then discuss trends of general economy-wide measures of inflation between 2016 and 2023. After this broad overview, we turn to the inflation dynamics of commodities and components that are key inputs to solar PV, onshore wind, and offshore wind projects. We show that general inflation and price pressures in specific sectors have moved together in recent years. As part of our analysis of historical inflation, we reviewed the signed affidavit from PA Consulting (the Affidavit) attached to the Alliance for Clean Energy's petition to the Commission. We verified the accuracy of the Affidavit's representations of inflation data between 2016 and mid-2023 and the degree to which inflation over this period was unforeseen at the time of RFP submissions. Following this review of inflation data for the 2016 to mid-2023 period, we review published information on the causes of inflation. We then review inflation forecasts from this period relative to the inflation that occurred.

2.1 Primer on Inflation Indices

We relied on several inflation indices to evaluate price trends over the 2016-2023 period. General measures of economy wide-inflation include the Consumer Price Index (CPI), published by the U.S. Bureau of Labor Statistics (BLS); the Personal Consumption Expenditures Price Index (PCE), published by the Bureau of Economic Analysis (BEA); and the Gross Domestic Product Implicit Price Deflator (GDP Deflator), also published by the BEA. We also examine the Producer Price Index (PPI), which is a family of indices that measures the average change over time in the *selling* prices received by domestic producers of goods and services. We relied upon PPI indices for commodities, in addition to historical commodity prices, to evaluate price changes of the raw materials used in solar PV, onshore wind, and offshore wind projects. Finally, we analyzed price indices designed to track the costs of labor and of construction projects of which labor is a major cost component. We describe each index family in turn below.

2.1.1 Measures of Economy-Wide Inflation

The CPI is a measure of the average change over time in the prices paid by consumers for a market basket of consumer goods and services. Similarly, the PCE, though calculated differently from CPI, tracks prices that consumers pay for goods and services. The PCE is the Fed's preferred measure of inflation and the basis for its two percent inflation target. The CPI and PCE are useful gauges of economy-wide inflation from the prospective of the average household, but they do not directly measure prices of key inputs that producers and businesses purchase and rely on for construction projects.

Our preferred index of general inflation is the GDP Deflator, which measures changes in the prices of all goods and services produced in the U.S., including exports. Broadly, the index shows how much a change in GDP relies on changes in prices (rather than productivity and output) by dividing GDP in current dollars to its corresponding chained-dollar value in the base year. Unlike other general inflation indices, such as the CPI or PCE, the GDP Deflator is not based on a fixed basket of goods and services; the underlying index components are updated based on changing consumption and investment patterns. The GDP Deflator would more accurately reflect, for example, the major economic changes associated with the renewable energy transition than would price indices based on fixed components of consumer goods. In addition, as we discuss in detail below, the GDP Deflator is highly correlated with price indices for key commodities that are necessary for the construction of solar PV, onshore wind, and offshore wind projects.

2.1.2 Producer Price Indices

The PPI is a family of indices that measures the average change over time in the selling prices received by domestic *producers* of goods and services. This contrasts with other measures, such as the CPI, that measure price change from the *purchaser's* perspective. Sellers' and purchasers' prices may differ due to government subsidies, sales and excise taxes, and distribution costs.

We relied on two classifications of PPI indices in our analysis of historical inflation:

- The industry classification of PPI is a measure of changes in prices received for a given industry's output sold outside the industry.
- The commodity classification structure of the PPI organizes products and services by similarity or material composition, regardless of the industry classification of the producing establishment.

2.1.3 Commodity Price Data

Construction of solar PV, onshore wind, and offshore wind projects requires significant quantities of raw materials such as aluminum, copper, iron, and polysilicon and of finished products such as steel and cement. As part of our review, we compiled available price data on these and other relevant commodities for the 2016-2023 period.

2.1.4 Employment Cost Indices

In addition to commodities and other materials, the cost of labor is an important cost driver for clean energy projects. To capture inflation in labor costs, we examined the Employment Cost Index (ECI) published by the BLS, which measures the change in the hourly labor cost to employers, independent of the influence of employment shifts among occupations and industry categories. We examine the ECI for all industries in addition to the ECIs for the construction and manufacturing industries, respectively.

2.2 Review of Inflation between 2016 and 2023

To provide a high-level view of inflation in recent years, Figure 2-1 graphs the CPI, GDP Deflator, and PPI - All Commodities between January 2016 and March 2023, the most recent period for which data for all three indices are available.¹⁰ Overall, the CPI and GDP Deflator increased by 27 percent and 25 percent over the period, respectively, though the growth rates accelerated beginning in 2021. As Table 2-1 shows, the compound annual growth rate (CAGR) of the GDP Deflator was 1.9 percent between the first quarter of 2016 and the fourth quarter of 2020 but increased to 6.1 percent between the first quarters of 2021 and 2023. The PPI followed a similar trend but spiked even higher after 2020, driven by supply chain disruptions, reopening economies following lockdowns in the earlier stages of the COVID-19 pandemic, pent-up demand, and Russia's invasion of Ukraine, which worsened supply chain bottlenecks.¹¹ The CAGR of the PPI all commodities index increased from 1.8 percent between 2016-2020 to 10.9 percent between 2021-

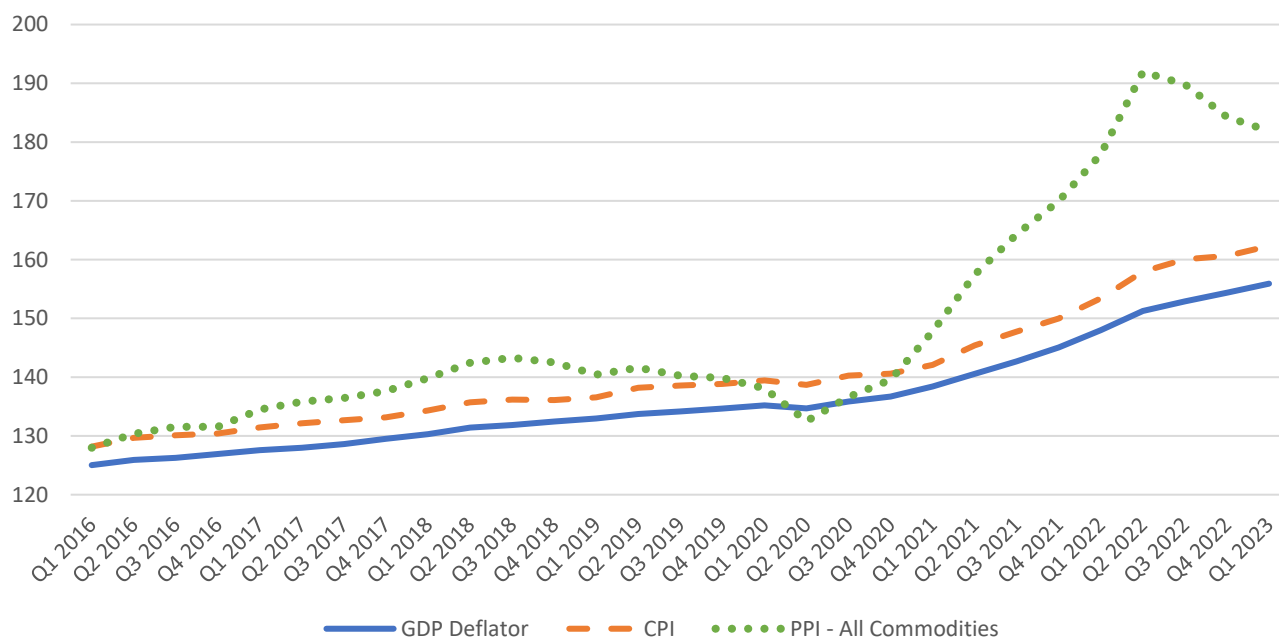
¹⁰ The CPI and PPI are published monthly, while the GDP Deflator is published quarterly. We calculate the quarterly CPI and PPI as the averages of the component months of the respective quarter.

¹¹ Annual Economic Report. 2022. *Bank for International Settlements* (BIS). Accessed at <https://www.bis.org/publ/arpdf/ar2022e.htm>.

2023. Recent data indicate that the pace of price increases has moderated in 2023, but economy-wide price levels remain well-above pre-COVID levels.

Prior to 2020, low inflation relative to the 1970s or 1980s had become ingrained and represented a new normal in the U.S. economy. For example, the GDP Deflator and CPI increased year-over-year, on average, by 2.0 percent and 2.2 percent respectively between 2000 and 2020.¹²

Figure 2-1. CPI, GDP Deflator, and PPI – All Commodities, Quarterly Values, 2016-2023



Sources: GDP Deflator: U.S. Bureau of Economic Analysis; CPI and PPI: U.S. Bureau of Labor Statistics. Data through March 2023.

Table 2-1. Compound Annual Growth Rates of Select Inflation Indices, 2016-2023

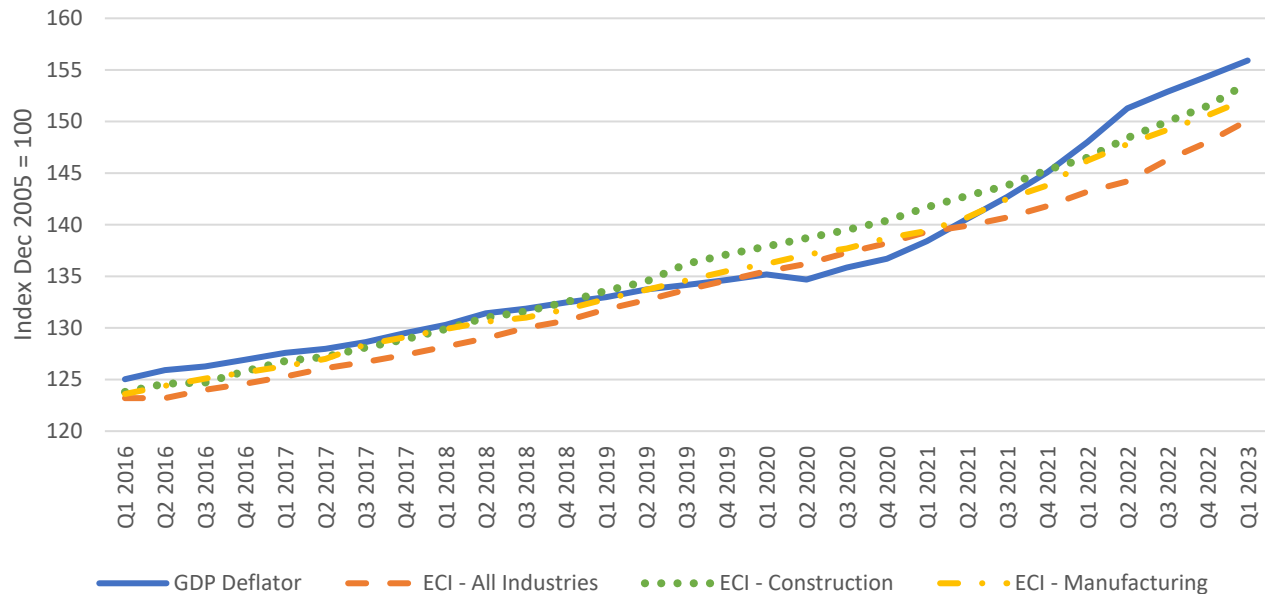
Time Period	GDP Deflator	CPI	PPI – All Commodities
Q1 2016 – Q4 2020	1.9%	2.0%	1.8%
Q1 2021 – Q1 2023	6.1%	6.9%	10.9%
Entire Period	3.2%	3.4%	5.1%

Labor costs have increased together with the goods and services inflation depicted in Figure 2-1. Figure 2-2 shows the BLS Employment Cost Indices for all occupations within all civilian industries and within the private sector construction and manufacturing industries. The GDP Deflator is also

¹² Based on the average of quarterly year-over-year percentage changes (GDP Deflator) and monthly year-over-year percentage changes (CPI).

included for comparison. Since 2021, labor costs in the construction and manufacturing sectors have increased at annualized rates of 4.1 and 4.5 percent, respectively, outpacing growth in the broader ECI - All Civilian Industries index. Solar PV, onshore wind, and offshore wind developers rely on skilled labor in the construction and manufacturing sectors and those awarded projects in New York prior to 2022 would therefore incur higher overall costs than they originally planned for unless they predicted the significant increase in workers compensation. The GDP Deflator increased more rapidly than the ECIs between January 2021 and March 2023 (see Table 2-2), but employment costs nevertheless rose sharply over this period and remain elevated above pre-COVID levels.

Figure 2-2. GDP Deflator and Employment Cost Indices, Quarterly Values, 2016-2023



Sources: GDP Deflator: U.S. Bureau of Economic Analysis; ECI: U.S. Bureau of Labor Statistics.

Table 2-2. Compound Annual Growth Rates of GDP Deflator and ECI Indices, 2016-2023

Time Period	GDP Deflator	ECI - All Industries	ECI - Construction	ECI - Manufacturing
Q1 2016 - Q4 2020	1.9%	2.4%	2.7%	2.5%
Q1 2021 - Q1 2023	6.1%	3.8%	4.1%	4.5%
Entire Period	3.2%	2.9%	3.1%	3.0%

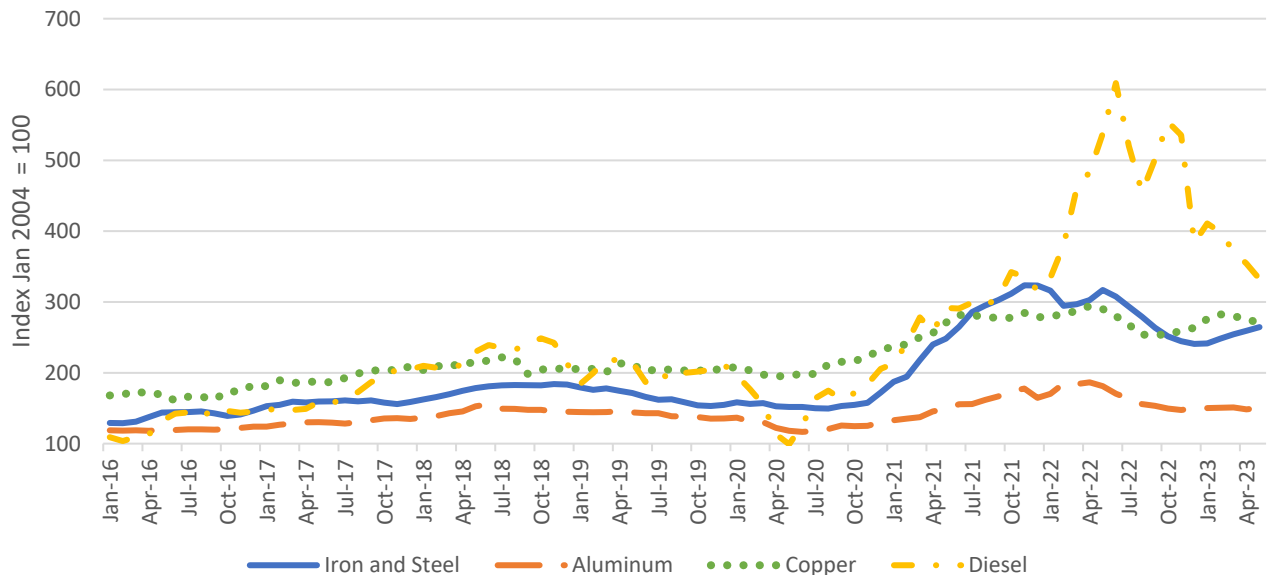
In summary, according to each of the broad-based metrics presented above, inflation between early 2021 and the first quarter of 2023 was significantly higher than the Fed's target of two percent and the relatively low rates of inflation experienced between 2016 and 2020. As further context, the U.S. economy experienced modest inflation since the beginning of the century: the GDP Deflator and CPI increased year-over-year, on average, by 2.0 percent and 2.2 percent respectively

between 2000 and 2020, while the ECI for all industries averaged 2.5 percent over the same period.¹³

2.2.1 Producer Price Index Commodity Data

PPI commodity classification indices illustrate the rapid price rises of key inputs that developers rely on to construct clean energy generating capacity. Figure 2-3 plots the indices for four components of the PPI - All Commodities index: iron and steel, aluminum, copper (wire and cable), and No. 2 diesel. Iron, steel, and aluminum are crucial inputs in constructing wind turbines; copper is vital to electrical systems in both wind-based and solar PV projects; and diesel fuel powers the specialty vessels and containers used to navigate and ship components to offshore wind sites. Between 2016 and 2020, these indices increased gradually, consistent with trends in labor and goods and services inflation. However, prices subsequently spiked: between January 2021 and May 2023 the PPIs for aluminum and copper both increased by 13 percent, the PPI for iron and steel increased by 41 percent, and the PPI for diesel increased by 56 percent (Table 2-3 reports the CAGRs for these indices). Similar to the inflation trends discussed above, price growth appears to have moderated in the first half of 2023, but key inputs for developing clean energy projects are more expensive relative to what trends in the pre-pandemic period indicated.

Figure 2-3. PPI Commodity Indices, Monthly Values, 2016-2023



Source: U.S. Bureau of Labor Statistics.

¹³ The ECI was first published in January 2001.

Table 2-3. Compound Annual Growth Rates of GDP Deflator and PPI Commodity Indices, 2016-2023

Time Period	GDP Deflator	PPI – Iron and Steel	PPI – Aluminum	PPI – Copper	PPI – No. 2 Diesel Fuel
Q1 2016 – Q4 2020	1.9%	4.7%	1.4%	5.9%	12.4%
Q1 2021 – Q1 2023	6.1%	11.4%	5.6%	7.4%	26.9%
Entire Period	3.2%	9.7%	3.5%	7.3%	20.4%

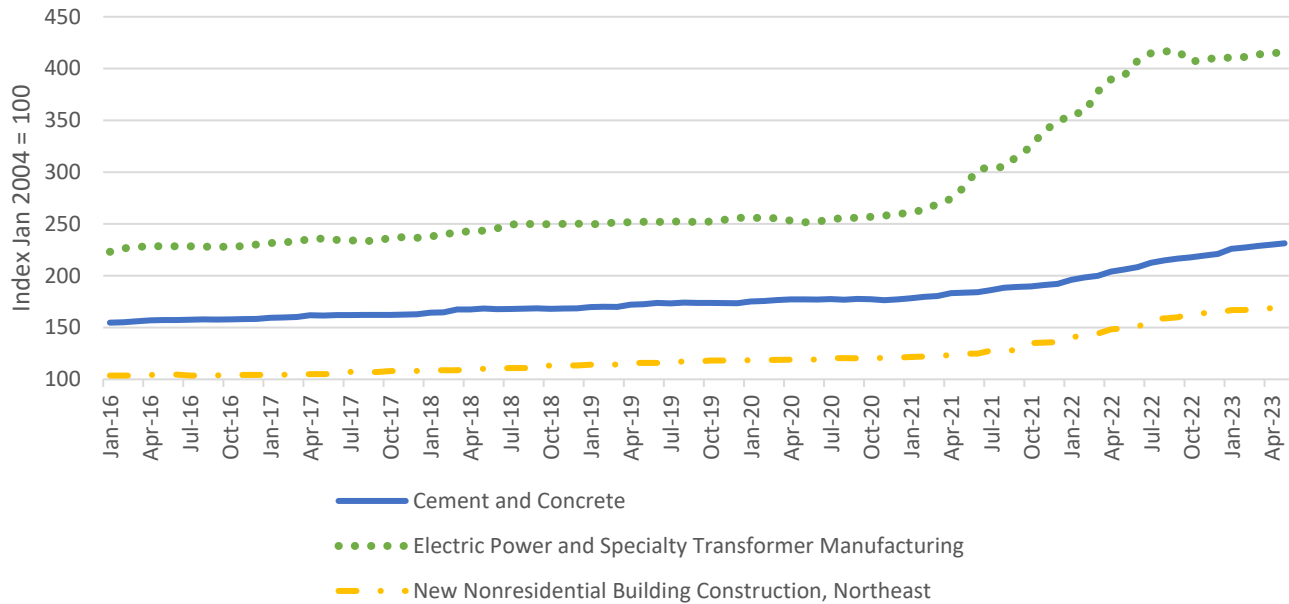
2.2.2 Producer Price Index Industry Data

Like the commodity classifications described above, PPI indices for specific industries shed light on the inflation dynamics in clean energy construction and component markets. LSR project development requires steady supplies of basic construction materials, such as cement and concrete, in addition to specialized electrical equipment. Figure 2-4 and Table 2-4 include PPI indices for three industries relevant to clean energy projects:

1. Cement and Concrete Product Manufacturing: a measure of the costs of producing cement and finished concrete.
2. Electric Power and Specialty Transformer Manufacturing: a reasonable proxy for specialized equipment used in solar PV, onshore wind, and offshore wind projects.
3. New Nonresidential Building Construction by Region, Northeast: a proxy for construction and related costs that reflect costs to producers in New York State.

These industry price indices followed similar pre-pandemic and post-lockdown trends as those observed for the GDP Deflator, ECIs, and commodity price indices. Between January 2021 and May 2023, the PPI for Electric Power and Specialty Transformer Manufacturing industries increased by 59 percent, compared to 16 percent between 2016 and 2020. Similarly, the New Nonresidential Building Construction index increased by 39 percent and 17 percent, respectively, between 2021-2023 and 2016-2020. Cement and concrete manufacturing industry costs began accelerating later relative to other costs indices (in April 2022) but have not abated in the first five months of 2023 due to cement shortages and heightened demand.¹⁴

¹⁴ Bryant, Chris. 2023. Cement Shortages, Concrete Inflation Threaten Biden's Building Boom. *The Washington Post*. Accessed at: https://www.washingtonpost.com/business/energy/2023/03/23/cement-shortages-concrete-inflation-threaten-biden-s-infrastructure-boom/7e19a160-c93a-11ed-9cc5-a58a4f6d84cd_story.html.

Figure 2-4. PPI Industry Indices, Monthly Values, 2016-2023

Source: U.S. Bureau of Labor Statistics, data through May 2023.

Table 2-4. Compound Annual Growth Rates of GDP Deflator and Select PPI Industry Indices, 2016-2023

Time Period	GDP Deflator	PPI- Cement and Concrete	PPI – Electric Power and Specialty Transformer Manufacturing	PPI – New Nonresidential Building Construction, Northeast
Q1 2016 – Q4 2020	1.9%	2.8%	2.8%	3.3%
Q1 2021 – Q1 2023	6.1%	12.6%	24.7%	17.1%
Entire Period	3.2%	5.6%	9.0%	7.1%

2.2.3 Price Increases Have Moderated in 2023 but the Price Level Remains High

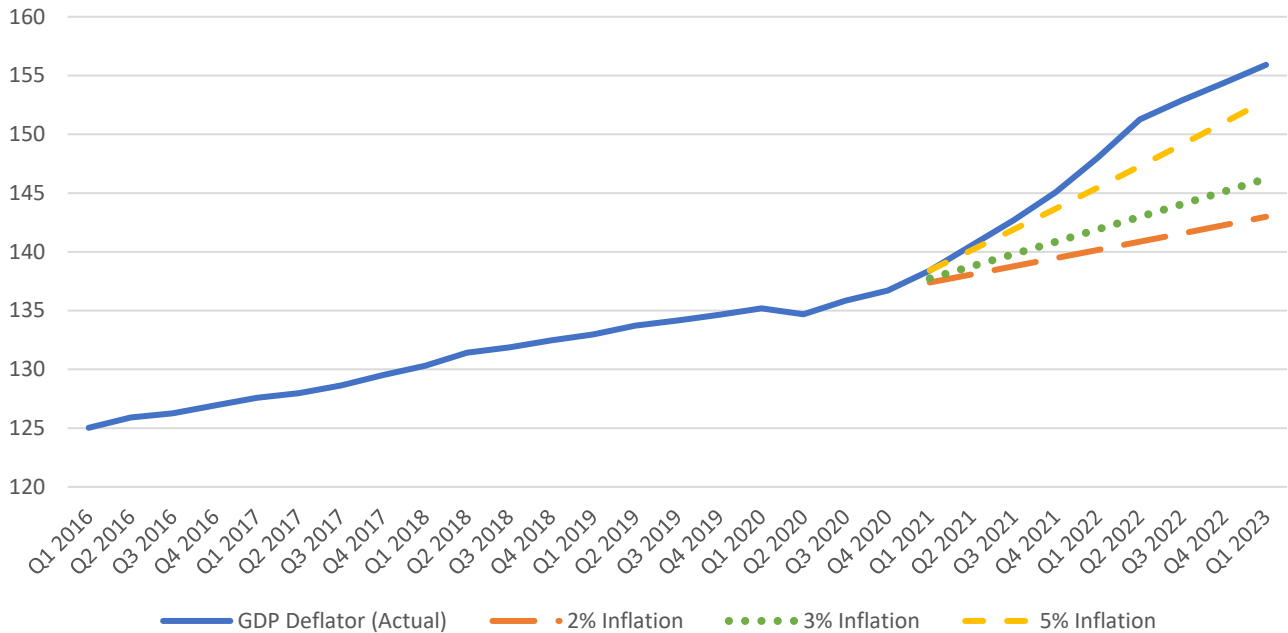
Data available through the first half of 2023 indicates that the rate of inflation has moderated relative to the inflation observed since early 2021. Year-over-year percent change data for the CPI during the initial months of 2022 show that the CPI consistently remained above 7.5 percent throughout the first six months of 2022, ending with a significant year-over-over price increase of 9 percent in June 2022. Through the first half of 2023, however, the highest year-over-year percent change recorded was 6.4 percent in January. In June and July 2023, the CPI fell to 3.0 and 3.2 percent, respectively. Similarly, the GDP Deflator increased year-over-year by 6.9 percent in Q1 2022, 5.3 percent in Q1 2023, and 3.6 percent in Q2 2023.

The PPI indices for commodities, though much more volatile than the GDP Deflator or CPI, exhibited similar trends to broader inflation measures. In the first half of 2022, the PPI for all

commodities consistently increased year-over-year by at least 20 percent, reaching its highest point in June 2022 at 22.4 percent. However, the rate of growth has moderated in the initial months of 2023, highlighted by May's percent change sliding to -7.11 percent (i.e., a reduction in prices relative to May 2022). Specifically, the pertinent PPIs for commodities like aluminum, cement and concrete, and diesel showed a cooling of price inflation in early 2023. Similarly, iron and steel, along with copper, have consistently exhibited a downward trend since the start of 2022.

This slowdown in inflation is distinct from sustained price deflation, and the overall price level remains higher than what pre-pandemic trends or forecasts would have indicated. For example, Figure 2-5 charts the actual GDP Deflator against counterfactual trajectories that show what the price level would have been between the first quarter of 2021 and the first quarter of 2023 if the index had increased at annualized rates of two, three, and five percent. The solid blue line in the figure represents the GDP Deflator, which increased by 25 percent between January 2016 and March 2023. If the GDP Deflator had instead increased at an annualized rate of two percent (the Fed's inflation target) beginning in 2021, the overall price level in the U.S. economy would have only increased by 14 percent between 2016 and 2023. In other words, in early 2023, the actual price level, as measured by the GDP Deflator, was nine percent higher than it would have been had inflation remained at two percent between January 2021 and March 2023. Similarly, the GDP Deflator was seven percent higher in early 2023 than it would have been had inflation been at three percent from 2021 onwards and two percent higher had inflation been at five percent during this period. Two percent inflation would have been a reasonable expectation through the end of 2020 given inflation data and forecasts available at the time. As we discuss in the next section, median private sector forecasts (current year to ten-year estimates) did not foresee inflation exceeding three percent in any year until the second quarter of 2021.

PPI indices for commodities also exceed pre-pandemic levels despite slowdowns in their growth rates. For example, between January 2016 and May 2023, the PPIs for all commodities, iron and steel, aluminum, copper, and diesel increased by 39 percent, 105 percent, 26 percent, 60 percent, and 205 percent, respectively.

Figure 2-5. GDP Deflator Relative to Counterfactual GDP Deflator Values, 2016-2023

Note: The 2%, 3%, and 5% inflation series represent counterfactual annualized rates of price increases between Q1 2021 and Q1 2023.
Source: Data for the GDP Deflator (Actual) from U.S. Bureau of Economic Analysis.

2.3 Review of Prices Specific to Renewable Energy Investments

Renewable energy projects are complex and require a wide range of inputs to develop. Drawing on many of the indices presented above as well as additional indices, the following sections show price indices relevant to key inputs specific to solar PV, onshore wind, and offshore wind projects. Note that for commodity prices, the sections below rely, where possible, on commodity-specific price indices rather than commodity-specific PPIs, as the former often reflect prices paid by the buyer rather than the price received by the seller. As noted above, the two may differ due to the cost of transporting commodities to market, subsidies, and taxes. Because clean energy project developers are the buyers of these commodities rather than the sellers, these price indices are more indicative of price trends faced by developers than the PPI.

2.3.1 Solar Photovoltaic Projects

The International Energy Agency (IEA) estimates that key commodities and freight costs make up about 15 percent of utility-scale solar PV investment costs, and that PV modules are the largest cost component of solar PV projects, accounting for approximately 40 percent of materials costs.¹⁵ The cost of PV modules halved between January 2016 and May 2023, according to U.S. Energy Information Administration (EIA) data, continuing a longer-term downward trend, beginning in

¹⁵ What is the impact of increasing commodity and energy prices on solar PV, wind and biofuels? 2021. *International Energy Agency*. Accessed at: <https://www.iea.org/articles/what-is-the-impact-of-increasing-commodity-and-energy-prices-on-solar-pv-wind-and-biofuels>.

2006, driven by manufacturing and design efficiencies.¹⁶ Module prices had already fallen to their current levels by the beginning of 2019. At the same time, however, spot prices of steel, aluminum, and solar grade silicon (polysilicon), which make up most of the material value in utility scale solar investments according to the IEA,¹⁷ increased by 206 percent, 53 percent, and 30 percent, respectively, between January 2016 and May 2023. Polysilicon prices were volatile since 2016 and dipped below the January 2016 level during the July 2018 to February 2021 period. By August 2022, silicon prices were 192 percent higher relative to the January 2016 price. As Figure 2-6 below shows, price growth of commodities (i.e., excluding module prices) relevant to solar PV development was coextensive with supply chain bottlenecks through 2021 and 2022.

Figure 2-6. Relevant Prices Indices for Utility-Scale Solar PV Projects, 2016-2023



Note: Index values based on the prices of PV modules (USD/peak watt), U.S. domestic steel hot rolled coil (USD/metric ton, CME-NYMEX) aluminum (USD/ton, global price), and solar grade silicon (USD/kg, monthly averages of daily average spot prices).

Sources: PV modules: U.S. Energy Information Administration; Steel: S&P Capital IQ; Aluminum: International Monetary Fund; Silicon: Bloomberg. PPI: Data through May 2023.

2.3.2 Onshore Wind Projects

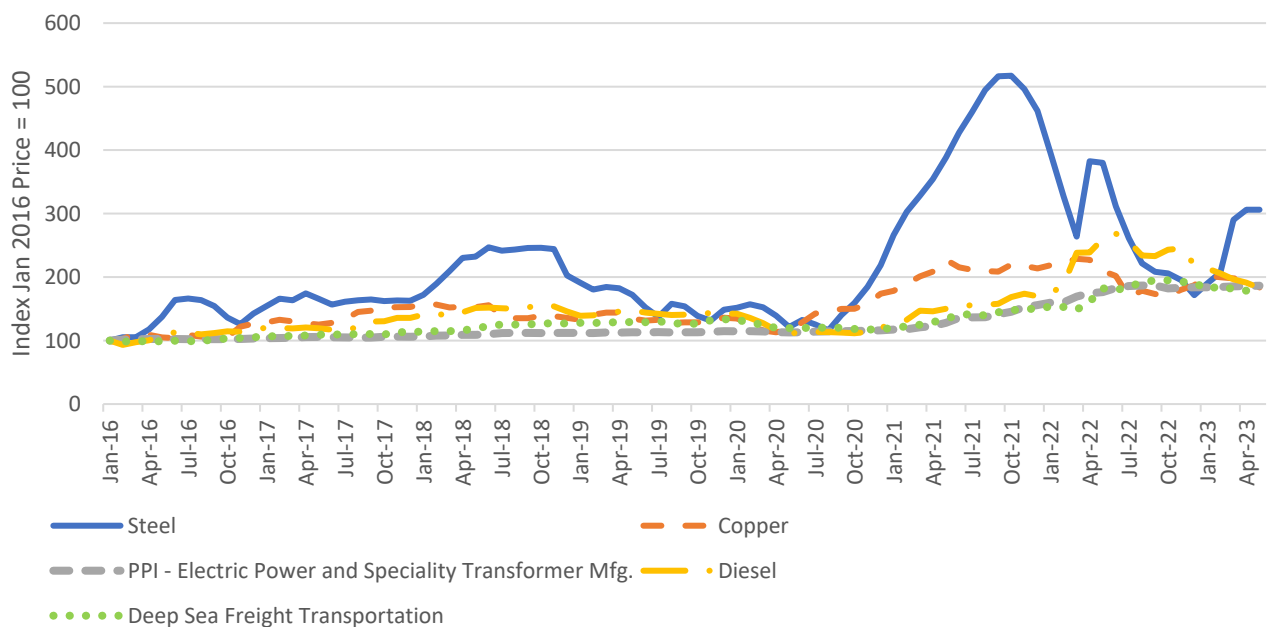
The major capital expenditures of onshore wind projects are nacelle/turbine construction (35 percent), rotor construction (21 percent), and tower construction (14 percent). Steel and copper

¹⁶ Chandler, David L. 2018. Explaining the plummeting cost of solar power. *MIT News*. Accessed at: <https://news.mit.edu/2018/explaining-dropping-solar-cost-1120>.

¹⁷ Renewables 2021. 2021. *International Energy Agency*. Accessed at: <https://iea.blob.core.windows.net/assets/5ae32253-7409-4f9a-a91d-1493ffb9777a/Renewables2021-Analysisandforecastto2026.pdf>.

are the primary commodity expenses due to their extensive use in manufacturing and installing towers, nacelle, and mechanical equipment.¹⁸ Additionally, the transport of bulky elements via specialized ships can account for up to six percent of the total onshore wind investment costs.¹⁹ Figure 2-7 plots the relevant prices of these key inputs for onshore wind projects, as well those for offshore wind projects. Both types of projects require similar inputs to develop. The figure shows that the prices of steel, copper, marine transport, and electric equipment and specialized transformer manufacturing spiked between January 2021 and July 2022, before moderating to levels that significantly exceeded pre-COVID levels. These trends reflect commodity spot prices for copper, diesel, and steel, and we use the PPI - Deep Sea Freight Transportation index to represent specialty transportation costs. Global copper spot prices and the PPI for the Deep Sea Freight Transportation industry index increased by 84 percent and 79 percent, respectively between January 2016 and May 2023. The PPI for the Electric Power and Specialty Transformer Manufacturing, a proxy for the costs of specialty products required for onshore wind development, increased by 83 percent over the same period. The most significant increase was for steel, with steel prices rising by 105 percent between January 2016 and May 2023.

Figure 2-7. Relevant Prices Indices for Onshore and Offshore Wind Projects, 2016-2023



Note: Index values based on the prices of copper (USD/metric ton, global price), U.S. domestic steel hot rolled coil (USD/metric ton, CME-NYMEX), the PPI - Electric Power and Specialty Manufacturing Industry, New York Harbor Low Sulfur No.2 (USD/gallon), and the PPI - Deep Sea Freight Transportation.

Sources: Copper and Diesel: International Monetary Fund; Steel: S&P Capital IQ; PPI: U.S. Bureau of Labor Statistics. Data through May 2023.

¹⁸ 2021 Cost of Wind Energy Review. 2021. *National Renewable Energy Laboratory*. Accessed at: <https://www.nrel.gov/docs/fy23osti/84774.pdf>.

¹⁹ What is the impact of increasing commodity and energy prices on solar PV, wind and biofuels? 2021. *International Energy Agency*. Accessed at: <https://www.iea.org/articles/what-is-the-impact-of-increasing-commodity-and-energy-prices-on-solar-pv-wind-and-biofuels>.

2.3.3 Offshore Wind Projects

The major capital expenditures of offshore wind projects are turbines (34 percent), electrical infrastructure (18 percent), and substructure and foundation (13 percent). Thus, key inputs for these investments include steel, copper, electrical components (e.g., cables, transformers), and diesel fuel for energy requirements (e.g., for vessels).²⁰ We use commodity spot prices for copper, diesel, and steel and use the PPI for Electric Power and Specialty Transformer Manufacturing industries to represent price trends for electrical infrastructure. As discussed above in the context of onshore wind, the prices of steel and copper spiked between January 2021 and July 2022, before moderating to levels that significantly exceeded pre-COVID levels. Between January 2016 and May 2023, New York Harbor Low Sulfur No. 2 Diesel prices increased by 84 percent.

2.3.4 Prices of Wind and Solar Power Purchase Agreements

Prices that wind and solar PV developers are offering to customers for Power Purchase Agreements (PPAs) have increased together with the prices discussed above. A PPA is a contractual arrangement in which an electricity generator sells its electric output to a load serving entity at an agreed upon price for a predetermined period of time. According to offer price data compiled by LevelTen Energy, the average market price of wind (onshore and offshore) PPAs in North America increased by approximately 142 percent between the third quarter of 2018 and the second quarter of 2023, while the average market price of solar PPAs in North America increased by approximately 64 percent over the same period.²¹ Figure 2-8 also shows that wind and solar PPA prices increased year-over-year by 30 percent and 25 percent, respectively, in the second quarter of 2023. Relative to 2023 Q1, wind PPA prices increased by 13 percent in the second quarter of 2023, but solar PPA prices decreased by one percent,²² which indicates that market conditions in the solar market are beginning to stabilize after supply chain disruptions, inflation, and the threat of import tariffs on solar panels entering the U.S. since 2020.²³ LevelTen attributes the opposing trend in wind prices to the long permitting periods for project development and interconnection costs that are far higher than historical norms.²⁴

Overall, the PPA trend shown in Figure 2-8 is consistent with the notion that costs for large-scale renewable projects increased unexpectedly and significantly from early to mid-2021 through the

²⁰ 2021 Cost of Wind Energy Review. 2021. *National Renewable Energy Laboratory*. Accessed at: <https://www.nrel.gov/docs/fy23osti/84774.pdf>.

²¹ PPA Price Index Executive Summary North America, Q2 2023. 2023. *LevelTen Energy*. Accessed at: <https://www.leveltenenergy.com/ppa>.

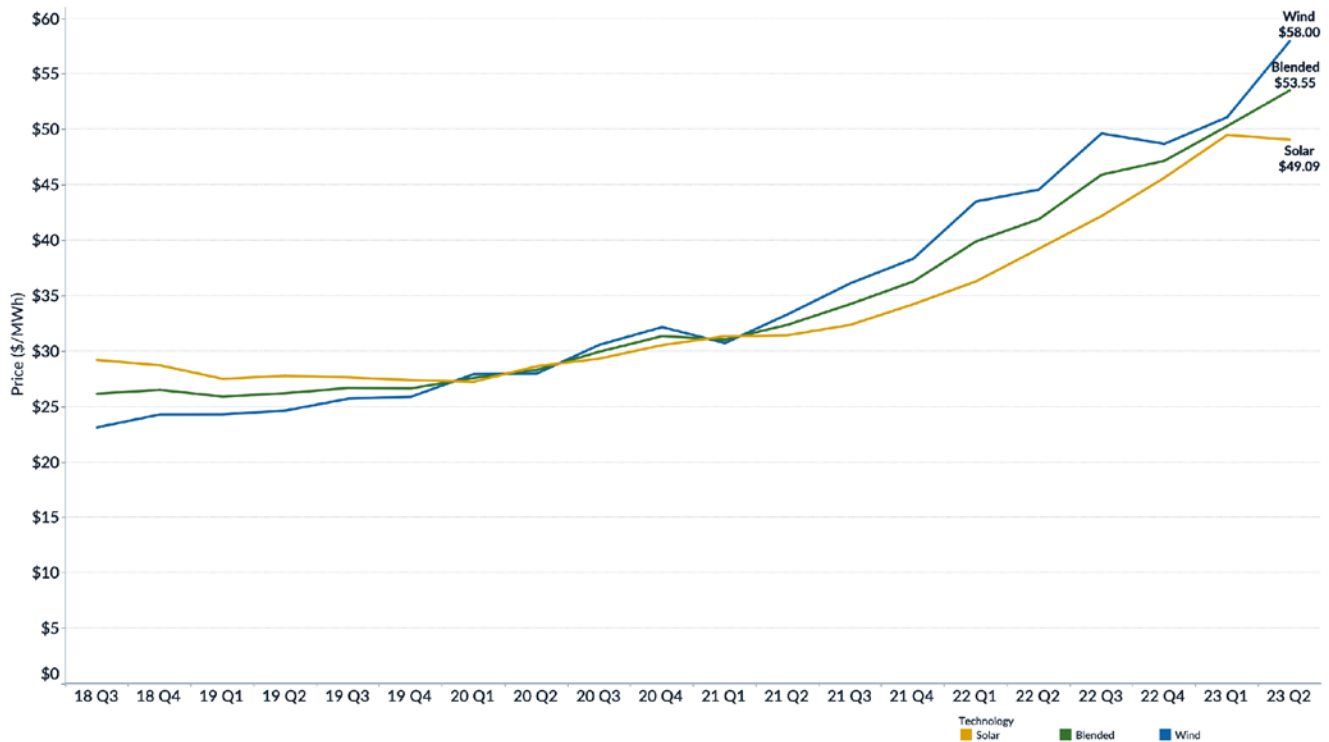
²² After Soaring for Years, Solar PPA Prices Show Signs of Stabilization in Q2, According to LevelTen Energy's PPA Price Index. 2023. *AltEnergy Mag*. Accessed at: <https://www.altenergymag.com/article/2023/07/after-soaring-for-years-solar-ppa-prices-show-signs-of-stabilization-in-q2-according-to-levelten-energys-ppa-price-index/39863>.

²³ Groom, Nichola. US solar contract prices stabilize on improved panel supplies-report. 2023. *Reuters*. Accessed at: <https://www.reuters.com/business/energy/us-solar-contract-prices-stabilize-improved-panel-supplies-report-2023-07-18/>.

²⁴ After Soaring for Years, Solar PPA Prices Show Signs of Stabilization in Q2, According to LevelTen Energy's PPA Price Index. 2023. *AltEnergy Mag*. Accessed at: <https://www.altenergymag.com/article/2023/07/after-soaring-for-years-solar-ppa-prices-show-signs-of-stabilization-in-q2-according-to-levelten-energys-ppa-price-index/39863>.

second quarter of 2023. The relative stability in PPA pricing between the third quarter of 2018 and early 2021 is consistent with the trend in inflation during this period and (as described in Section 2.5 below) economists' forecasts at the time for continued low inflation. Because PPAs are established through competitive bid processes, the sharp increase in PPA prices observed from January 2021 through early 2023 is suggestive of an unexpected industry-wide increase in costs.

Figure 2-8: North America PPA Price Index, Market Average, Q3 2018 – Q2 2023



Source: LevelTen Energy PPA Price Index Executive Summary North America, Q2 2023.

2.4 Causes of Inflation between 2021 and 2023

The signed affidavit from PA Consulting attached to the Alliance for Clean Energy's petition to the Commission ascribes the relatively high inflation between 2021 and mid-2023 to three factors. First, the PA Affidavit points to the severity of the supply chain bottlenecks and labor force constraints associated with the COVID-19 pandemic. Second, the PA Affidavit asserts that the war in Ukraine exacerbated pandemic-related inflation effects. Finally, the PA Affidavit states that the demand for renewable energy has grown dramatically over the past three to five years, which has led to inflationary pressures for the renewable energy sector. Our review of the economics literature supports PA Affidavit's claim that the pandemic and the war in Ukraine were important drivers of inflation. We also verified PA Consulting's representation of inflation data in the affidavit, which is consistent with the data presented earlier in this chapter.

Economists continue to debate the contributions of specific factors in driving pandemic-era inflation. However, according to the consensus narrative, some combination of the following dynamics produced the sustained and persistent price rises across the U.S. economy beginning in

2021. The COVID-19 pandemic led to both unprecedented economic disruption and expensive government responses to contain it and support economies. Through June 2023, U.S. federal agencies have spent approximately \$5.7 trillion in response to COVID-19, which included direct financial support of businesses (\$1.7 trillion) and individuals/households (\$1.8 trillion) as directed by the Coronavirus Aid, Relief, and Economic Security (CARES) Act passed in March 2020 and the American Rescue Plan Act (ARPA) passed in March 2021.^{25,26} The Fed injected a further \$4.7 trillion into the economy through monetary stimulus programs, including asset purchases, liquidity measures, and loan purchase facilities. Fiscal and monetary stimulus measures led to strong aggregate demand and so-called excess savings accumulated during the pandemic, which consumers used to spend first on durable goods during pandemic lockdowns and then on a wider range of services as economies reopened in 2021.

At the same time, shifts in consumer spending from services to durable goods during the pandemic combined with pandemic-induced supply chain bottlenecks and price spikes (or shortages) of key commodities increased prices in certain sectors of the economy.²⁷ A study published by former Fed Chair Ben Bernanke and former chief economist of the International Monetary Fund Oliver Blanchard found that inflation during this period reflected strong aggregate demand, easy fiscal and monetary policies during the pandemic, excess savings accumulated during the pandemic, and the re-opening of locked down economies.²⁸ The study also found that the Russian invasion of Ukraine caused a further spike in commodity prices, though this effect waned as the perceived threat to global commodity prices moderated. Similarly, a study by economists at Johns Hopkins University and the International Monetary Fund found that the 6.9 percentage point increase in U.S. headline inflation between the end of 2020 and September 2022 was due to energy price shocks (2.7 percentage points), labor market tightness (2.0 percentage points), supply chain constraints as measured by backlogs of goods and services (1.7 percentage points), and inflation expectations (0.5 percentage points).²⁹

We identified no studies in the literature that quantify the extent to which increased demand for clean energy has contributed to inflationary pressure for clean energy technologies. The available data, however, are indicative of such an increase in demand. According to the IEA's World Energy Outlook, wind and solar accounted for 7.8 percent of global electricity supply in 2019, 9.1 percent in 2020, and 10.1 percent in 2021.³⁰ In addition, the IEA projects that wind and solar will account for 25 percent of global electric generation in 2030. Focusing on the United States, data from the

²⁵ <https://www.covidmoneytracker.org/>.

²⁶ Parlapano et al. 2022. Where \$5 Trillion in Pandemic Stimulus Money Went. *The New York Times*. Accessed at: <https://www.nytimes.com/interactive/2022/03/11/us/how-covid-stimulus-money-was-spent.html>.

²⁷ di Giovanni et al. 2023. Quantifying the Inflationary Impact of Fiscal Stimulus under Supply Constraints. *American Economic Review Papers and Proceedings*, 113: 76-80. Accessed at <https://www.aeaweb.org/articles?id=10.1257/pandp.20231028>.

²⁸ Bernanke, Ben and Blanchard, Olivier. 2023. What caused the U.S. pandemic-era inflation? *The Brookings Institution*. Accessed at: <https://www.brookings.edu/articles/what-caused-the-u-s-pandemic-era-inflation/>

²⁹ Ball et al. 2022. Understanding U.S. inflation during the COVID era. *National Bureau of Economic Research*, Working Paper 30613.

³⁰ World Energy Outlook 2022 and World Energy Outlook 2021. *International Energy Agency*.

U.S. EIA indicate that utility-scale solar generation in the U.S. more than doubled between 2019 and 2022 and that wind generation increased by 47 percent during this period, indicative of growing demand.³¹ In addition, in Chapter 3 we discuss forecasts of global wind and solar capacity for 2030, which increased significantly during the 2021-2023 period. This change in projection is also consistent with the idea of increased demand for renewable energy putting upward pressure on prices faced by the industry.

The primary causes of inflation between 2021 and 2023 that we identified in the literature, as described above, are consistent with the position that the degree and persistence of inflation were unforeseen prior to mid-2021 at the earliest. Prior to 2021, the energy price shock and fiscal stimulus had not fully materialized in the U.S. economy. The CARES Act passed in March 2020, but it was not until the imminent passage of ARPA the following year when some analysts, including former Obama administration officials Larry Summers and Steve Rattner, began to warn that fiscal spending would be too high and would increase inflation.^{32,33} This represented a minority view, however, as median inflation forecasts remained anchored around two percent and did not increase immediately following ARPA's passage in March 2021. In addition, most observers could not have predicted the war in Ukraine beginning in February 2022 and its impacts on supply chain bottlenecks and commodities inflation. Labor market tightness, though more foreseeable than war, also increased and contributed to inflation beginning in 2022.

2.5 Actual vs. Forecasted Inflation

As described above, broad measures of inflation show that, relative to 2016 to 2020, prices increased after February 2021 and have remained at elevated, pre-COVID levels. Inflation forecasts provide evidence as to whether these trends were unforeseen at the time of NYSEDA's solicitations for solar PV, onshore wind, and offshore wind projects.

Relative to a two percent annualized rate of inflation, the Fed's target rate and a benchmark anchoring private-sector expectations, the CPI and PCE increased by between 2.5 and 9 percent year-over-year in each month between March 2021 and May 2023.

2.5.1 Review of Inflation Forecasts

Prior to the onset of the COVID-19 pandemic in March 2020, forecasts from both U.S. government and private sector sources indicated that both short-term (up to two years) and long-term (five or ten years) inflation would closely track – and mostly undershoot – the Fed's two percent inflation target. For example, Figure 2-9 shows the Federal Reserve Bank of Cleveland's inflation forecasts over different time horizons. The Cleveland Fed's forecasts are frequently used and relied upon by economists and are calculated based on a model that uses Treasury yields, historical inflation data, inflation swaps, and survey-based measures of inflation expectations. One-year inflation

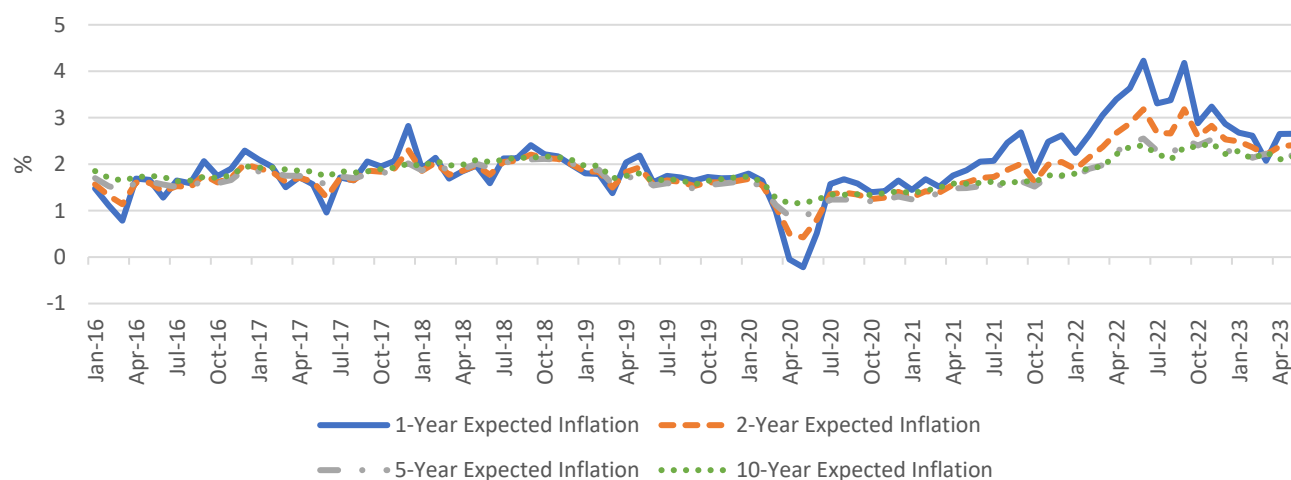
³¹ U.S. Energy Information Administration. Electricity Data Browser, accessed August 8, 2023.

³² Summers, Lawrence. 2021. The Biden stimulus is admirably ambitious. But it brings some big risks, too. *The Washington Post*. Accessed at: <https://www.washingtonpost.com/opinions/2021/02/04/larry-summers-biden-covid-stimulus/>.

³³ Rattner, Steven. 2021. Too Many Smart People Are Being Too Dismissive of Inflation. *The New York Times*. Accessed at: <https://www.nytimes.com/2021/03/05/opinion/fed-inflation-markets.html>.

expectations, the most volatile of the series, exceeded two percent in just 14 months between January 2016 and February 2020 and never exceeded 2.9 percent. Five-year and ten-year expectations exceed two percent in nine months and ten months, respectively, during this same period. Inflation expectations dropped below 1.5 percent for several months beginning in March 2020, as the onset of COVID-19 engendered significant economic uncertainty and increased the likelihood of recession and *deflation*. For example, the price of a barrel of West Texas Intermediate (WTI), the benchmark for U.S. oil, turned negative in April 2020 as inventories grew and demand for oil declined, falling to as low as minus \$37.63 a barrel.³⁴ The Federal Reserve Bank of Cleveland did not predict that annualized inflation would exceed three percent under any time horizon until March 2022 (the one-year inflation expectation), immediately following Russia's invasion of Ukraine.

Figure 2-9: Federal Reserve Bank of Cleveland's Inflation Expectations, Annualized Percent, January 2016 – May 2023



Note: Inflation estimates reflect expectations of the average inflation rate over the specified number of years. For example, the 10-year expected inflation estimate is the rate that inflation is expected to average over the next 10 years.

Source: Federal Reserve Bank of Cleveland, retrieved from FRED, Federal Reserve Bank of St. Louis.

The Federal Open Market Committee (FOMC, the Committee), the body of the Federal Reserve System that sets national monetary policy, regularly issues statements about the U.S. macroeconomic environment and the central bank's policy goals. Throughout 2021 the FOMC and high-ranking officials in the Biden administration attributed inflation to "transitory factors," namely COVID-related economic dislocation, that were impacting specific sectors of the economy. The FOMC's forecasts of inflation changed little between the September 2020 and December 2021

³⁴ US oil prices turn negative as demand dries up. 2020. *The British Broadcasting Corporation*. Accessed at: <https://www.bbc.com/news/business-52350082>.

iterations of the Survey of Economic Projections,³⁵ and the Committee continued to expect that inflation would return close to the Fed’s two percent target by 2023 (see Table 2-5 below) and, even in 2022, would not exceed this target by more than 0.6 percentage points. The Committee’s press releases and minutes consistently referenced “transitory factors” to explain high and persistent inflation. According to the FOMC’s statement released on November 3, 2021, following year-over-year increases of the CPI and PCE by 5.4 percent and 4.4 percent, respectively: “Inflation is elevated, largely reflecting factors that are expected to be transitory. Supply and demand imbalances related to the pandemic and the reopening of the economy have contributed to sizable price increases in some sectors.”³⁶ It was not until the end of the same month when Chair Jerome Powell officially reversed course and retired the word “transitory” to describe the rapid and persistent price increases in the U.S. economy.³⁷

Large fiscal stimulus packages, supply chain disruptions associated with the COVID-19 pandemic, and actual inflation data ultimately drove policymakers to revise their inflation expectations upwards. The FOMC revised its annualized PCE inflation projection for 2021 from 2.4 percent in March to 3.4 percent in June of the same year. In other words, the nation’s top monetary policymakers expected inflation to continue into 2022 at similar levels to those observed prior to the pandemic.

Table 2-5. FOMC Median PCE Projections, Annualized Percentage Rate of Change

Month of Estimate	2021	2022	2023	Longer Run
Sep. 2020	1.7%	1.8%	2.0%	2.0%
Dec. 2020	1.8%	1.9%	2.0%	2.0%
Mar. 2021	2.4%	2.0%	2.1%	2.0%
Jun. 2021	3.4%	2.1%	2.2%	2.0%
Sep. 2021	4.2%	2.2%	2.2%	2.0%
Dec. 2021	5.3%	2.6%	2.3%	2.0%

Source: Summary of Economic Projections, September 2020 – December 2021. Federal Open Market Committee.

Biden administration officials drew similar conclusions to the FOMC concerning the causes and persistence of inflation. In July 2021, the Council of Economic Advisors compared the current inflationary environment to past inflationary episodes that included supply chain disruptions and temporary, pent-up consumer demand. Using the post-World War II period as a historical

³⁵ Economic projections are collected from each member of the Board of Governors and each Federal Reserve Bank president four times a year, in connection with the Federal Open Market Committee’s (FOMC’s) meetings in March, June, September, and December. Participants forecast the future paths of macroeconomic variables such as GDP and inflation. See most recent release here: <https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20230614.pdf>.

³⁶ <https://www.federalreserve.gov/newsevents/pressreleases/monetary20211103a.htm>.

³⁷ Cheung, Brian. 2022. Fed Chairman Jerome Powell retires the word 'transitory' in describing inflation. *Yahoo News*. Accessed at: <https://news.yahoo.com/fed-chairman-jerome-powell-retires-the-word-transitory-in-describing-inflation-162510896.html>.

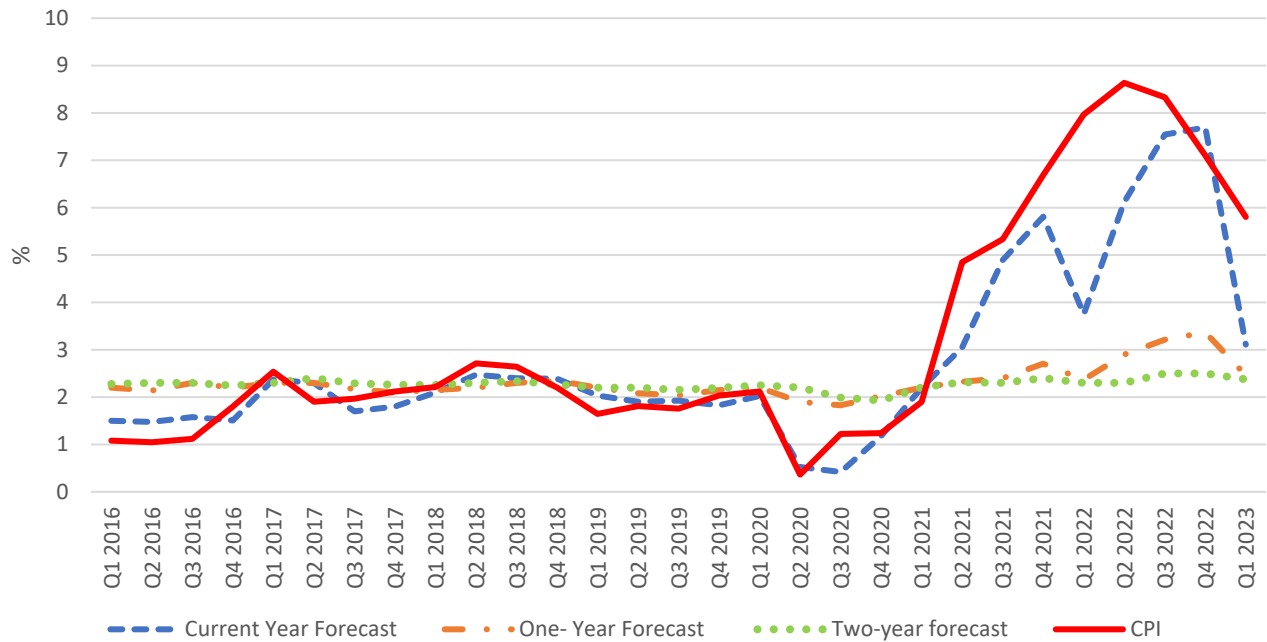
analogue, the Council concluded at the time that inflation could quickly decline once supply chains were restored and consumers moderated their spending as the economy returned to normal following pandemic lockdowns.³⁸ Treasury Secretary Janet Yellen told G7 finance ministers in June 2021 that inflation represented transitory factors and that price pressures would remain elevated at three percent on a year-over-year basis only until about the end of 2021.³⁹

Finally, optimistic inflation expectations were not confined to government officials and policymakers. Private sector economists likewise predicted that inflation would remain close to the Fed's two percent target up until mid-2021, according to the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters. Figure 2-10 contrasts the actual year-over-year percentage changes in CPI with the median private-sector forecasts of the CPI over different time horizons. Inflation estimates represent fourth quarter over fourth quarter inflation forecasts (percentage changes) for the current year and the next two years. For example, survey responses in the first quarter of 2021 correspond to estimates of the average annualized inflation rate for 2021, 2022, and 2023. Unlike Fed projections, two-year inflation forecasts were above the Fed's two percent target in each quarter between January 2016 and June 2020, averaging 2.3 percent per observation. Though higher than government estimates, median private sector forecasts did not foresee inflation exceeding three percent in any year until the second quarter of 2021, at which point the median inflation forecast for year-over-year percentage change in CPI was 3.05 percent for 2021. As Figure 2-10 shows, private sector CPI forecasts failed to predict the extent of CPI increases throughout 2021 and 2022, even as analysts gained insight into supply chain dynamics and other drivers of inflation.

³⁸ Rouse et al. 2021. Historical Parallels to Today's Inflationary Episode. *Council of Economic Advisors*. Accessed at: <https://www.whitehouse.gov/cea/written-materials/2021/07/06/historical-parallels-to-todays-inflationary-episode/>.

³⁹ Bruce, Andy and Lawder, David. 2021. U.S. Treasury's Yellen tells G7 to keep spending, says inflation will pass. *Reuters*. Accessed at: <https://www.reuters.com/business/yellen-urges-g7-keep-up-fiscal-support-sees-inflation-transitory-2021-06-05/>.

Figure 2-10: Actual CPI Compared to Professional Forecasters' Projections of CPI, Annualized Percent, January 2016 – March 2023



Note: Inflation estimates represent fourth quarter over fourth quarter inflation forecasts (percentage changes) for the current year and the next two years.

Sources: CPI: U.S. Bureau of Labor Statistics; Forecasts: Federal Reserve Bank of Philadelphia.

2.5.2 Inflation Forecasts as of Bid Dates for LSR Solicitations

Table 2-6 below presents inflation data that developers could access at the time of their bids for NYSERDA's LSR solicitations between July 2016 and August 2021. It shows actual observed year-over-year changes for the GDP deflator and CPI, and, like Figure 2-10, the one-year and two-year forecasts for CPI per the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters. At the time of bid submittals between 2016 and 2020, both of the observed inflation metrics and short-term inflation forecasts indicated that the period of moderate price rises would endure for at least the next two years (note that long-term inflation forecasts were consistently below the one and two-year forecasts, as shown in the previous section). Prior to 2021, the maximum observed inflation rate for the preceding period at the time of bids was 2.71 percent (CPI, August 2018) and the maximum inflation projection was 2.40 percent (two-year CPI, September 2017). Beginning in 2016 the Fed gradually raised its target interest rate (the Federal Funds Rate) from near-zero to 2.5 percent in December 2018 before lowering it again to 1.75 percent by the end of 2019 to protect the U.S. economy from potentially harmful impacts of trade disputes with China.⁴⁰ The Fed's reversal exemplifies the inflationary dynamics before the onset of COVID-19: actual inflation typically undershot the Fed's two percent target, only temporarily exceeding it, which exerted downward pressure on inflation expectations. The COVID-19 pandemic initially lowered prices and

⁴⁰ Tepper, Taylor. 2023. Federal Funds Rate History 1990 to 2023. *Forbes*. Accessed at: <https://www.forbes.com/advisor/investing/fed-funds-rate-history/>.

inflation expectations, reflected in the row for the October 2020 bid in Table 2-6. Given actual inflation data, inflation expectations, and the Fed's actions that petitioners bidding between 2016 and 2020 observed, it is reasonable to conclude that the high and persistent inflation that followed in 2021-2023 was unforeseeable for the solicitations through October 2020.

Table 2-6. Economic Indicators and Forecasts: GDP Deflator, CPI, and CPI Forecasts as of Project Solicitation Bid Dates

Date of Bids for NYSERDA LSR Solicitations	GDP Deflator (Year-over-Year % Change Leading up to Bid Date)	CPI (Year-over-Year % Change Leading up to Bid Date)	Release Date of Most Recent Forecast before Bid Date	CPI One-Year Forecast	CPI Two-Year Forecast
July 12, 2016	0.89	1.05	May 13, 2016	2.14	2.30
September 28, 2017	1.87	1.97	August 11, 2017	2.17	2.29
August 16, 2018	2.69	2.71	May 11, 2018	2.20	2.30
February 14, 2019	2.28	2.20	November 13, 2018	2.35	2.27
September 10, 2019	1.74	1.76	August 9, 2019	2.04	2.15
October 20, 2020	1.26	1.22	August 14, 2020	1.83	1.99
August 26, 2021	4.36	4.85	May 14, 2021	2.33	2.32

Note: Solicitations were issued between 3 to 4 months prior to the presented dates. The second and third columns reflect year-to-year changes in the most recently observed GDP Deflator and CPI values prior to bid date. Inflation estimates represent fourth quarter over fourth quarter inflation forecasts (percentage changes) for the next two years.

Sources: GDP Deflator: U.S. Bureau of Economic Analysis; CPI: U.S. Bureau of Labor Statistics; Forecasts: Federal Reserve Bank of Philadelphia.

The inflationary environment was more complex in August 2021. As Table 2-6 shows, observed levels of both the GDP Deflator and CPI exceeded four percent year-over-year by August, well above the Fed's two percent inflation target. Despite these data, inflation expectations remained anchored slightly above two percent, according to both policymakers and professional private sector forecasters, as economists in the Fed and Biden administration maintained that the observed inflation was "transitory" and would stabilize by early 2022. As discussed above, it was not until November 2021 when Chair Jerome Powell officially retired the word "transitory" to describe inflation dynamics. The FOMC raised its projection of annualized 2021 inflation from 3.4 percent in June 2021 to 4.2 percent in September 2021 (Table 2-5). Only the former was available as of the August 2021 bid date.

Based on contemporaneous forecasts and inflation data available as of the August 2021 bid date, the information available to developers at the time was conflicting, and businesses were operating under conditions of significant global economic uncertainty following COVID-19 lockdowns. Although inflation as of the August 2021 bid date was higher than both the Fed target and the relatively low inflation of prior years, available forecasts from the Fed and private forecasters suggested that inflation would remain elevated for a relatively short period of time and would not continue to worsen. In hindsight forecasters were mistaken about inflation's path for the remainder of 2021 and through 2022, as inflation persisted longer than expected and reached levels not anticipated by forecasters. On this basis, in August 2021 it would have been reasonable for

developers to expect short-term and long-term levels of inflation that were higher than what could have been reasonably predicted prior to 2021 but lower than the observed price increases that followed after August 2021.

2.6 Conclusion

In this chapter, we showed that inflation of goods, services, labor, and key components relevant to solar PV, onshore wind, and offshore wind projects all increased between 2021 and early 2023 by more than what pre-2021 trends indicated. The main drivers of inflation over this period (e.g., large fiscal stimulus, energy price shocks, war in Ukraine) materialized after a period of severe and unprecedented economic uncertainty; large swathes of the U.S. economy remained locked down throughout 2020 and effective COVID-19 vaccines were distributed in early 2021. Inflation forecasts at the time of bid dates for LSR projects in New York did not predict the actual levels of inflation that occurred from later 2021 onwards. Overall, this narrative is consistent with the representations made by the petitioners that the inflation observed between 2021 and 2023 was unpredictably high and persistent.

CHAPTER 3 | Forecast of Future Inflationary Pressures on Renewable Energy Project Development

This chapter provides a forward-looking view on inflationary pressures affecting clean energy project development in the United States, examining three main topics:

1. What do economic forecasts indicate about future levels of inflation and borrowing costs in the U.S. economy? What prices are most relevant to projecting the costs of developing renewable energy projects?
2. How are inflation-driven clean energy project development costs anticipated to change over the next ten years? When will they reach pre-2022 levels?
3. How will supply chain constraints that are not incorporated into existing forecasts impact the project development costs of solar PV, onshore wind, and offshore wind projects in the U.S.?

Pursuant to these questions, this chapter begins by evaluating projections of inflation indices of goods and services and of labor. Drawing on our review of historical inflation between 2016 and 2023, we extrapolate from past inflation trends and correlations between price indices to identify the potential courses of future price developments of producer price indices (PPIs) relevant to renewable energy generation. We then turn to forecasts of the overall costs of solar photovoltaic (PV), onshore wind, and offshore wind projects, incorporating our assessment of energy consultancy Wood Mackenzie's supporting report to the petition submitted by Empire Offshore Wind LLC and Beacon Wind LLC (appended as Exhibit C to the petition). Finally, we evaluate the expected paths of various interest rates in the U.S. economy and their potential impact on the financing costs of clean energy project development over the next ten years.

Though the exact estimates vary, a wide swathe of policymakers and professional economists agree that the rate of increases for inflation have peaked, with future increases moderating to at least two percent annually for the foreseeable future. Forecasts are inherently uncertain, but most economics commentators would likely accept that prices, including those of many renewable energy components, will remain above pre-2022 levels over the next ten years even if inflation moderates as predicted. In other words, analysts do not expect price deflation over the next ten years. Similarly, interest rates, as of July 2023 at their highest level in 22 years, are projected to stabilize between the rates observed from 2016-2021 and their current peak. Some analysts have suggested that structural changes in the global economy, such as ageing populations, large and persistent fiscal deficits, decarbonization, and deglobalization, have engendered a new era of high and volatile inflation and borrowing costs in advanced economies that succeeded the so-called "Great Moderation", the four-decade period of low and stable inflation.^{41,42}

⁴¹ 2023 Global Outlook: A new investment playbook. *Blackrock Investment Institute*. Accessed at: <https://www.blackrock.com/corporate/literature/whitepaper/bii-global-outlook-2023.pdf>.

⁴² Moulle-Berteaux, Cyril and Parmenov, Sergei. 2023. The Five Forces of Secular Inflation. *Morgan Stanley*. Accessed online at <https://www.morganstanley.com/im/en-us/individual-investor/insights/articles/the-five-forces-of-secular-inflation.html>.

Within the renewable energy sector, supply chain constraints continue to affect component pricing and delivery schedules. These constraints are driven by both heightened global demand for solar and wind developments and ongoing macroeconomic challenges. In addition, as of this writing, the financial viability of renewable energy projects in several U.S. states is in jeopardy due to persistent inflation and supply chain constraints (see Chapter 4). It is uncertain if supply will keep pace with the heightened global demand for clean energy to alleviate these pressures.

However, general economic headwinds should be considered against the rapid development of and demand for renewable energy technologies which are expected mitigate cost pressures for solar PV, onshore wind, and offshore wind projects. As we discuss in detail below, current forecasts published by the National Renewable Energy Laboratory (NREL) show gradual but consistent declines in capital expenditures required to construct renewable energy infrastructure through 2035. Annual forecasts varied but all projected a similar downward trend in costs (measured by total capital expenditures required to install the infrastructure) for solar PV, onshore wind, and offshore wind projects relative to baseline forecasts made in 2016. If accurate, NREL's forecasts indicate that the required capital expenditures to develop these three types of renewable energy projects will be lower by 2030 than they were between 2019 and 2021, prior to the onset of major (and ongoing) pandemic-induced supply chain bottlenecks.

3.1 Inflation Forecasts

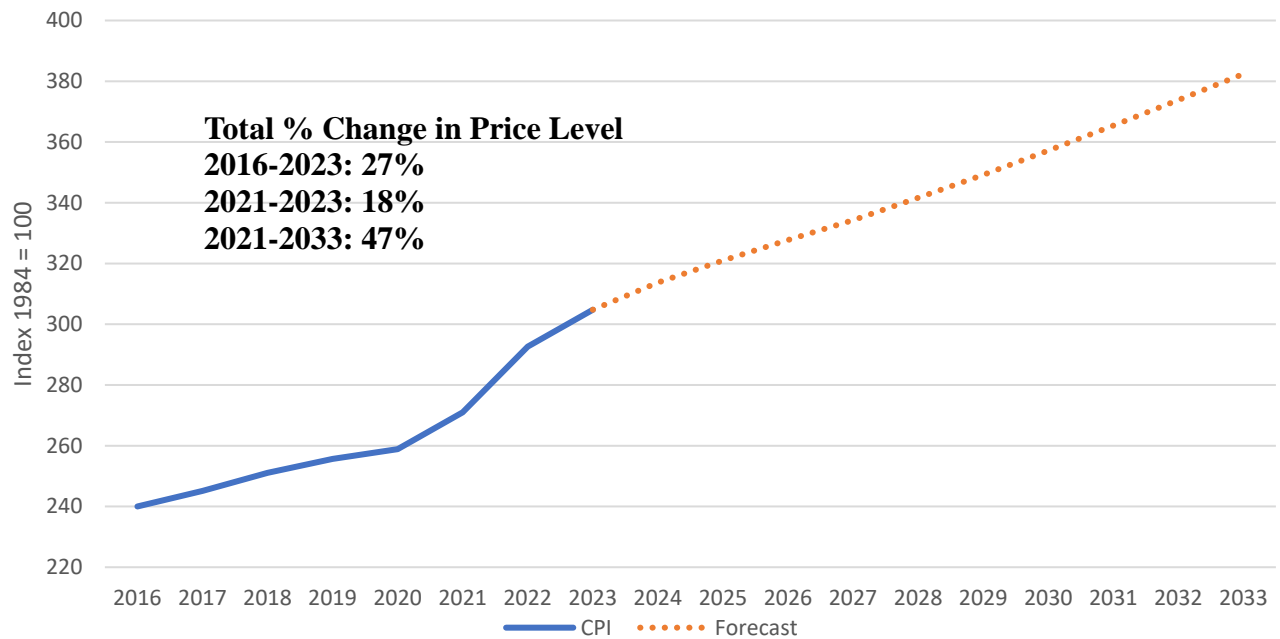
3.1.1 Measures of Economy-Wide Inflation

The U.S. Congressional Budget Office (CBO), a nonpartisan agency that provides economic analysis to Congress, regularly updates its projections of general inflation indices such as the Consumer Price Index (CPI) and GDP Deflator. Figures 3-1 and 3-2 chart the CBO's projections of the CPI and the GDP Deflator, respectively. Inflation is expected to moderate relative to the January 2021 to March 2023 period when the CPI increased at a compound annual growth rate (CAGR) of 6.9 percent and the GDP Deflator increased at a CAGR of 6.1 percent. As of July 2023, the CBO projects that both indices will increase at an annual rate of four percent in 2023 and then gradually approach two percent in subsequent years. Specifically, the CPI will increase by 3.0 percent in 2024, 2.2 percent in 2025, and between 2.0 and 2.3 percent in 2026-2033; the GDP Deflator will increase by 2.3 percent in 2024, 2.2 percent in 2025, and between 1.9 and 2.1 percent in 2026-2033, according to CBO forecasts.

Though the rate of price growth is likely to slow down, the general expectation among economists is that price levels will continue to rise and thus remain elevated above levels observed prior to 2022. For example, if the CBO's inflation projections are accurate, then the price level in the U.S. will be 42 percent higher at the end of 2033 than it was at the end of 2020, as measured by the GDP Deflator (47 percent if measured by the CPI). The Fed's Open Market Committee (FOMC) only forecasts the Personal Consumption Expenditures (PCE) Index for 2023-2025 and the longer run, which typically equals the Committee's two percent inflation target. According to the latest

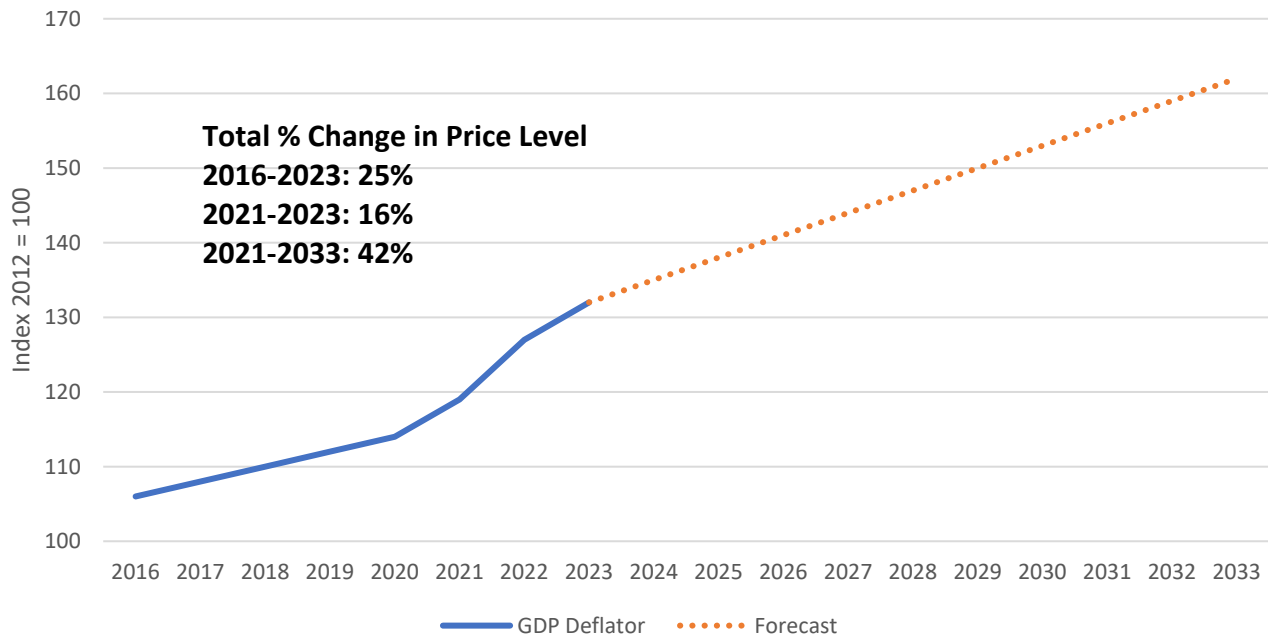
projections (June 2023), the median FOMC forecast shows that the PCE will increase at annual rates of 3.2 percent, 2.5 percent, and 2.1 percent, respectively, in 2023, 2024, and 2025.⁴³

Figure 3-11. Actual and Forecasted CPI, Annual Averages, 2016-2033



Source: U.S. Congressional Budget Office.

⁴³ Summary of Economic Projections. 2023. *U.S. Federal Reserve System*. Accessed at: <https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20230614.pdf>.

Figure 3-2. Actual and Forecasted GDP Deflator, Annual Averages, 2016-2033

Source: U.S. Congressional Budget Office.

Private sector economists likewise forecast that inflation will moderate after 2023 but continue to increase by at least two percent annually. Table 3-1 shows private sector median forecasts of the CPI inflation rate over several time horizons, as reported in the Federal Reserve Bank of Philadelphia’s Survey of Professional Forecasters released on August 11, 2023. Though the exact estimates vary, the accepted narrative among policymakers, businesses, and economic analysts alike is that prices will continue to rise by at least two percent annually for the foreseeable future. An optimistic faction within the economic analysis mainstream expects that inflation will stabilize around the Fed’s two percent target while more cautious observers, though not predicting the inflation rates seen in 2022 will continue, contend that inflationary risks remain and that the Fed will struggle to control inflation at such a low level without large and potentially intolerable increases in unemployment.^{44, 45} We did not identify a reputable source that projected price *deflation* (a sustained drop in the general price level) would occur in the next ten years. Deflation in the U.S. is historically associated with periods of significant economic uncertainty, weak output growth, and high unemployment, such as the Great Depression in the 1930s.⁴⁶ Persistent decreases in prices (i.e., deflation/negative inflation) across the U.S. economy would likely be the result of a prolonged

⁴⁴ Casselman, Ben and Smialek, Jeanna. 2023. Could the Recession in the Distance Be Just a Mirage? *The New York Times*. Accessed at: <https://www.nytimes.com/2023/07/19/business/economy/economy-soft-landing.html>.

⁴⁵ Adrian et al. 2023. Inflation Remains Risk Confronting Financial Markets. *International Monetary Fund*. Accessed at: <https://www.imf.org/en/Blogs/Articles/2023/07/27/inflation-remains-risk-confronting-financial-markets>.

⁴⁶ Neely, Christopher. 2010. U.S. Historical Experience with Deflation. *U.S. Federal Reserve Bank of St. Louis*. Accessed at: https://files.stlouisfed.org/files/htdocs/publications/net/20101001/cover.pdf?utm_campaign=Twitter&utm_medium=Social%2BMedia&utm_source=Twitter.

recession and extreme shocks (financial crises, war, natural disasters, etc.) that would be more severe than those that have materialized in the 21st century.⁴⁷

Table 3-1. Survey of Professional Forecasters' Estimates of CPI Inflation as of August 11, 2023

Time Horizon (End of Year)	CPI
Current Year (2023)	3.10%
One Year (2024)	2.49%
Two Years (2025)	2.40%
Five Years (2028)	2.68%
Ten Years (2033)	2.40%

Source: Survey of Professional Forecasters (CPI). August 2023. Federal Reserve Bank of Philadelphia.

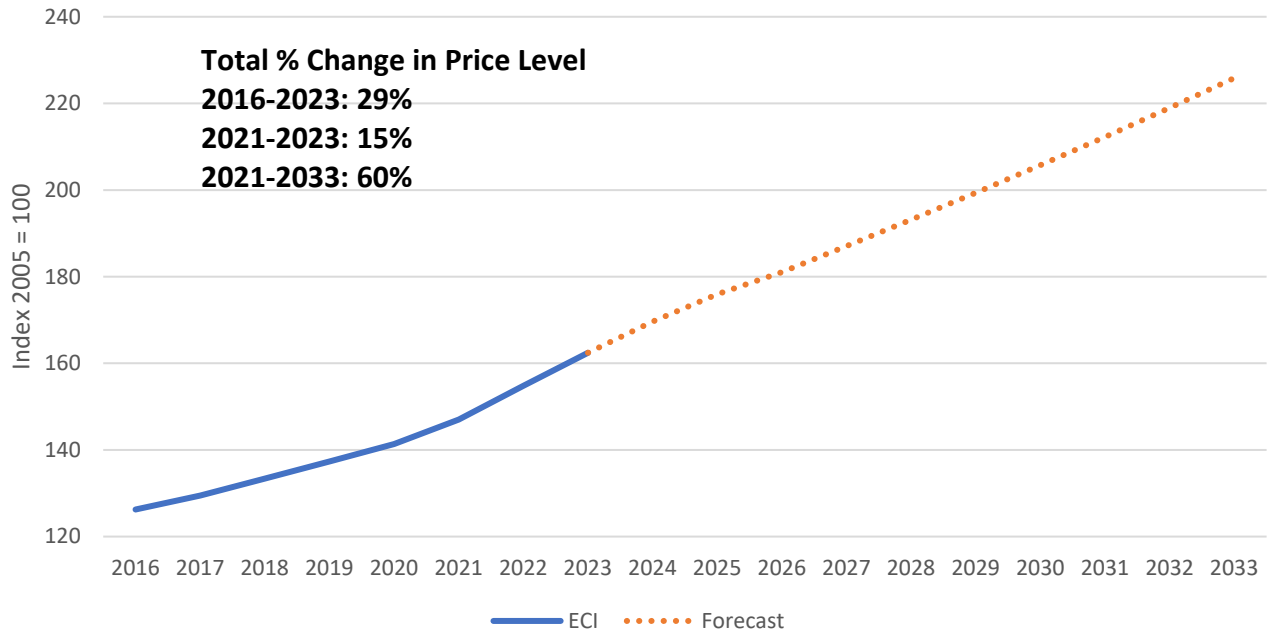
3.1.2 Labor Costs

Labor accounts for a significant portion of the overall costs of clean energy projects. If current forecasts prove accurate, clean energy developers will face higher labor costs over the next ten years. The CBO projects that total compensation for workers, as measured by the Employment Cost Index (ECI) for all occupations in civilian industries, will increase faster than inflation of goods and services (see Table 3-2).⁴⁸ This conclusion partially reflects the delayed impact of wage pressures in driving inflation. Wages increased precipitously in 2022 and 2023 after, and in response to, the spike in commodities prices and general inflation that began in 2021.⁴⁹ Growth in labor costs is expected to outpace the growth of the CPI and GDP Deflator as long as tight labor markets and wage demands to compensate for reduced purchasing power continue. As shown in Figure 3-3, the CBO forecasts that the ECI will grow at annual rates of 4.4 percent, 3.7 percent, and 2.9 percent in 2024, 2025, and 2026, respectively, and then between 3.1 and 3.3 percent between 2027 and 2033. Relative to the end of 2020, labor costs are projected to be 60 percent higher at the end of 2033.

⁴⁷ Periods of deflation were rare and short-lived in the U.S. after 1950. For example, even following the financial crisis of 2007-2008, the U.S. exhibited moderate deflation for just eight months in 2009, defying economists' predictions. Relative to the era preceding the Federal Reserve System's establishment in 1913, after 1950 periods of high inflation were followed by a return to normal (and positive) inflation rates instead of deflation. See <https://www.aeaweb.org/research/charts/why-prices-didn't-plummet-during-great-recession> and <https://www.stlouisfed.org/publications/regional-economist/second-quarter-2017/a-short-history-of-prices-inflation-since-founding-of-us>.

⁴⁸ The CBO does not release forecasts of ECIs for specific industries. However, the ECI for the construction and manufacturing indices increased faster than the ECI for all industries between 2016 and the first quarter of 2023. Therefore, it is reasonable to expect that the costs of skilled labor required for renewable energy generation projects will continue to increase by more than the average costs of labor across all industries for the foreseeable future.

⁴⁹ Bernanke, Ben and Blanchard, Olivier. 2023. What caused the U.S. pandemic-era inflation? *The Brookings Institution*. Accessed at: <https://www.brookings.edu/articles/what-caused-the-u-s-pandemic-era-inflation/>.

Figure 3-3. Actual and Forecasted Employment Cost Index Annual Averages, 2016-2033

Source: U.S. Congressional Budget Office.

Table 3-2. Compound Annual Growth Rates of CPI, GDP Deflator, and ECI Indices, 2016-2033

Time Period	CPI	GDP Deflator	ECI - All Industries
Q1 2016 - Q4 2020	2.0%	1.9%	2.4%
Q1 2021 - Q1 2023	6.9%	6.1%	3.8%
2024-2033 (Forecast)	2.2%	2.0%	3.2%

3.1.3 Correlation between Price Indices

In this section, we show that the price indices of general goods and services, labor, and PPIs relevant to clean energy generation were highly correlated between January 2016 and March 2023. The relationships between indices serve as baselines to forecast future price growth in key commodities and industries, as price forecasts for specific construction inputs are much less common (and accurate) than forecasts for general inflation indices such as the CPI, GDP Deflator, and PCE.

Figure 3-4 shows the correlation coefficients of the GDP Deflator, ECI, and relevant PPIs.⁵⁰ The correlation coefficient between the GDP Deflator and the PPI indices ranged from 0.73 (PPI - aluminum) to 0.99 (PPI - cement and concrete manufacturing). This indicates that prices of key

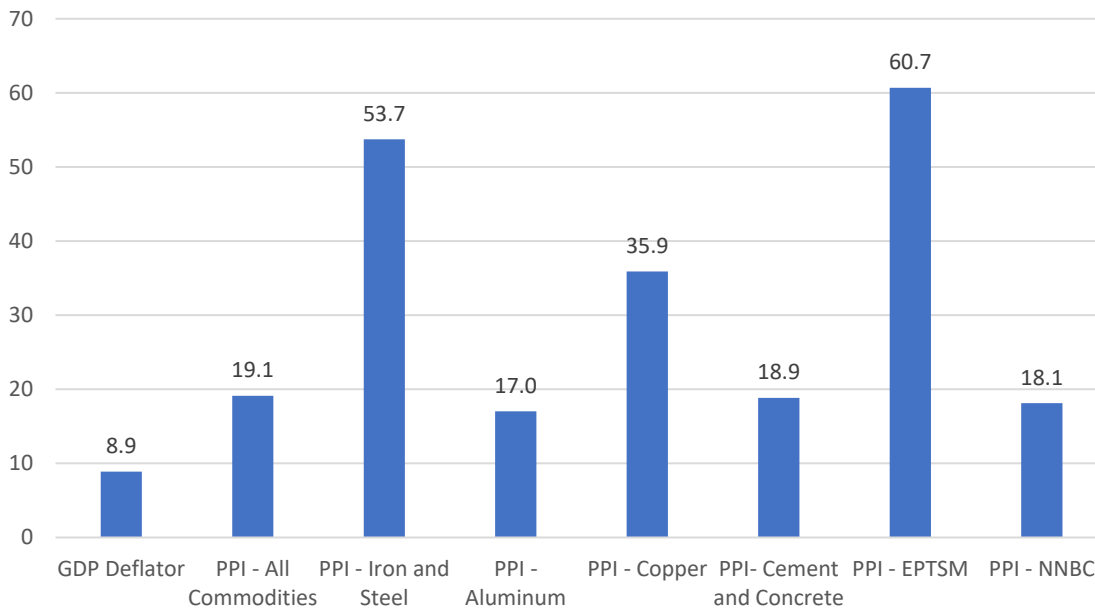
⁵⁰ A correlation coefficient of 1 indicates the strongest possible (positive) statistical relationship between two variables.

inputs for renewable energy generation development closely tracked broader inflation of goods and services between January 2016 and March 2023. If past trends are indicative of future trends, we can expect the PPI indices in Figure 3-4 to increase in the next 10 years, consistent with forecasts of the GDP Deflator. It is important to note that the correlation coefficient is a measure of direction, not of magnitude. PPI indices increased at much faster rates than did the GDP Deflator between January 2016 and March 2023, particularly after 2020; correlation captures the fact that the price indices increased together at similar times. Figure 3-4 shows that none of the price indices had a negative correlation coefficient, meaning one index increases while another other index decreases. Prices of commodities are also more volatile than indices of economy-wide inflation. For example, as Figure 5 shows, the standard deviation of the GDP Deflator between Q1 2016 and Q1 2023 was 8.9, compared to 19.1 for the PPI for all commodities, 35.0 for the PPI for copper, and 53.7 for the PPI for iron and steel. Despite this volatility, the correlations between price indices in Figure 3-4 show that PPI indices followed a similar overall upward trend to that of the GDP Deflator between January 2016 and March 2023; prices are higher in 2023 than they were in 2016 according to any metric included in the figure. While we do not provide precise forecasts of changes in PPI indices, there is no *a priori* reason to expect that any of the indices would exhibit *persistent deflation* relative to pre-2022 levels over the next ten years. As we discuss below, commodity prices fluctuate given supply and demand dynamics specific to their production.

Figure 3-4. Correlation between Price Indices, 2016-2023

	GDP Deflator	PPI - All Commodities	PPI - Iron and Steel	PPI - Aluminum	PPI - Copper	PPI - Diesel	PPI- Cement and Concrete	PPI- EPSTM	PPI - NNBC	ECI - All Industries
GDP Deflator	1.000									
PPI - All Commodities	0.953	1.000								
PPI - Iron and Steel	0.847	0.918	1.000							
PPI - Aluminum	0.727	0.831	0.908	1.000						
PPI - Copper	0.906	0.903	0.941	0.858	1.000					
PPI - Diesel	0.917	0.982	0.869	0.826	0.857	1.000				
PPI- Cement and Concrete	0.991	0.932	0.786	0.659	0.854	0.894	1.000			
PPI- EPSTM	0.971	0.979	0.849	0.728	0.848	0.950	0.970	1.000		
PPI - NNBC	0.986	0.937	0.780	0.650	0.832	0.904	0.996	0.980	1.000	
ECI - All Industries	0.971	0.866	0.785	0.653	0.895	0.819	0.956	0.890	0.940	1.000

Notes: Data through March 31, 2023. EPTSM = Electric Power and Specialty Transformer Manufacturing. NNBC = New Nonresidential Building Construction, Northeast

Figure 3-5. Standard Deviation (Volatility) of Price Indices, 2016-2023⁵¹

Notes: Data through March 31, 2023. EPTSM = Electric Power and Specialty Transformer Manufacturing. NNBC = New Nonresidential Building Construction, Northeast

Our analysis of general inflation measures suggests that price increases of goods, services, and labor will moderate relative to high rates of inflation observed in 2021 and 2022. Forecasts indicate that the GDP Deflator and CPI will stabilize slightly above the Fed's two percent inflation target over the next ten years (2024-2033). Labor costs, as measured by the Employment Cost Index, have historically lagged price indices of general inflation; analysts expect this trend to continue and forecast that the ECI will increase at a compound annual growth rate of 3.2 percent, compared to CAGRs of 2.2 and 2.0 percent for the CPI and GDP Deflator, respectively. Commodity prices were volatile between 2016 and 2023, which poses a significant challenge to accurately forecasting their future trajectories. However, the PPIs of key commodities necessary for renewable energy projects were highly correlated with the GDP Deflator over the same period. As we discuss below, supply and demand dynamics are unique to each commodity, but based on historical relationships it is reasonable to assume that commodity prices, despite future peaks and troughs due to volatility, will follow an upward trend similar to that of the GDP Deflator over the next ten years.

Below, we shift to a discussion of forecasts of the costs of solar PV, onshore wind, and offshore wind projects. Forecasting renewable energy project costs is inherently difficult due to complex global supply chains and fluctuating prices of components, including commodities and finished durable goods such as wind turbines and solar panels. Further, as of this writing there is significant tension between two economic forces pushing renewable energy development prices in opposite directions. On one hand, prices of frontier technologies such as those used in renewable energy

⁵¹ Not shown in the graph: PPI for diesel as it exhibited an extremely high standard deviation of 116.9 and the ECI, which had essentially the same standard deviation as the GDP Deflator between Q1 2016 and Q1 2023.

generation typically decrease over time, as industries mature, achieve economies of scale, and incentivize competitors to join the market. On the other hand, persistent supply chain constraints and inflationary pressures in renewable energy sectors are pushing prices higher and could potentially offset or outweigh the secular downward trend in prices driven by efficiency gains in these sectors. It is uncertain if supply will keep pace with the heightened global demand for clean energy to alleviate the inflationary pressures specific to the solar PV, onshore wind, and offshore wind development.

3.2 Review of Forecasts Specific to Renewable Energy Investments

In this section, we attempt to reconcile conflicting information from different renewable energy analysts, suppliers, and developers regarding construction costs and supply and demand imbalances in renewable energy sectors. For example, the National Renewable Energy Laboratory (NREL) forecasts that the costs of solar PV, onshore wind, and offshore wind projects will follow gradual downward trajectories between 2023 and 2035. NREL's projections embody the view referenced above that prices of frontier renewable energy technologies will secularly decline over time due to efficiency gains and despite temporary setbacks. We also found convincing evidence supporting the opposing view that constrained supply chains cannot match the insatiable global demand for renewable energy, resulting in higher costs for solar PV, onshore wind, and offshore wind projects than what analyses such as NREL's predict. Consultancies such as McKinsey and Wood Mackenzie as well as the financial press provide data and analyses which question the financial viability of these projects absent supply chain relief or additional government support.

We begin this section with an overview of the methodology that NREL uses to estimate historical and projected capital expenditures (CAPEX) of solar PV, onshore wind, and offshore wind projects. We then analyze the market dynamics in each of these sectors. Relative to solar PV and onshore wind markets, in the offshore wind market we find the starkest contrast between NREL's economic forecasts and the financial and supply-side challenges impeding the technology's expansion and cost reduction. We add to our assessment of offshore wind our review of energy consultancy Wood Mackenzie's supporting report to the petition submitted by Empire Offshore Wind LLC and Beacon Wind LLC (appended as Exhibit C to their petition).

3.2.1 National Renewable Energy Laboratory Forecasts Methodology

NREL is a research organization that studies renewable energy and energy efficiency technologies. NREL publishes its Annual Technology Baseline (ATB) report, which offers a comprehensive analysis and projections of the cost and performance attributes of diverse renewable energy and energy efficiency technologies. Updated on an annual basis, each edition of the ATB encompasses a broad spectrum of technologies including solar PV and onshore and offshore wind power.

In addition to actual CAPEX for renewable energy projects, we focused on the CAPEX projections from the ATB reports released in each year between 2016 and 2023. NREL measures CAPEX by U.S. dollars (2021\$) per kilowatt hour (kWh). NREL includes the following cost items in CAPEX for solar PV, onshore wind, and offshore wind technologies:⁵²

⁵² <https://atb.nrel.gov/electricity/2023/definitions#capitalexpenditures>.

- Balance of system/balance of plant, i.e., major plant components needed to deliver electricity to the bulk power system;
- Electrical infrastructure and interconnection (including transmission substation upgrades);
- Generation equipment and infrastructure;
- Installation and indirect costs (labor and materials, engineering, startup and commissioning costs);
- Owners' costs, such as development and permitting costs, insurance, and preliminary feasibility studies;
- Site costs, including land acquisition, site preparation, and transformers.

For onshore wind projects, NREL derives CAPEX estimates from wind plants installed in the interior of the country, incorporating wind speeds corresponding to the median conditions of recently installed facilities. Offshore wind CAPEX estimates are derived from a “bottom-up techno-economic” cost model that incorporates economies of size and scale, with a particular emphasis on turbines and plants. This cost model is based on the work by Beiter et al. (2016).⁵³ Similarly, solar PV CAPEX is based on comprehensive bottom-up cost modeling and market data sourced from the work of Feldman et al. (2021).⁵⁴

Note that the ATB does not account for geographic variation in the costs of labor, materials, and other inputs to renewable energy generation. In addition, the ATB relies on cost-modelling to derive actual observed CAPEX and to estimate future CAPEX; like all modeling exercises NREL’s methodology requires certain assumptions that, though potentially unrealistic, strongly influence the model’s results. For example, our review of the sources underlying the ATB’s calculations (listed above) indicates that consistent supply chain development is a key factor driving the downwards cost trajectories for solar PV, onshore wind, and offshore wind project CAPEX.⁵⁵ In the most recent ATB, NREL’s cost modeling did not incorporate renewable energy supply chain constraints that worsened or materialized after February 2023 or realistic assumptions about their persistence going forward.⁵⁶

A final, related limitation of NREL’s forecasts (applicable to forecasting in general) relevant to this report is that the underlying data and supply and demand dynamics in renewable energy sectors are constantly evolving. NREL relied predominantly on 2021 technology cost and performance

⁵³ Beiter et al. 2016. A Spatial-Economic Cost-Reduction Pathway Analysis for U.S. Offshore Wind Energy Development from 2015-2030. U.S. Department of Energy Office of Scientific and Technical Information. Accessed at: <https://www.osti.gov/biblio/1324526/>.

⁵⁴ Feldman et al. 2021. U.S. Solar Photovoltaic System and Energy Storage Cost Benchmark (Q1 2020). U.S. Department of Energy Office of Scientific and Technical Information. Accessed at: <https://www.osti.gov/biblio/1764908/>.

⁵⁵ See the “Key Caveats and Limitations” section in Beiter et al. (2016) concerning offshore wind : “To achieve the modeled cost reductions [of offshore wind development] in the United States, a key assumption is that there will be continued investments in technology innovation, developments, and the market visibility of a robust domestic supply chain commensurate with the established European offshore wind supply chains during the analysis period from 2015-2027 and sustained domestic offshore wind development.”

⁵⁶ Communications with NREL, August 16, 2023.

data to estimate CAPEX and released the 2023 ATB report in June 2023.⁵⁷ Subsequent developments in supply chains impacting solar PV, onshore wind, and offshore wind projects should also be considered to anchor expectations of the future costs for these projects, particularly for projects that are currently or soon to be in the construction phase.

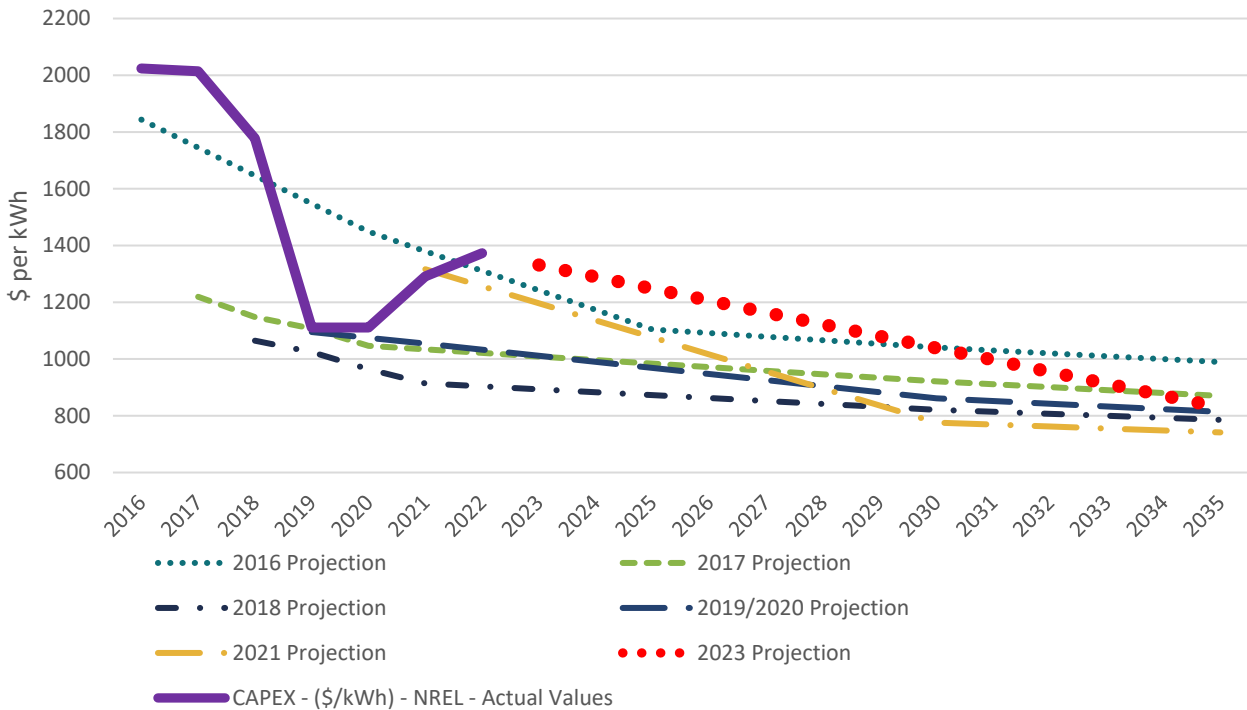
A full discussion of the limits of this approach and the applicability of NREL's projections to the New York market is beyond the scope of this report. NREL's forecasts of the long-term economic viability of a renewable energy technology are distinct from and cannot reasonably account for short-term financial considerations at the individual firm or project level. However, in our view, the forecasts provide valuable insights about how economies of scale, technological improvements, demand for renewable energy, and supply chain dynamics have influenced and may continue to influence the cost effectiveness of producing renewable energy through solar PV, onshore wind, and offshore wind technologies since 2016. Below, we provide a holistic evaluation of each of these sectors by juxtaposing NREL's forecasts with additional market data and analyses that often suggest more challenging future financial prospects for LSR projects.

For Figures 3-6, 3-7, and 3-8 shown below, note that NYSERDA's petitions pertain to proposals submitted between 2016 and 2021. As a result, and to produce more legible figures, we exclude NREL's vintage 2022 projections from these figures. Additionally, note that the reported forecasts released in 2019 and 2020 are identical.

3.2.2 Solar PV Projects

Figure 3-6 presents actual CAPEX for solar PV projects between 2016 and 2022 in addition to NREL's annual CAPEX forecasts released between 2016 and 2023. The scenario utilized in these forecasts is described by NREL as 'Utility PV 14% - mid', which represents a capacity factor of 14 percent for regions with moderate insolation levels. NREL's CAPEX estimates incorporate the cost of hardware, equipment, labor, system design, and other overhead expenses involved in system installation. The figure illustrates the dynamic nature of the solar PV industry and the ongoing refinement of projections as new data become available and the industry matures. The consistent downward trajectory of CAPEX forecasted in each ATB report reflects the increasing economies of scale and efficiency improvements in developing solar PV technology.

⁵⁷ Specifically, 2021 serves as the base year in the 2023 ATB to establish forward-looking cost and performance estimates of renewable energy technologies. NREL either incorporates 2022 data when available or inflates costs by a technology-neutral multiplier of 3.5 percent relative to the overnight capital cost of a given technology/scenario.

Figure 3-6. Actual and Forecasted CAPEX for Solar PV Projects, Annual Averages (2016-2035)

Source: National Renewable Energy Laboratory. Annual Technology Baseline Reports.

Though the CAPEX forecasts are modeled based on system prices that are representative of bids issued in the fourth quarter of the preceding year and may not explicitly account for regional differences, the consistent downward trend exhibited across forecasts signifies an increasingly accessible and economically viable future for solar PV projects in the U.S., in NREL's view.

The 2016 forecasts are the most conservative and anticipate higher CAPEX relative to other years' ATB reports. This is reasonable given that, at the time and particularly in the U.S., the solar industry was less mature and exhibited lower economies of scale relative to subsequent years. NREL's 2016 forecasts were initially lower than the actual costs (the thick purple line in Figure 3-6) realized in 2017 and 2018. Actual costs then dropped below 2016 forecasts between 2019 and 2021 before overshooting them again in 2022. NREL's forecasted CAPEX values between 2017 and 2022 were all lower than 2016 predictions, as analysts refined their cost estimates with new data. 2023 forecasts (the large red dotted line), however, exceed 2016 forecasts between 2024 and 2029 but dip below them in subsequent years. According to the most recent forecast, solar PV CAPEX will not reach the low levels observed in 2019-2020 until 2029. NREL maintains that the economic viability of solar will improve in the long-run, despite short-run supply chain issues and heightened demand for solar energy that are expected to strain the industry and keep prices higher than predicted in prior years. A gradual ease in inflationary pressures is consistent with the stabilization of offer prices for PPAs in the second quarter of 2023 that we discussed in Chapter 2. 2023 Q2 PPA prices more than doubled since 2018 but decreased by one percent relative to the first quarter of 2023.

Note that actual CAPEX has increased since 2020 and we cannot discount the possibility that solar PV costs outpace their expectations. A potential headwind for solar PV development is that the supply chain of solar components is concentrated and vulnerable to disruptions in China. According to McKinsey, seven of the top ten suppliers of polysilicon suppliers are based in China and collectively hold 80 percent of global polysilicon capacity.⁵⁸ The exposure for American developers is particularly worrisome given the ongoing economic disputes between China and the U.S.^{59,60} In sum, the domestic solar industry has had to navigate varying and unpredictable trade policy actions taken by the Trump and Biden administrations to impose tariffs on imports first from China and then from other Southeast Asian nations.⁶¹

3.2.3 Onshore Wind Projects

Figure 3-7 below charts actual CAPEX for onshore wind projects between 2016 and 2022 in addition to NREL's annual CAPEX forecasts released between 2016 and 2023.⁶² The scenario utilized in these forecasts is referred to as 'TRG 1' by NREL, representing the most efficient 100 gigawatts of wind resources and the most likely wind plants to be deployed. Like the projections for solar PV development, NREL consistently forecasted a declining cost trajectory for onshore wind projects, reflecting optimism of the industry's capacity to mature and achieve economies of scale.

⁵⁸ Bettoli et al. 2023. Renewable-energy development in a net-zero world: Disrupted supply chains. *McKinsey and Company*. Accessed at: <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/renewable-energy-development-in-a-net-zero-world-disrupted-supply-chains>.

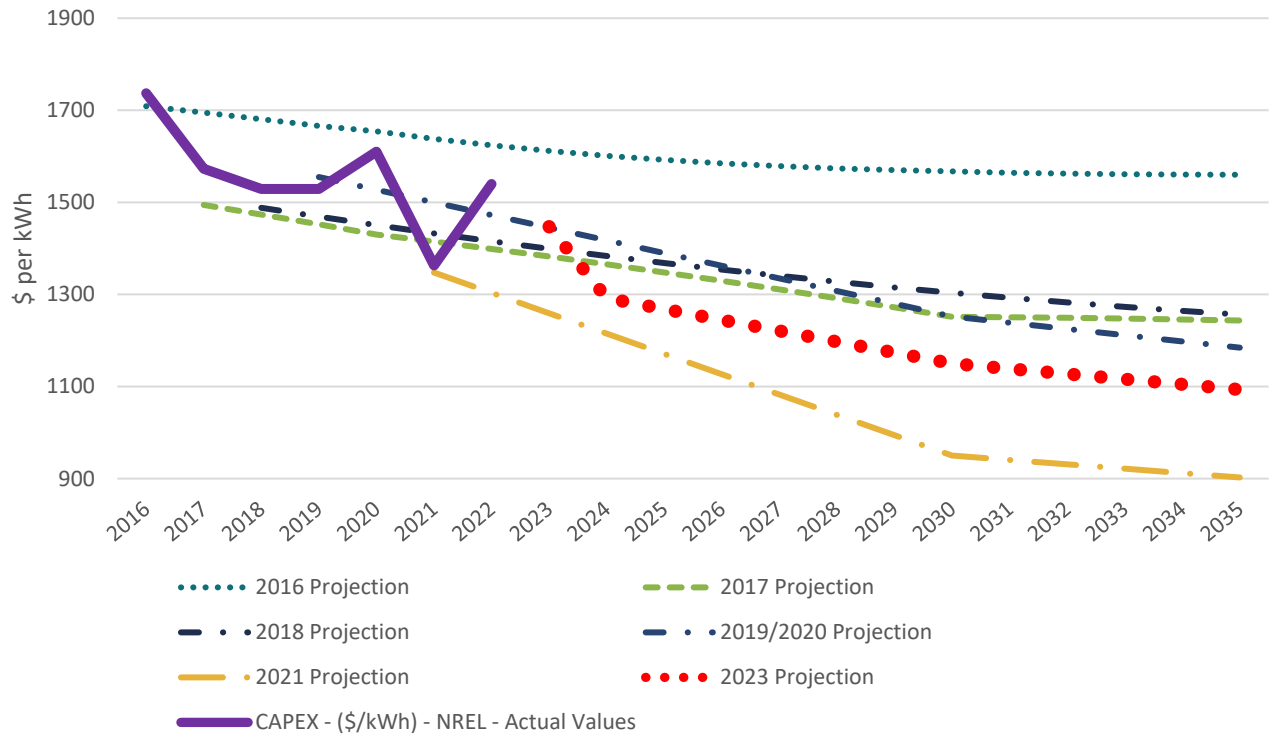
⁵⁹ Lin, Liza. 2023. China's Options for Retaliation Are Few After U.S. Investment Ban. 2023. *The Wall Street Journal*. Accessed at: <https://www.wsj.com/articles/chinas-options-for-retaliation-are-few-after-u-s-investment-ban-f539102e?page=1>.

⁶⁰ Liang, Anabelle and Mash, Nick. 2023. Gallium and germanium: What China's new move in microchip war means for world. *British Broadcasting Corporation*. Accessed at: https://www.bbc.com/news/business-66118831?at_campaign_type=owned&at_objective=awareness&at_ptr_type=email&at_ptr_name=salesforce&at_email_send_date=20230808&at_send_id=3958514&at_link_title=Type-Article-Name-Gallium+and+germanium+What+Chinas+new+move+in+microchip+war+means+for+world_Sponsor-Undefined_Social-Website_Topic-Semiconductors_Value-Free_Event-Undefined_Language-en_Placement-4_Location-hyperlink&at_bbc_team=crm.

⁶¹ Gelles et al. 2022. Biden to Pause New Solar Tariffs as White House Aims to Encourage Adoption. *The New York Times*. Accessed at: <https://www.nytimes.com/2022/06/06/business/economy/biden-solar-tariffs.html>.

⁶² The CAPEX values represent the total expenditures necessary for an onshore wind project to begin commercial operations within one year. CAPEX reflects, among other components, the supply of wind turbines, balance of system costs, project indirect costs, and financing costs.

Figure 3-7. Actual and Forecasted CAPEX for Onshore Wind Projects, Annual Averages (2016-2035)



Source: National Renewable Energy Laboratory. Annual Technology Baseline Reports.

Among NREL's forecasts, those in the 2016 ATB report again predicted the highest onshore wind CAPEX values through 2035. However, as innovation and competition accelerated and costs decreased more rapidly than expected, NREL released its most optimistic projections in 2021. The 2023 forecast then tempered expectations and acknowledged both the sector's advances in reducing costs but also uncertainty about global economic conditions and adequate (and affordable) supply of key components. Figure 3-7 shows that 2016 projections are markedly higher than the actual costs that were realized between 2017 and 2022. The divergence between anticipated and actual CAPEX underscores the rapid evolution of the wind energy sector relative to cost efficiency expectations set in 2016.

Figure 3-7 also demonstrates a marked downward shift from the highest cost estimates forecasted in 2016 to the significantly lower projections provided in the 2021 ATB report. NREL's 2023 forecasted trajectory lies between these two extremes, signaling a recalibration of industry and investor expectations to economic developments. In other words, supply chain bottlenecks and inflation have influenced upwards-revised expectations but have not fundamentally altered the projected economic viability of onshore wind development. It is unclear to what extent NREL assumes that supply chain issues will persist or how this assumption impacts the forecasts. Based on the 2023 forecast, onshore wind CAPEX will immediately decline in 2023 below the 2022 and pre-pandemic (2018-2019) levels. CAPEX is expected to be less in 2025 than the actual realized CAPEX in 2021, when CAPEX reached historical lows. Relative to solar PV CAPEX, onshore wind CAPEX is forecasted to reach their pre-2022 and pre-COVID levels much faster; one explanation is

that the key component parts of onshore wind infrastructure, though impacted by trade restrictions,⁶³ were not subject to similar tariffs that the U.S. placed on solar module imports from China, which continue to influence solar PV development in the U.S.⁶⁴

Forecasts should be weighed against the spike in onshore wind CAPEX between 2021 and 2022, general uncertainty surrounding the supply of affordable components required to construct onshore wind infrastructure, increasing PPA offer prices, and a related slowdown of wind installations in the U.S. For example, German turbine maker Siemens Energy reported a net loss of 2.9 billion euros (\$3.2 billion) for the second quarter of 2023 due to increased product costs and quality issues in its onshore wind turbine division, which could cost the company up to \$1.75 billion to fix. Siemens says it has a record high backlog for wind turbines. Another turbine supplier, TPI Composites, cautioned investors that higher inspection and repair costs would hurt the company's profits in 2023, which could negatively impact its future deliveries of turbines.⁶⁵ Regarding new installations, relative to the second quarter of 2022 (April 1 - June 30), land-based wind installations in the U.S. decreased by 27 percent in the second quarter of 2023, the slowest quarter since 2019, according to the American Clean Power Association. In addition, land-based wind installations decreased 32 percent compared to the first quarter of 2023.⁶⁶ As we discussed in Chapter 2, PPA prices for wind projects have increased by 142 percent between the third quarter of 2018 and the second quarter of 2023, with no indication that prices have begun to stabilize.

3.2.4 Offshore Wind Projects

Given the heightened uncertainty surrounding offshore wind development and its financial viability, namely constrained supply chains and imbalances between supply and demand, we begin this section with our review of Wood Mackenzie's supporting report to the petition submitted by Empire Offshore Wind LLC and Beacon Wind LLC. The report and corroborating sources provide important context for evaluating NREL's optimistic CAPEX forecasts for offshore wind. Specifically, NREL's forecasts of consistently declining offshore wind CAPEX depend on the timely resolution of supply chain constraints such that the supply of offshore components is sufficient to meet their global demand.

Review of Wood Mackenzie Report

Wood Mackenzie's report describes how both short-term macroeconomic challenges and longer-term mismatches between supply and demand will continue to constrain supply chains supporting offshore wind development. Specifically, the report argues that recent broad-based inflation across the U.S. economy and higher interest rates have translated into upward pricing pressures on

⁶³ <https://www.iea.org/articles/what-is-the-impact-of-increasing-commodity-and-energy-prices-on-solar-pv-wind-and-biofuels>.

⁶⁴ Groom, Nichola. 2022. U.S. to expand solar panel tariffs after probe finds Chinese invasion. *Reuters*. Accessed at: <https://www.reuters.com/markets/commodities/us-says-solar-imports-four-southeast-asian-countries-were-dodging-china-tariffs-2022-12-02/>.

⁶⁵ Hiller, Jennifer and Novik, Mari. 2023. Wind Industry in Criss as Problems Mount. *The Wall Street Journal*. Accessed at: <https://www.wsj.com/articles/wind-industry-hits-rough-seas-as-problems-mount-5490403a?page=1>.

⁶⁶ 2023 Q2 Clean Power Quarterly Market Report. 2023. *American Clean Power Association*. Accessed at: https://cleanpower.org/wp-content/uploads/2023/08/2023_Q2_Report_Public.pdf.

offshore wind projects, and that ambitious government targets in the U.S. and in Europe for clean energy generation by the end of the decade will further increase the demand for offshore wind. Growing global demand for offshore wind is expected to outpace supply of key components and exacerbate existing supply chain constraints.

We assessed the veracity of Wood Mackenzie's claims in two steps, corresponding to the report's demand and supply side narratives. First, we reviewed historical trends in offshore wind forecasts provided by the Global Wind Energy Council (GWEC) to identify how predictions of installed capacity for offshore wind evolved between 2020 and 2023. Second, we researched the supply chain dynamics of offshore wind development to corroborate the supply gaps the report identified across major offshore wind components. We find that: (1) independent forecasts of global offshore wind capacity increased from 2020 to 2023, reflecting the rapidly growing demand for offshore wind; and (2), the supply gaps specific to offshore wind development that the Wood Mackenzie report identified are corroborated by other sources. Our assessment suggests that the supply chain constraints observed between 2021 and 2023 were unexpected and that these constraints are likely to persist until at least 2030.

Forecasts of Global Offshore Wind Installations

In 2020 the GWEC began publishing a yearly Global Offshore Wind Report (GOWR) that evaluates long-term offshore wind trends across the world and forecasts energy capacity through 2030. The GWEC derives its short-term forecasts using its global offshore wind project database, which considers projects currently under construction, global auction results and announced offshore wind tenders worldwide.⁶⁷ For medium-term forecasts, aside from existing project pipelines, the GWEC uses a top-down approach, which accounts for existing policy, support schemes, offshore wind auction plans and medium/long-term national and regional offshore wind targets.⁶⁸

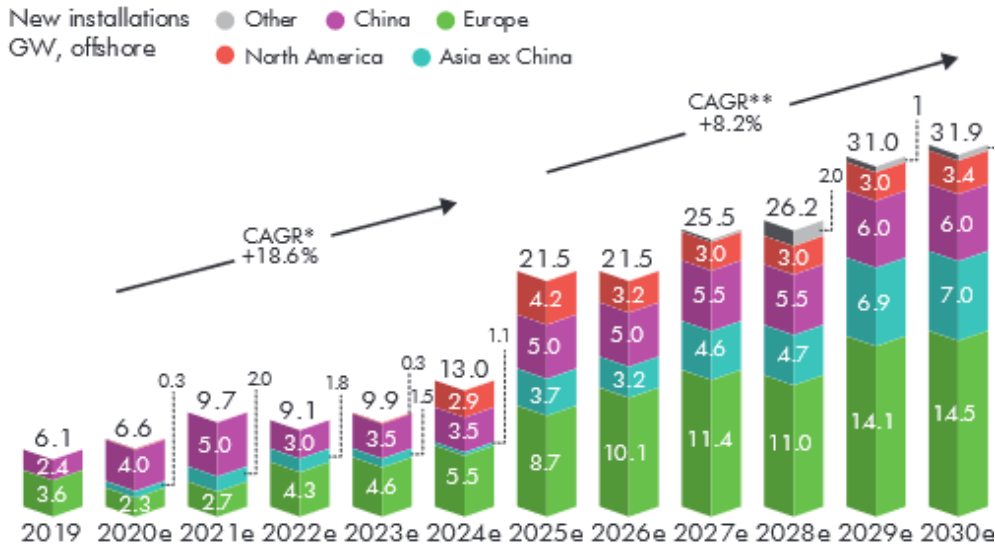
Figure 3-8 presents the GOWR forecast for 2020, which projects offshore wind capacity (GW, or gigawatts) through 2030. The GOWR's forecasts of new installations through 2024 show an overall upward trend, reflecting increasing global demand for renewable energy capacity. However, beginning in 2025, there is a significant upward revision of yearly capacity expectations. The GOWR forecasts an increase in new installations from 2024 to 2025 of 65.4 percent, citing increased growth of the mature European market, significant expansion in Taiwan and China, and completion of large-scale U.S. projects.⁶⁹ This represents the greatest increase year-over-year within the ten-year period.

⁶⁷ Global Offshore Wind Report 2022. 2022. *Global Wind Energy Council*. Accessed at: <https://gwec.net/wp-content/uploads/2020/12/GWEC-Global-Offshore-Wind-Report-2020.pdf>

⁶⁸ Ibid

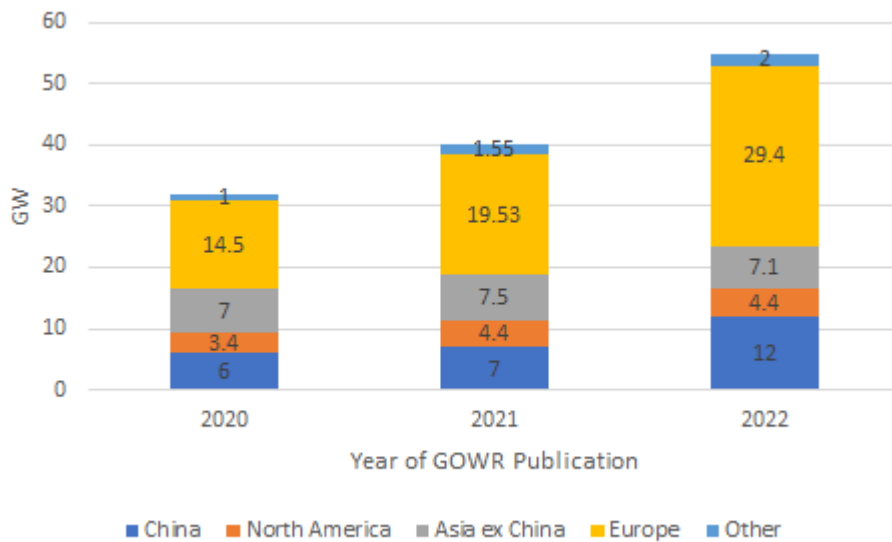
⁶⁹ Ibid

Figure 3-8. 2020 GOWR Projections of New Offshore Wind Installations, 2019 - 2030



Source: Global Wind Energy Council

Figure 3-9. 2020-2022 GOWR Projections of New Offshore Wind Installations (GW) in 2030



Source: Global Wind Energy Council

The 2020, 2021, and 2022 GOWR forecasts show similar trends, but each forecast increases yearly installation expectations. The 2020 GOWR projects installations in 2030 of 31.9 GW, while the 2021 and 2022 GOWRs estimate 39.98 GW and 54.9 GW, respectively, in 2030. Projections by region are presented in Figure 3-9. The GWEC cites a sharp drop in offshore wind's levelized cost of energy (LCOE), continued revisions of renewable and decarbonization targets, and general volatility in fossil fuel markets exacerbated by the war in Ukraine as the major drivers of increasing

installation expectations.^{70,71} Most of the projected increase in year 2030 offshore wind capacity shown in Figure 3-9 is due to significant growth in European demand for offshore wind. This sharp increase coincides with Russia's invasion of Ukraine in early 2022 and subsequent efforts by several European countries to reduce their dependence on Russian natural gas. For example, such efforts include the REPowerEU Plan and European Gas Demand Reduction Plan developed by the European Commission in 2022.⁷² The REPowerEU Plan increased the EU's 2030 renewables target from 40 percent to 45 percent and recommended several measures to reduce the permitting time for renewable energy projects.

Thus far, China has led the world in offshore capacity additions, accounting for 72.3 percent of 2022 additions, and in the short term this trend is likely to continue.⁷³ In Figure 3-8 above, 2023 and 2024 global capacity additions are dominated by China. By 2025, Europe and North America are expected to contribute significantly to new installations, but these projections are contingent on the completion of proposed projects, which will require an extensive and efficient supply chain. The first commercial-scale projects in the U.S. are already placing pressure on the global turbine vessel fleet, and in Europe manufacturing must increase its capacity from 7 GW to 20 GW of turbines a year to reach 2027 government targets.⁷⁴ Global supply chains must continue to develop to facilitate the projected rapid expansion of offshore wind.

Corroboration of Supply Chain Constraints by Offshore Wind Development Component

In its analysis, Wood Mackenzie relies on proprietary data and calculations that we cannot replicate with available information. We limited our review of Wood Mackenzie's supply-side claims to gathering available evidence from other sources about the production and prices of five major components of offshore wind development: installation; foundation supply; turbine blades; turbine towers; and turbine nacelles. For each component that Wood Mackenzie analyzes, we assessed the supply chain constraints and expected supply and demand mismatches that could delay or decrease the economic viability of offshore wind development. We find that independent, reputable sources generally corroborate the findings of the Wood Mackenzie report, as detailed below.

⁷⁰ Global Offshore Wind Report 2021. 2021. *Global Wind Energy Council*. Accessed at: <https://gwec.net/wp-content/uploads/2021/09/GWEC-offshore-wind-2021-updated-1.pdf>

⁷¹ Global Offshore Wind Report 2022. 2022. *Global Wind Energy Council*. Accessed at: <https://gwec.net/wp-content/uploads/2022/06/GWEC-Global-Offshore-Wind-Report-2022.pdf>

⁷² See REPowerEU. European Commission. May 18, 2022. Accessed at <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A230%3AFIN&qid=1653033742483>.

⁷³ Global Offshore Wind Report 2022. 2022. *World Forum Offshore Wind*. Accessed at: https://wfo-global.org/wp-content/uploads/2023/03/WFO_Global-Offshore-Wind-Report-2022.pdf

⁷⁴ Blackburne, Alex. 2023. Offshore wind supply chain 'not nearly big enough' to keep up with growth. *S&P Global*. Accessed at: <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/offshore-wind-supply-chain-not-even-nearly-big-enough-to-keep-up-with-growth-76177288>.

Wind Installation Vessels

Wood Mackenzie describes two types of wind installation vessels: wind turbine installation vessels (WTIV) and foundation installation vessels (FIV). An independent study commissioned by the Polish Wind Energy Association and conducted by Dutch renewable consulting firm BLIX and Polish renewable consulting firm Horizons forecasts future production of the two types of vessels. The study projects that by 2030, 22 WTIV and 21 FIV will be available, for a total of 43 operational vessels, which is insufficient to meet projected market demand of 35 WTIV and 29 FIV.⁷⁵ Wood Mackenzie makes specific projections for the number of viable WTIV, along with the total number of vessels, but not for FIV. They project that by 2030, there will be approximately 15 operational WTIV, and approximately 28 total vessel years, compared to vessel demand of 38 vessel years. While the nominal values may be different, the relative supply-demand gaps should be comparable between vessel years and vessels. Both studies project that by 2030 the supply of wind installation vessels will be just 65 to 75 percent of demand. We did not identify any sources that contradicted Wood Mackenzie's representations.

Steel Foundations

Most offshore turbine foundations are monopiles, which are primarily made from steel. Analysts expect monopiles will continue to be the most common type of foundation. Wood Mackenzie projects demand for offshore wind primary foundation steel to grow by 261 percent from 800,000 tons in 2023 to 3 million tons in 2030.⁷⁶ A 2022 academic study projected demand for offshore wind primary foundation steel to grow 154 percent from 2020 to 2030, based on the assumptions that monopiles would dominate future offshore wind turbine foundations and that renewable energy would progress to achieve net-zero carbon emissions by 2070.⁷⁷ These findings are of similar magnitude to Wood Mackenzie's calculations of potential demand. We were unable, however, to corroborate Wood Mackenzie's projections for offshore wind primary foundation steel supply, which estimate that 29 percent of steel demand will not be met by 2029.⁷⁸ We did not identify any sources that contradicted Wood Mackenzie's representations.

Turbine Blades

As wind turbine blade size increases, rated power increases. The Netherlands Organization for Applied Scientific Research projected linear growth of rated power (measured in megawatts) from 2010 to 2030 and a 60 percent increase in rated power from 2020 to 2030 (12.5 MW to 20 MW).⁷⁹ This growth corresponds to increases in turbine blade size from approximately 100 to 125 meters

⁷⁵ Offshore wind vessel availability until 2030: Baltic Sea and Polish perspective. 2022. *H-BLIX*. Accessed at <https://windeurope.org/wp-content/uploads/files/policy/topics/offshore/Offshore-wind-vessel-availability-until-2030-report-june-2022.pdf>

⁷⁶ Ibid

⁷⁷ Li et al. 2022. Future material requirements for global sustainable offshore wind energy development. *Renewable and Sustainable Energy Reviews*, 164. Accessed at: <https://doi.org/10.1016/j.rser.2022.112603>

⁷⁸ Offshore wind supply chain constraints. 2023. *Wood Mackenzie*.

⁷⁹ The Blade of the Future: Wind Turbine Blades in 2040. 2022. *Netherlands Organization for Applied Scientific Research*. Accessed at: <https://repository.tno.nl//islandora/object/uuid:dd0af2a2-0e65-4e65-9b5c-fcecb624d80>

over the same period. Wood Mackenzie does not project linear growth of rated power from 2010 to 2030 and instead projects a higher rate of growth beginning in 2022, with a 145 percent increase in MW generation from 2020 to 2030.⁸⁰ Over the same period Wood Mackenzie estimates that turbine blades will increase by 62 percent from approximately 80 to 125 meters. To facilitate future blade growth, manufacturing facilities will need to make significant investments expanding facility size both in length, to fit longer blades, and in height, to lift the blades from their molds after adhesives cure, according to the Netherlands Organization for Applied Scientific Research.⁸¹ For example, in 2022, Siemens Gamesa spent more than \$233 million at one facility to expand manufacturing capacity in expectation of new 108 meter blades.⁸² Wood Mackenzie estimates \$3.4 billion in investments will be necessary to meet global demand for blades by 2023, but we could not independently verify their calculations or quantify a gap between global supply and demand for turbine blades. We did not identify any sources that contradicted Wood Mackenzie's representations.

Turbine Towers

Wood Mackenzie and Rystad Energy produced similar projections of offshore wind turbine towers. Rystad Energy, an independent energy research and business intelligence company, projects tower supply to remain constant after 2025,⁸³ while Wood Mackenzie projects the constant supply after 2026.⁸⁴ Both firms project a rapid increase in demand for towers beginning in 2023, with Wood Mackenzie projecting peak demand in 2029 and Rystad in 2031. Rystad projects demand to overtake supply in 2028, while Wood Mackenzie projects this will occur in 2027. Note, however, that Rystad Energy's forecasts are specific to the European market, while Wood Mackenzie's consider the global market excluding China. We did not identify any sources that contradicted Wood Mackenzie's representations.

Nacelles

In its assessment of five key markets of offshore wind components, Wood Mackenzie identified nacelles as the component with the fewest supply-demand concerns. Strong scaling factors, combined with vertical integration of components, leave nacelles less exposed to supply-side disruptions. In its analysis, Wood Mackenzie excludes the Chinese market, which, according to the U.S International Trade Commission, became a major exporter of Wind Turbine Nacelles during

⁸⁰ Offshore wind supply chain constraints. 2023. *Wood Mackenzie*.

⁸¹ The Blade of the Future: Wind Turbine Blades in 2040. 2022. *Netherlands Organization for Applied Scientific Research*. Accessed at: <https://repository.tno.nl/islandora/object/uuid:dd0af2a2-0e65-4e65-9b5c-fcecb624d80>

⁸² Maslin, Elaine. 2022. Storage Space a Challenge for Offshore Wind Turbine Manufacturers. *Offshore Engineer*. Accessed at: <https://www.oedigital.com/news/497042-storage-space-a-challenge-for-offshore-wind-turbine-manufacturers>

⁸³ Shortage looming as Europe's demand for offshore wind towers to surpass manufacturing capacity by 2028. 2023. *Rystad Energy*. Accessed at: <https://www.rystadenergy.com/news/shortage-looming-as-europe-s-demand-for-offshore-wind-towers-in-europe-to-surpass>

⁸⁴ Offshore wind supply chain constraints. 2023. *Wood Mackenzie*.

2011-2020.⁸⁵ According to the GWEC, in 2021 China produced between 60 and 65 percent of global turbine nacelle output, including key components like gearboxes and generators.⁸⁶ Including Chinese exports would reinforce the claim that nacelles are not subject to the same supply chain constraints as other offshore wind components.

Our efforts to independently research supply and demand gaps for offshore wind turbine components generally corroborate Wood Mackenzie's findings. Independent studies agree that wind installation vessels, turbine blades, and turbine towers face significant future supply chain constraints, though we could not quantify the supply and demand gap of turbine blades. Academic research supports Wood Mackenzie's projections for steel foundation demand, but we could not verify the projections for supply due to limited data availability. Unlike the other components evaluated in this section, nacelle production is set to meet global demand. We did not identify any sources that contradicted Wood Mackenzie's representations.

NREL CAPEX Forecasts

NREL's forecasts of offshore wind CAPEX should be considered against the supply chain constraints described above. The 2023 ATB does not account for the supply and demand imbalances in global offshore wind markets that have worsened through August 2023. Individual offshore wind project costs will vary depending on procurement timelines, which in turn depend on how supply chain dynamics evolve over the next few years.

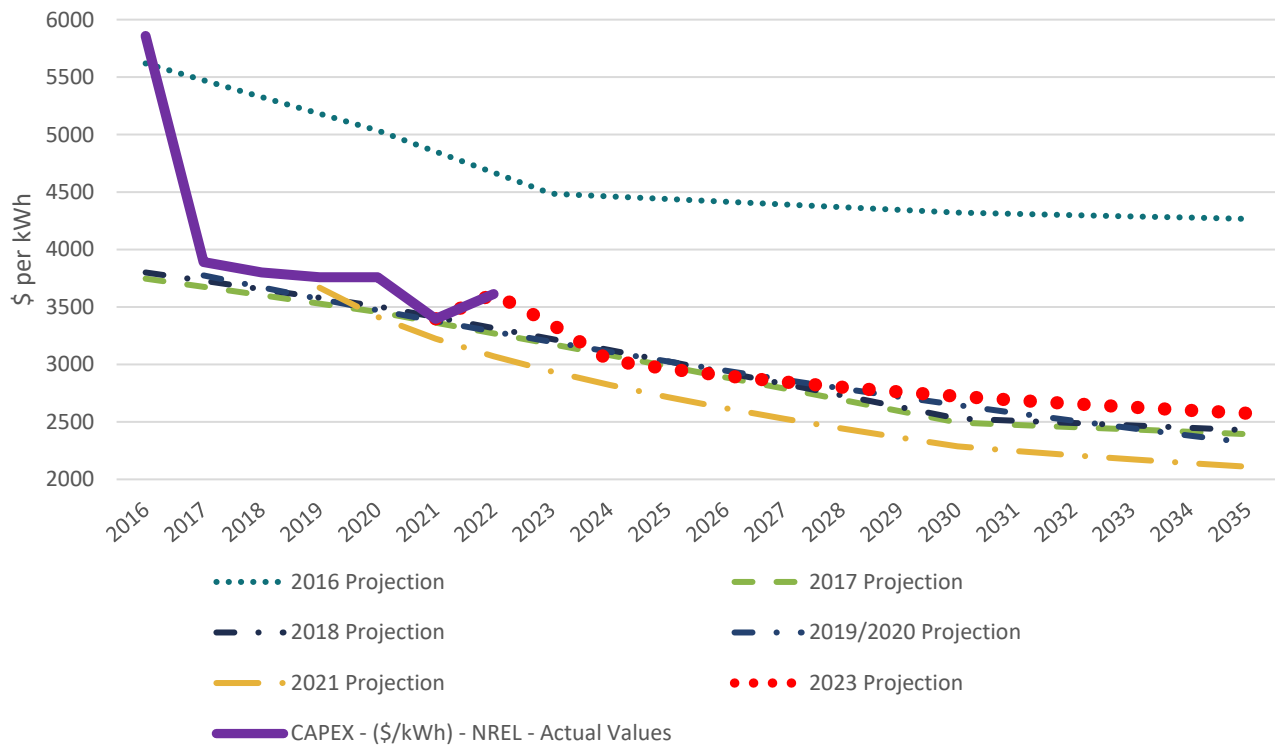
Figure 3-10 charts actual CAPEX for offshore wind projects between 2016 and 2022 in addition to NREL's annual CAPEX forecasts released between 2016 and 2023.⁸⁷ The scenario utilized in these forecasts relies on the same standard used in the onshore wind section, 'TRG 1'. The graph illustrates a progressive reduction in CAPEX over time, driven by advancements in the offshore wind sector and the growing efficiencies in turbine installation, infrastructure development, and operations management.

⁸⁵ David, Andrew. 2021. China Emerges as a Major Exporter of Wind Turbine Nacelles. *U.S. International Trade Commission*. Accessed at: https://www.usitc.gov/publications/332/executive_briefings/ebot_wind_turbine_nacelles.pdf

⁸⁶ Global Offshore Wind Report 2022. 2022. *Global Wind Energy Council*. Accessed at: HYPERLINK "https://gwec.net/wp-content/uploads/2022/06/GWEC-Global-Offshore-Wind-Report-2022.pdf" <https://gwec.net/wp-content/uploads/2022/06/GWEC-Global-Offshore-Wind-Report-2022.pdf>

⁸⁷ NREL's analysis accounts for high-cost components including hardware, labor, permitting, insurance costs, and the impact of interest rates on construction costs.

Figure 3-10. Actual and Forecasted CAPEX for Offshore Wind Projects, Annual Averages (2016-2035)



Source: National Renewable Energy Laboratory. Annual Technology Baseline Reports.

Relative to solar PV and onshore wind projects, realized values of offshore wind CAPEX exhibited the most significant and sustained decrease following 2016 forecasts, with a modest uptick between 2021 and 2022. Relatedly, post-2016 forecasts all show a much lower CAPEX trajectory than the 2016 baseline, which suggests that post-COVID economic turbulence has not impacted the financial prospects for the offshore wind industry as much as it has impacted solar PV and onshore wind projects.

At the same time, recent reporting and industry analysts suggest that NREL's modelling approach yields optimistic forecasts that do not conform to reality in the case of offshore wind development. Offshore wind project setbacks and supply chain constraints are global, consistent with Wood Mackenzie's position. The Wall Street Journal reported in August 2023 that at least ten offshore wind projects totaling around \$33 billion in planned spending have been delayed or cancelled across the U.S. and Europe.⁸⁸ In addition, The New York Times detailed the setbacks facing Vattenfall, an energy company owned by the Swedish government, and its offshore wind complex off the east coast of England. In July 2023, Vattenfall halted the first of three phases of the project's development, citing escalating costs of equipment and construction expenses that have risen by as

⁸⁸ Hiller, Jennifer and Novik, Mari. 2023. Wind Industry in Criss as Problems Mount. *The Wall Street Journal*. Accessed at: <https://www.wsj.com/articles/wind-industry-hits-rough-seas-as-problems-mount-5490403a?page=1>.

much as 40 percent over the past year. The company's head of business area wind stated: "With the new market conditions, it simply does not make sense to continue the project."⁸⁹

Referencing offshore wind capacity targets of approximately 150 GW by 2030 set by European countries and the U.S., Sven Utermöhlen, offshore wind CEO at RWE Renewables GmbH, stated: "The size of the supply chain is simply not big enough to deliver [on those targets]...Not even nearly big enough".⁹⁰ According to S&P Global Market Intelligence, bottlenecks are evident across the entire supply chain, including turbines, vessels and foundations. Growing demand and project delays in the U.S. threaten to prolong supply chain constraints to the end of the decade, according to Jeff Andreini, vice president of marine operations at Crowley Maritime Corp., a marine logistics firm. "If you move everything to the right and all the projects happen in [2029 and 2030] ... now your [supply chain] capacity shrinks," Andreini said. "That's going to create huge bottlenecks" and will require some kind of "stimulus" to prompt investments in the supply chain.⁹¹

3.2.5 Commodity Prices

We supplemented our review of solar PV, onshore wind, and offshore wind CAPEX forecasts with available forecasts of commodities used as inputs in these projects. Commodity prices are volatile and difficult to predict, so forecasts (or futures contracts) are typically limited to a few years. We discuss price forecasts for aluminum, copper, diesel, steel, and iron ore between 2023 and 2026, drawing from reputable sources such as Fitch Ratings (Fitch), the U.S. Energy Information Administration (EIA) and the World Bank. We did not find price forecasts for polysilicon, cement, and concrete products.

Figure 3-11 illustrates actual and forecasted prices of aluminum, copper, diesel, steel, and iron ore between 2016 and 2026. Note that values shown between 2016-2022 represent actual indexed prices while values for 2023-2026 represent forecasted prices. The prices of copper, steel, and iron ore peaked in 2021. Fitch and the World Bank project that copper prices will remain elevated due to strong demand for the metal in advancing the clean energy transition, while demand and prices for steel and iron ore are expected to drop to 2018 levels mainly because China plans to curb its steel production to reduce pollution.^{92,93} Aluminum prices are expected to persist close to 2021

⁸⁹ Penn, Ivan and Reed, Stanley. 2023. Offshore Wind Runs Into Rising Costs and Delays. *The New York Times*. Accessed at: <https://www.nytimes.com/2023/08/07/business/offshore-wind-costs-delays.html>.

⁹⁰ Blackburne, Alex. 2023. Offshore wind supply chain 'not nearly big enough' to keep up with growth. *S&P Global*. Accessed at: <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/offshore-wind-supply-chain-not-even-nearly-big-enough-to-keep-up-with-growth-76177288>.

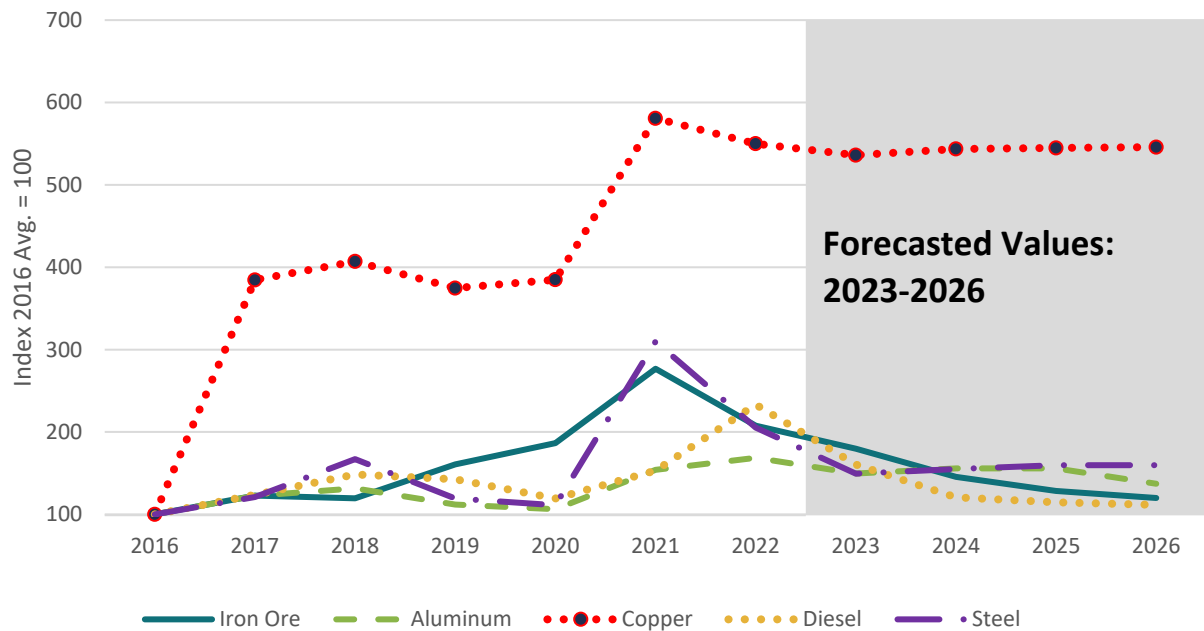
⁹¹ Ibid.

⁹² Fitch Ratings Updates Global Metals and Mining Price Assumptions. 2023. *Fitch Ratings*. Accessed at: <https://www.fitchratings.com/research/corporate-finance/fitch-ratings-updates-global-metals-mining-price-assumptions-21-06-2023>.

⁹³ Commodity Markets Outlook. 2023. *World Bank*. Accessed at: <https://openknowledge.worldbank.org/server/api/core/bitstreams/6864d537-d407-4cab-8ef1-868dbf7e07e2/content>.

levels, supported by demand for the metal as a replacement for copper in some applications.⁹⁴ Relative to the price spikes throughout most of 2022, the EIA projects that diesel prices will continue their downward trend between 2023 and 2026, driven by lower demand growth for diesel combined with high refinery utilization (supply) in the U.S.⁹⁵

Figure 3-11. Actual vs Forecasted Prices of Commodities (Annual Averages)



Note: Index values based on the prices of aluminum (USD/ton, global price), copper (USD/metric ton, global price), U.S. domestic steel hot rolled coil (USD/metric ton, CME-NYMEX), iron ore (USD/dry metric ton), and New York Harbor Low Sulfur No.2 Diesel (USD/gallon).

Sources: Copper, aluminum, and iron ore: International Monetary Fund (historical prices) and Fitch Ratings (forecasted prices); steel: S&P Capital IQ (historical and forecasted prices); No. 2 Diesel: U.S. Energy Information Administration (historical prices and forecasted prices for 2023-2024 and S&P Capital IQ (forecasted prices for 2025-2026).

⁹⁴ Fitch Ratings Updates Global Metals and Mining Price Assumptions. 2023. *Fitch Ratings*. Accessed at: <https://www.fitchratings.com/research/corporate-finance/fitch-ratings-updates-global-metals-mining-price-assumptions-21-06-2023>.

⁹⁵ EIA expects U.S. gasoline and diesel retail prices to decline in 2023 and 2024. 2023. *U.S. Energy Information Administration*. Accessed at: <https://www.eia.gov/todayinenergy/detail.php?id=55179>.

3.3 Interest Rate Forecasts

Interest rates are a key determinant of financing costs for renewable energy generation projects. The Federal Funds Rate is the target interest rate the FOMC sets to influence borrowing conditions in the economy. Lenders use this rate as a benchmark to price the cost of loans they extend for various economic activities, including renewable energy projects. A renewable energy developer's financing costs will increase or decrease together with, and typically remain above (absent subsidies), the Federal Funds Rate.

After two years of near-zero interest rates between March 2020 and March 2022, the FOMC raised interest rates precipitously to a target range of 5.0 to 5.25 percent as of July 26, 2023, the highest level in 22 years. Like inflation, the Federal Funds Rate is expected to moderate after 2023 but remain elevated above pre-2022 levels. Figure 3-12 compares the actual Federal Funds Rate (annual averages) between 2016-2023 and the CBO's projections of the same rate for 2024-2033. The CBO forecasts that the Fed's target interest rate will remain at or above five percent through 2024 and then decrease to 3.9 percent in 2025 and 2.4 percent in 2026.

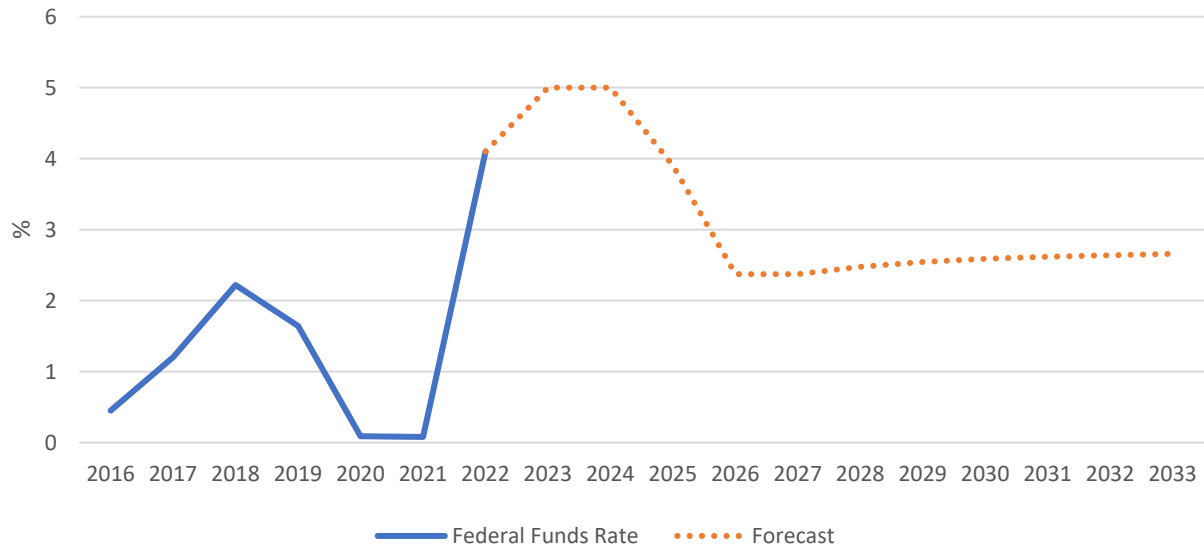
The rate on 10-year U.S. Treasury Notes is another important economic benchmark that influences other interest rates and borrowing costs across the economy. It is also a gauge of general economic sentiment, with rising rates generally signaling confidence in global economic conditions and declining rates indicating caution. As Figure 3-13 shows, the CBO forecasts that interest rates on 10-year Treasuries will increase to 4.0 percent in 2024 before leveling off at 3.7-3.8 percent between 2024 and 2033. Normalized interest rates on 10-year Treasuries reflect increasing optimism regarding the prospects of the U.S. economy lowering inflation without entering a recession.^{96,97} In a July 2023 survey of U.S. businesses, 71 percent of panelists reported that the probability of the U.S. entering a recession in the next 12 months is 50 percent or less.⁹⁸

The forecasts for the Federal Funds Rate and interest rates of 10-year Treasuries indicate that borrowing costs across the U.S. economy will stabilize at levels between the "low for longer" interest rates observed in 2008-2021 and the peak interest rates currently (as of August 2023) in effect. Like the overall price level, however, interest rates have reached a higher plateau compared to what pre-pandemic trends implied. Higher financing costs, if the new normal persists, will increase the overall solar PV, onshore wind, and offshore wind project costs over the next ten years.

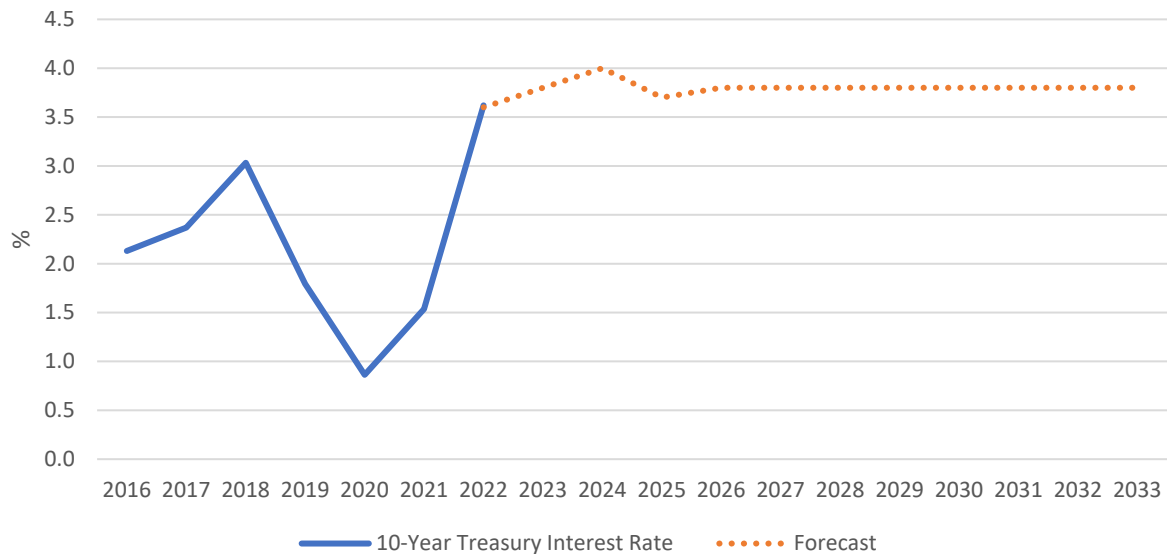
⁹⁶ Sasso, Michael. 2023. US Economy Will Skirt a Recession, Latest CBO Projections Show. *Bloomberg*. Accessed at: <https://www.bloomberg.com/news/articles/2023-07-26/us-economy-will-skirt-a-recession-latest-cbo-projections-show>.

⁹⁷ Gura, David and Horsley, Scott. 2023. *National Public Radio*. <https://www.npr.org/2023/07/24/1189268260/economy-recession-inflation-jobs-interest-rates>.

⁹⁸ Business Conditions Survey. 2023. *National Association for Business Economics*. Accessed at: https://nabe.com/NABE/Surveys/Business_Conditions_Surveys/July-2023-Business-Conditions-Survey-Summary.aspx.

Figure 3-12. Actual and Forecasted Federal Funds Rate, Annual Averages, 2016-2033

Source: U.S. Congressional Budget Office

Figure 3-13. Actual and Forecasted Interest Rates on 10-Year Treasury Notes, Annual Averages, 2016-2033

Source: U.S. Congressional Budget Office

In our view, it would not have been reasonable for developers to assume stability in interest rates at the time of their bids. In contrast to inflation, which the Fed seeks to keep at or near the 2 percent target, interest rates are subject to change due to both market conditions (e.g., based on the outlook for the U.S. economy) and policy changes by the Fed to manage inflation and keep the economy at or near full employment. The four-year period prior to the COVID-19 pandemic

illustrates that interest rates are subject to change over a relatively short period of time (see Figures 3-12 and 3-13). The projected interest rates shown in both figures are also within historical norms. For example, in 2007 both the Federal Funds rate and the 10-year U.S. Treasury rate were as high as the corresponding CBO projections for 2024 in Figures 3-12 and 3-13. Similarly, the rate at which interest rates recently changed is also unprecedented, with historical examples including the sharp decline in the Federal Funds rate between July 2007 and November 2008, the decline between December 2000 and December 2001, and the increase in the Federal Funds rate between July 1980 and December 1980. Because interest rates are driven in part by Fed policy, it would have been appropriate for developers to consider the pace of both interest rate increases and reductions when developing their proposals.

3.4 Conclusion

In this chapter, we showed that the consensus narrative that inflation of goods, services, and labor will moderate, but remain positive, over the next ten years is reasonable. Persistent supply chain constraints are likely to contribute to higher costs in renewable energy sectors and could potentially offset or outweigh the secular downward trend in prices driven by efficiency gains in these sectors. It is uncertain if supply will keep pace with the heightened global demand for clean energy to alleviate the inflationary pressures specific to the solar PV, onshore wind, and offshore wind development. Even optimistic forecasts that do not incorporate these constraints show that solar PV, onshore wind, and offshore wind project costs will remain above pre-2022 levels until at least 2025 and potentially to 2030. Reconciling the economic forecasts that show immediate declines in project CAPEX beginning in 2023 with existing macroeconomic uncertainty and supply-side challenges requires more data and a greater degree of certainty than are available as of this writing.

CHAPTER 4 | Survey of Renewable Energy Inflationary Pressures and Relief Requests in Other Jurisdictions

To provide context for the petitions that New York received in June 2023 for inflationary relief requests for a broad portfolio of clean energy projects, this chapter summarizes inflationary relief requests for clean energy projects in jurisdictions outside of New York State and the outcomes of these requests. The jurisdictions examined include New Jersey, Massachusetts, California, Hawaii, New Mexico, Maine, Indiana, and Michigan. For each of these jurisdictions, we include a summary of the inflationary relief sought, the approximate cost of the relief (where available), and key decisions made by the relevant authorities in each jurisdiction. Table 4-1 summarizes each of the projects discussed below.

While circumstances differ across the various requests, the key conclusions that we draw from our review are as follows:

- ***Requests for inflationary relief are not unique to New York:*** Requests for inflationary relief on clean energy projects have been submitted in several jurisdictions across the U.S. for a variety of clean energy technologies. Thus, New York's receipt of inflationary relief petitions from project developers is unlikely to reflect any characteristics specific to the State's clean energy programs but instead is consistent with contemporaneous requests in other jurisdictions.
- ***Processes and outcomes vary across jurisdictions:*** The requests for relief and subsequent responses of state governing bodies do not follow a consistent pattern across jurisdictions. For example, petitions were approved in some jurisdictions and rejected in others. Similarly, in some jurisdictions the state legislature intervened to provide relief through legislation, while legislatures in other jurisdictions took no action. Factors such as deadlines for reaching renewable energy targets, the amount of relief requested, the flexibility that State decision-making authorities had to change contract terms, and the willingness of these decision-making bodies to let projects be withdrawn played a role in the outcomes seen across jurisdictions.
- ***In some cases projects have been withdrawn:*** Although outcomes for inflationary relief have varied across projects and jurisdictions, some projects have been withdrawn. This confirms that inflationary pressures, at least in some cases, have adversely affected the economic viability of projects.

Table 4-1. Summary of Projects Seeking Inflationary Relief Across Jurisdictions

Jurisdiction	Project Name(s)	Technology	Capacity	Outcome
Massachusetts	Commonwealth Wind Farm	Offshore wind	1.2 GW	Relief not granted; project terminated
Massachusetts	New England Clean Energy Connect	Hydropower transmission	1.2 GW	Relief pending
New Jersey	Ocean Wind 1	Offshore wind	1.1 GW	Relief granted; project proceeding
California	Canyon Country Beaumont Inland Empire Nighthawk Storage	Storage	80 MW 100 MW 50 MW 300 MW	Relief granted; projects proceeding
California	Big Beau Solar	Solar & Storage	128 MW / 40 MWh(storage)	Relief not granted; project terminated
Hawaii	Pulehu Solar Mahi Solar Kama'ole Solar Puako Solar	Solar & Storage Solar & Storage Solar & Storage	40 MW/160 MWh 120 MW/480MWh 40 MW/160 MWh 60 MW/240 MWh	Relief granted; project terminated Relief granted; project terminated Project abandoned prior to PPA
New Mexico	San Juan Solar	Solar & Storage	200MW/100MW	Relief granted; project proceeding
Maine	Eddington Solar Church Hill Solar	Solar	20 MW 20 MW	Relief not granted; project pending
Indiana	Green River Solar	Solar	200 MW	Relief granted; project proceeding
Michigan	Calhoun Solar Cereal City Solar Jackson County Solar	Solar	200MW 100MW 125MW	Relief granted; project proceeding

While this report focuses on the projects identified in Table 4-1, inflationary pressure is widespread across the clean energy industry, threatening the economic viability of many projects across the U.S. For example, in addition to the projects listed above, Atlantic Shores Offshore Wind has conveyed concerns about inflation and supply chain shortages to New Jersey's Board of Public Utilities.⁹⁹ Similarly, Southcoast Wind's (formerly Mayflower Wind) CEO gave testimony to the Rhode Island Public Utilities Commission expressing interest in terminating contracts for two projects in Rhode Island and Massachusetts due to inflation uncertainty.¹⁰⁰

⁹⁹ Comments of Atlantic Shores Offshore Wind. N.J. Bureau of Public Utilities. Docket No. QO22080481. https://publicaccess.bpu.state.nj.us/DocumentHandler.ashx?document_id=1278384

¹⁰⁰ Direct Testimony of Mr. Francis Slingsby. R.I. Public Utilities Commission. Docket No. SB-2022-02. https://ripuc.ri.gov/sites/g/files/xkqbur841/files/2023-06/Pre-FiledDirectTestimony_Francis_Slingsby-6-2-2023-REDACTED.pdf

4.1 Massachusetts

Massachusetts has committed to soliciting proposals for 5.6 GW of offshore wind capacity by mid-2027.¹⁰¹ Prior to setting this target in May 2022, the Commonwealth's target was 4.0 GW of offshore wind by 2027. The current Clean Energy and Climate Plan sets a goal to achieve 97 percent renewable energy by 2050.¹⁰² However, there is currently a proposed bill in the Massachusetts state legislature which would change the goal to achieve 100 percent renewable energy by 2030.¹⁰³

4.1.1 Commonwealth Wind Farm

Commonwealth Wind LLC (subsidiary of Avangrid) contracted with Massachusetts electric companies to build a 1,200 MW wind project off the coast of Martha's Vineyard (or 21 percent of Massachusetts' target of 5.6 GW by mid-2027). In April 2022, the company entered into Power Purchase Agreements (PPAs) with three major electric utilities—Eversource, National Grid, and Unitil—over a term of 20 years. In October 2022 (six months after signing the PPAs), Commonwealth Wind petitioned the Massachusetts Department of Public Utilities (DPU) for a one-month suspension in proceedings for the developer and the utilities to negotiate price relief due to price increases, supply shortages, and rising interest rates.¹⁰⁴ This time was requested to revise contracts to include cost saving measures, tax incentives, increase in PPA prices, and/or other project efficiency measures. Commonwealth Wind also cited the Inflation Reduction Act's passage in August 2022 as potentially affecting the availability of tax credits for Commonwealth Wind.

DPU denied Commonwealth Wind's request, stating that the company should have anticipated these price changes when negotiating its PPAs during the spring of 2022. However, the original request for proposals (RFP) from the utilities included a clause that placed a price cap on the maximum price that Commonwealth Wind could propose.¹⁰⁵ Due to this clause, Commonwealth Wind subsequently moved to terminate the PPAs on the grounds that the project was no longer economically viable as further negotiations would not yield a price high enough to ease inflationary pressures.¹⁰⁶ DPU rejected the motion, barring the company from terminating the contracts without penalty. Commonwealth Wind and the three utility companies negotiated termination amendments to the PPAs which were then approved by DPU. Pursuant to the terms of the

¹⁰¹ Offshore Wind Update. 2022. *Massachusetts Executive Office of Energy and Environmental Affairs*. <https://www.mass.gov/news/offshore-wind-update-2022-q1-and-q2>. Also see An Act Driving Clean Energy and Offshore Wind, The 193rd General Court of the Commonwealth of Massachusetts, <https://malegislature.gov/Laws/SessionLaws/Acts/2022/Chapter179>

¹⁰² Clean Energy and Climate Plan for 2050. 2022. *Massachusetts Executive Office of Energy and Environmental Affairs*. <https://www.mass.gov/doc/2050-clean-energy-and-climate-plan/download>

¹⁰³ H.3689, 193rd General Ct. (Mass. 2023). <https://malegislature.gov/Bills/193/HD3348.pdf>

¹⁰⁴ Commonwealth Wind, LLC's Motion For a One-Month Suspension of Proceedings. Massachusetts Department of Public Utilities. D.P.U. 22-70/22-71/22-72. <https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/15660345>

¹⁰⁵ Joint Petition for Approval of Timetable and Method for Solicitation of Long-Term Contracts for Offshore Wind Energy Generation. Mass. Dept. of Public Utilities. D.P.U. 21-40. <https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/13243970>

¹⁰⁶ Motion to Dismiss of Commonwealth Wind, LLC. Mass. Dept. of Public Utilities. D.P.U. 22-70/22-71/22-72. <https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/16729236>

amended PPAs between Commonwealth Wind and the utilities, the company is required to pay out penalties for termination: \$25.9 million to Eversource, \$21.6 million to National Grid, and \$480,000 to Unitil.

4.1.2 New England Clean Energy Connect

New England Clean Energy Connect is a \$1 billion transmission line from Canada through Maine into the rest of New England which will transport up to 1,200 MW of hydroelectric power. After some initial construction in Maine, there was a multiyear litigation which resulted in the project being halted. In the fall of 2021, Maine voters passed a referendum prohibiting high impact transmission lines in the Kennebec River Valley. However, Avangrid and Hydro-Quebec (the Canadian hydropower generator) went to court for exemption from the rule, on the grounds that the developers had secured permits and begun construction prior to its passing. The case was heard by the Maine Supreme Court, which ruled that the developers had the right to continue with their project. This ruling was issued in August 2022, a year after construction had halted, and construction is set to resume early August 2023.

Given the litigation costs and inflation over the last two years, Avangrid approached the Massachusetts state legislature to seek out price relief to make up for losses from the litigation and inflation. These losses total approximately \$500 million or 50 percent of the original project cost. Massachusetts legislators were receptive to the proposal, as this transmission line is crucial to achieve the fast-approaching clean energy goals they have set out. A spending bill with a provision which would allow for renegotiations between the developers and utility companies passed the House on July 13, 2023.¹⁰⁷ The provision allows for renegotiations such that the developers' losses from the delay can be recuperated from Massachusetts ratepayers. The bill is pending approval from the MA Senate before proceeding to renegotiations.

4.2 New Jersey

The New Jersey Clean Energy Act of 2023, which was enacted in February 2023, issued a goal to achieve 100 percent clean energy by 2035.¹⁰⁸ This is an accelerated timeline from the 2019 Executive Order 28, which sought 50 percent clean energy by 2030 and 100 percent by 2050.¹⁰⁹ In 2022, Governor Phil Murphy signed Executive Order 307, which increased the NJ offshore wind capacity goal to 11GW by 2040.¹¹⁰ In addition, New Jersey's Solar Act of 2021 directed the Board of Public Utilities to double the growth of the State's existing solar program, incentivizing up to 3,750 MW of new solar by 2026.

4.2.1 Ocean Wind 1

Ørsted is contracted with the State to start development on a 1.1 GW offshore wind project, Ocean Wind 1, off the coast of Atlantic City. This project makes up about 10 percent of the State offshore

¹⁰⁷ H.3982, 193rd General Ct. (Mass. 2023). <https://malegislature.gov/Bills/193/H3982.pdf>

¹⁰⁸ S2978, 220th Legislature, 2022-2023 Sess. (N.J. 2023). https://pub.njleg.state.nj.us/Bills/2022/S3000/2978_11.PDF

¹⁰⁹ EO28, Gov. Phil Murphy (N.J. 2019). <https://nj.gov/infobank/eo/056murphy/pdf/EO-28.pdf>

¹¹⁰ EO307, Gov. Phil Murphy (N.J. 2022). <https://nj.gov/infobank/eo/056murphy/pdf/EO-307.pdf>

wind solicitation goal for 2040. After gaining the necessary approvals, Ørsted was set to begin construction on Ocean Wind 1 in the fall of 2023. Rampant inflation, supply chain delays, war in Europe, and the COVID-19 pandemic created widely reported cost issues for Ørsted, prompting the state legislature to provide financial relief for Ørsted to proceed with development.¹¹¹ New Jersey governor Phil Murphy was a proponent of passing a bill with inflationary relief for Ørsted to keep the offshore wind facility in New Jersey rather than pushing the developer to another jurisdiction.

On July 6, 2023, Bill A5651 was signed into law, granting a tax credit to developers.¹¹² In order to qualify, offshore wind developers must have contracts approved prior to July 1, 2019. Specifically, this bill allows qualified developers to retain certain federal tax benefits that would typically be required to be passed to ratepayers. The bill also requires developers to submit a \$200 million performance security, which will be invested into the project on a schedule prescribed by the state, as well as a \$100 million security for the completion of the project. This is estimated to be a \$1 billion tax break.

While the bill was written for any “qualified wind project”, the criteria qualify Ørsted’s projects but not any other projects currently under development in New Jersey. This spurred other developers such as Atlantic Shores to seek similar concessions, but as of yet none have been granted.¹¹³ Additionally, New Jersey residents opposed to the exclusivity of the bill filed a lawsuit on July 28, 2023 against Ørsted and the state, alleging that the bill violates the New Jersey State constitution. The residents’ groups that filed the suit, Protect Our Coast NJ and Defend Brigantine Beach, claim that the state cannot enact legislation that benefits only one party. No decisions have been reached yet with respect to the lawsuit.¹¹⁴

4.2.2 Competitive Solar Incentive Program

Pursuant to the Solar Act of 2021, New Jersey’s BPU established the grid-scale (projects exceeding 5 MW of capacity) Competitive Solar Incentive (CSI) program with a goal of developing 300 MW of capacity per year. The CSI Program represents a key element for New Jersey’s goals of 5.2 GW of solar by 2025, 12.2 GW by 2030, and 17.2 GW by 2035, culminating in New Jersey’s path to 100 percent clean energy by 2050.¹¹⁵ The CSI is part of the state’s latest solar incentive program, the Successor Solar Incentive (“SuSI”) Program, the goal of which is to “increase(s) the supply of

¹¹¹ New Jersey lawmakers eye tax break for offshore wind developer Orsted. 2023. *AP News*. <https://apnews.com/article/offshore-wind-tax-credit-orsted-new-jersey-619b3e90678a8430155dae09f63dcd0c>. See also: <https://www.njspotlightnews.org/2023/06/orsted-offshore-wind-company-advances-to-big-tax-win-in-nj/>

¹¹² A5651, 220th Legislature, 2022-2023 Sess. (N.J. 2023). https://pub.njleg.state.nj.us/Bills/2022/A6000/5651_R2.PDF

¹¹³ New Jersey’s other wind farm developer wants government breaks, too; says project ‘at risk’. *AP News*. <https://apnews.com/article/offshore-wind-atlantic-shores-tax-break-4a431a49ec2fc7e5f7956e7ac63a8656>

¹¹⁴ New Jersey residents challenge Orsted offshore wind farm’s \$1 billion subsidy. 2023. *Reuters*. <https://www.reuters.com/legal/government/new-jersey-residents-challenge-orsted-offshore-wind-farms-1-billion-subsidy-2023-07-28/>

¹¹⁵ State of New Jersey, Board of Public Utilities, Clean Energy, Order Launching the CSI Program, Docket No. QO21101186, December 7, 2022.

electricity that New Jersey consumers receive from clean solar energy while simultaneously bringing down the costs of solar generation in the State”.¹¹⁶

The first CSI Program solicitation launched on February 1, 2023, and bids were due by March 31, 2023. While the BPU noted that it received a “vigorous response” from developers with “submissions totaling over 300 MW of solar generation”, on July 12, 2023, the BPU announced it rejected the first round of bids as too expensive, noting that all the “responsive bids were in excess of the pre-determined price caps put in place by the Board to protect ratepayers from excessive costs.”¹¹⁷ The BPU’s order identified a number of contributing factors to explain why bids were higher than expected, including high inflation, uncertainty regarding tariffs on solar panels manufactured in Southeast Asia, and Congressional pushback on the Inflation Reduction Act of 2022, which includes tax breaks designed to promote clean energy development.

The BPU also directed Board Staff to conduct an analysis of price caps for future solicitation rounds and to open another CSI solicitation window. Thus, while the increase in costs may have delayed some projects, New Jersey plans to refine its implementation of the CSI Program and proceed with the development of additional grid-scale solar capacity.

4.3 California

In September of 2022, California legislators passed The Clean Energy, Jobs, and Affordability Act, which sets goals for 90 percent clean energy by 2035 and 100 percent by 2045.¹¹⁸ The California Public Utilities Commission (PUC) issued a mandate in 2021 requiring power providers to acquire 11.5 GW of clean energy capacity by 2026.¹¹⁹ An integrated resource plan set forth by the PUC in 2023 extends this further, adding an additional 4 GW to the 11.5 GW goal set in 2021 and expansions of each type of renewable energy resource by 2035. Notably, solar energy and battery storage had the largest expansion goals of 3.9 GW and 2.8 GW, respectively.¹²⁰

4.3.1 Pacific Gas & Electric: Lithium-Ion Battery Storage

In September 2022, Pacific Gas & Electric (PG&E) filed a request to amend energy storage contracts to bolster grid reliability.¹²¹ The amended contracts are 15-year term agreements for four energy storage projects: Canyon Country, Beaumont, Inland Empire, and Nighthawk Storage. The

¹¹⁶ State of New Jersey, Board of Public Utilities, In the Matter of the Competitive Solar Incentive (“CSI”) Program Pursuant to P.L. 2021, c. 169, Order on the Outcome of the 2023 CSI Program Solicitation, July 12, 2023.

¹¹⁷ *Ibid.*

¹¹⁸ SB1020, Cal. Legislature, 2021-2022 Sess. (Cal. 2022).
https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB1020

¹¹⁹ Decision Requiring Procurement To Address Mid-Term Reliability (2023-2026). Cal. P.U.C.
<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M389/K155/389155856.PDF>

¹²⁰ Decision Ordering Supplemental Mid-Term Reliability Procurement (2026-2027). Cal. P.U.C.
<https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M502/K537/502537593.pdf>

¹²¹ Pacific Gas & Electric Company Status of Advice Letter 6711E. Cal. P.U.C.
https://www.pge.com/tariffs/assets/pdf/adviceletter/ELEC_6711-E.pdf

amended contracts increased prices, reduced one contract's storage capacity, and delayed the operational deadline for the four projects. The adjusted storage capacities are 80MW for Canyon Country, 100 MW for Beaumont, 50 MW for Inland Empire (reduced from 100MW), and 300MW for Nighthawk Storage—or 530 MW across all four projects. This makes up about 19 percent of the State's energy storage expansion goal for 2035. These storage facilities were contracted to enable renewable energy to replace a nuclear plant that was planned to retire by 2025. Due to the amended contracts pushing back these projects from summer 2023 to June 2024, the plant retirement has also been delayed until 2030.¹²² The adjusted prices are confidential, but PG&E cited inflationary pressures as the reason for the contract amendments. In December 2022, the California Public Utilities Commission (PUC) approved the amended contracts.

4.3.2 Big Beau Solar and Storage Contracts

As discussed above, California PUC issued a mandate in July 2021 requiring power providers to acquire 11.5 GW of capacity from clean energy by 2026. This required energy providers to quickly gather clean energy inputs and storage capacity under the continued stress of pandemic inflation and supply shortages. Among these providers was Central Coast Community Energy (3CE), which had several developers raise concerns about rising costs for clean energy generation. Among those was Big Beau Solar, which had signed a 20-year contract with 3CE and Silicon Valley Clean Energy (SVCE) in October 2018. This PPA included a predetermined price for a solar project and a battery storage project. However, in March 2022, Big Beau requested an increase of \$77 million, or 233 percent, on the rates for the battery storage contract. The developer and energy providers were unable to come to a settlement, leading them to terminate their contracts. This prompted 3CE and SVCE to sue Big Beau for renegeing their contract; the litigation is ongoing.

4.4 Hawaii

The Hawaii Clean Energy Initiative was enacted in 2008 to promote local, clean energy production in Hawaii and was expanded in 2014 to include a goal of 100 percent renewable energy by 2045.¹²³ Since then, Hawaii has been steadily expanding its solar capacity.

4.4.1 Pulehu and Mahi Solar

Longroad Energy won contracts in 2020 to build two major solar projects, Pulehu Solar, a 40MW solar and 160MWh battery system on Maui, and Mahi Solar, a 120MW solar and 480MWh battery system on Oahu. Development was underway shortly after, but rising costs due to the COVID-19 pandemic and tightness in global supply chains threatened the construction and completion of the projects. Longroad Energy requested a 19 percent price increase in its PPA with Maui Electric Company from the Hawaii PUC in February 2022.¹²⁴ PUC initially denied this request in a decision issued in March 2022. Following the decision, Longroad Energy submitted an appeal for

¹²² California moves to up PG&E energy storage contract prices amid 'unprecedented' market conditions. 2022. *Utility Dive*. <https://www.utilitydive.com/news/california-moves-to-up-pge-energy-storage-contract-prices-amid-unpreceден/637584/>

¹²³ Hawai'i Clean Energy Initiative. *Hawai'i State Energy Office*. <https://energy.hawaii.gov/hawaii-clean-energy-initiative/>

¹²⁴ Letter For Approval of a First Amendment to Power Purchase Agreement. Hawai'i P.U.C. Docket No. 2020-0141 <https://shareus11.springcm.com/Public/Document/25256/af512b7f-7f0d-ee11-b83b-48df377ef808/d9928edc-680e-ee11-b83b-48df377ef808>.

reconsideration but ultimately terminated the PPA for the solar facilities in May 2022. Within a few days of Longroad’s PPA termination, the PUC approved the appeal to increase the price and continue with development and construction of the projects¹²⁵. Despite this, Longroad Energy was unable to proceed with completion of the projects and chose to continue with dissolving the PPA. The company has stated that it plans to rebid the projects in the future but has not yet done so as of July 2023.

4.4.2 Kama’ole Solar

In April 2021, the Hawaii PUC approved a PPA between the Maui Electric Company and Kamaole Solar LLC for the proposed Kama’ole solar project, which would include a 40 MW solar facility and 160 MWh of lithium-ion battery storage. Under the terms of the PPA, Maui Electric would purchase electricity from Kamaole at a price of \$81.50 per MWh.¹²⁶ In October 2022, Maui Electric requested that the PUC approve an amendment to the PPA agreement, increasing the unit price to \$132.52 per MWh, an increase of approximately 66 percent, and delaying the project’s operational date by 20 months from April 30, 2023 to December 31, 2024.¹²⁷ In its submission to the PUC, Maui Electric stated that it would not typically entertain such a proposal under normal conditions but noted exceptionally unique circumstances that had driven up project costs. Such circumstances include limited availability of engineering, procurement, and construction contractors in an environment of heightened market activity and supply chain disruptions associated with both the COVID-19 pandemic and Russia’s invasion of Ukraine.

In December 2022, the PUC approved Maui Electric’s proposed changes to the PPA, noting that it was unclear whether a new competitive procurement would yield a significantly lower unit price given current market uncertainties.¹²⁸ Even with this price adjustment, however, Kamaole withdrew from the PPA on March 10, 2023. In its withdrawal letter, Kamaole explained that “[t]he Project has been subject to continued rising costs and interest rates since the amended Unit Price was established in July 2022. The combined impact of these factors started to crystallize in late November, just prior to the December 2, 2022, conditional approval of the First Amendment to the PPA by the PUC, and became fully understood in early December 2022. For reference, between July 2022 and December 2022, the Project saw costs continue to rise by approximately \$10 million

¹²⁵ Granting Mecos Motion for Reconsideration. Hawai’i P.U.C. Docket No. 2020-0141 <https://shareus11.springcm.com/Public/Document/25256/bf583479-7f0d-ee11-b83b-48df377ef808/655d0ac2-4f0e-ee11-b83b-48df377ef808>.

¹²⁶ Hawai’i Public Utilities Commission, Order No. 37742 Approving The Proposed Stipulated Procedural Schedule. April 21, 2021. Hawai’i PUC Docket No. 2021-0026 in the matter of the application of Maui Electric Company For Approval of Power Purchase Agreement for Renewable Dispatchable Generation with Kamaole Solar LLC. <https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A21D21B60445J00502>

¹²⁷ Letter from Maui Electric Company to the Hawai’i Public Utilities Commission, For Approval of a First Amendment to Amended and Restated Power Purchase Agreement for Renewable Dispatchable Generation with Kamaole Solar LLC. October 21, 2022. Hawai’i PUC Docket No. 2021-0026. <https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A22J24B03551F02534>

¹²⁸ Hawai’i Public Utilities Commission, Order No. 38742 Conditionally Approving Maui Electric’s Proposed PPA Amendment. December 2, 2022. Hawai’i PUC Docket No. 2021-0026 in the matter of the application of Maui Electric Company For Approval of Power Purchase Agreement for Renewable Dispatchable Generation with Kamaole Solar LLC.

(assuming full use of contingency). Similarly, interest rates rose by one percent.”¹²⁹ The developers of Kamaole Solar attempted to find a buyer for the project, but there was limited interest, and no viable offers were received. As of this writing, the project is not moving forward.

4.4.3 Puako Solar

In May 2020, Hawaiian Electric issued an award to ENGIE to develop the Puako solar and storage project that would include 60 MW of solar paired with 240 MWh of battery storage. ENGIE subsequently abandoned the project in October 2021 prior to signing a PPA, citing elevated interconnection costs, global supply chain and production challenges, and ongoing tariffs and trade disputes that are impacting the U.S. solar industry.¹³⁰

4.5 New Mexico

New Mexico’s 2019 Energy Transition Act directed electric utility companies to transition to at least 50 percent clean energy by 2030.¹³¹ This target has not been updated since 2019.

4.5.1 San Juan Solar

Following the Energy Transition Act’s passage, the Public Service Company of New Mexico (PNM) signed a 20-year PPA and energy storage agreement in 2020 with D.E. Shaw Renewable Investments (DESRI) for the San Juan Solar project, which includes 200 MWAC of solar and 100MWAC of storage. PNM sought to shut down the coal-fired San Juan Generating Station and replace it with a combination of solar plants, including San Juan 1, that were set to open in June of 2022. As planned, the coal plant ceased operations in the fall of 2022, but soon after the facility’s closure, DESRI proposed an amendment to the PPA and energy storage agreement for a 27.5 percent increase for the PPA, a 24 percent price increase for the energy storage agreement, and a new date for completion. PNM agreed to the price increase and added a \$2 million fee upon completion of the project to compensate for the delay in completion. PNM and DESRI petitioned the New Mexico Public Regulation Commission for approval of the amended PPA, and the Commission granted its approval.¹³²

4.6 Maine

Maine Governor Janet Mills signed an Act to Reform Maine’s Renewable Portfolio Standard in 2019, which directs Maine to achieve an 80 percent clean energy portfolio by 2030 and 100 percent by 2050. Maine has taken on many renewable energy projects including hydroelectric

¹²⁹ Exhibit A to Letter from Maui Electric Company to the Hawai’i Public Utilities Commission. Seller’s Right to Declare the Power Purchase Agreement to be Null and Void and Withdrawal of Request for Approval of Second PPA Amendment. March 15, 2023. Hawai’i PUC Docket No. 2021-0026. <https://dms.puc.hawaii.gov/dms/DocumentViewer?pid=A1001001A23C16B05136F02748>

¹³⁰ Colthorpe, Andy. 2021. ENGIE abandons Hawaii solar-plus-storage project over solar industry turbulence, grid connection costs. *Energy Storage News*. Accessed at: . <https://www.energy-storage.news/engie-abandons-hawaii-solar-plus-storage-project-over-solar-industry-turbulence-grid-connection-costs/>.

¹³¹ S.B. 0489, 54th Leg. First Ses. 2019. (N.M. 2019) <https://www.nmlegis.gov/Sessions/19%20Regular/bills/senate/SB0489.pdf>

¹³² Order On PNM’s Motion For Approval Of Amendments To San Juan Solar PPA and ESA And Pre-Hearing Order. N.M. Pub. Reg. Commission. Case No. 20-00182-UT. https://edocket.nmprc.state.nm.us/AspSoft/HandlerDocument.ashx?document_id=1215273

transmission, wind, and solar. Additional legislation enacted in tandem with the first bill was an Act to Promote Solar Energy Projects and Distributed Generation Resources. This bill incentivizes 375 MW of solar generation in Maine by 2024, primarily through projects under 5 MW.¹³³

4.6.1 Eddington and Church Hill Solar

BNRG Maine filed a petition in November of 2022 to amend prices on PPAs for two 20 MW solar projects, Eddington and Church Hill Solar, that had been approved in 2020.¹³⁴ The price increase is confidential, but BNRG cites the cumulative effects of higher capital expenditure (CapEx) and engineering, procurement, and construction (EPC) costs; higher interconnection costs; and higher interest rates as the reasons for increased prices. In its petition, BNRG asserted that increased CapEx and EPC costs were due to supply chain shortages as well as tariffs and embargoes placed on parts needed to manufacture solar cells. BNRG also accounted for tax credits from the Inflation Reduction Act, but state that those credits are not sufficient to mitigate the increased costs. In March of 2023, the Maine PUC issued an order denying BNRG's request for price increases.¹³⁵ BNRG has not made any public statements about whether the projects will continue.

4.7 Indiana

Indiana established its renewable energy goals in the 2012 Voluntary Clean Energy Portfolio Standard Program, which targets 10 percent renewable energy by 2025.¹³⁶ Despite the low target for renewables from the State, utility companies such as Northern Indiana Public Service Company (NIPSCO) and Duke Energy Indiana are expanding renewable energy for their customers, especially with solar energy.¹³⁷

4.7.1 Green River Solar

In May of 2021, NIPSCO entered into a PPA with Green River Solar for a 20-year term on a 200 MW solar project. In December of 2022, NIPSCO petitioned the Indiana Utilities Regulatory Commission (URC) to amend the pricing for the PPA.¹³⁸ The price increase was confidential, but

¹³³Governor Mills Signs Major Renewable Energy and Climate Change Bills Into Law. 2019. *State of Maine Office of Gov. Janet T. Mills*. <https://www.maine.gov/governor/mills/news/governor-mills-signs-major-renewable-energy-and-climate-change-bills-law-2019-06-26>

¹³⁴ BD Solar Church Hill LLC and BD Solar Eddington LLC Request to Amend Contracts, Me. P.U.C. Case No. 2020-00033. <https://mpuc.cms.maine.gov/COM.Public.WebUI/MatterManagement/MatterFilingItem.aspx?FilingSeq=117316&CaseNumber=2020-00033>

¹³⁵ Order Denying Request to Amend Contracts. Maine P.U.C. Case No. 2020-00033. <https://mpuc.cms.maine.gov/COM.Public.WebUI/Common/ViewDoc.aspx?DocRefId={5CFAFA4B-F1EE-454A-9E21-EDBCC70EDE92}&DocExt=pdf&DocName={5CFAFA4B-F1EE-454A-9E21-EDBCC70EDE92}.pdf>

¹³⁶ (Indiana) Voluntary Clean Energy Portfolio Standard Program. 2023. *IEA*. <https://www.iea.org/policies/17014-indiana-voluntary-clean-energy-portfolio-standard-program>

¹³⁷ Duke Energy Indiana commits to purchase up to 199 megawatts of solar power from Shelby County-based facility. 2023. *Duke Energy*. <https://news.duke-energy.com/releases/duke-energy-indiana-commits-to-purchase-up-to-199-megawatts-of-solar-power-from-shelby-county-based-facility>

¹³⁸ Verified Petition of NIPSCO for an Order. Ind. Utility Regulatory Com. Cause No. 45818. https://iurc.portal.in.gov/entity/sharepointdocumentlocation/da182789-b271-ed11-9562-001dd8070a7e/bb9c6bba-fd52-45ad-8e64-a444aef13c39?file=NIPSCO_Verified%20Petition_12012022.pdf

NIPSCO cites supply chain shortages and the Uyghur Forced Labor Prevention Act as reasons for the price increase. URC approved the amended PPA as “reasonable and necessary,” stating that under Indiana Code, the Commission should “encourage clean energy projects by creating financial incentives” in an order filed in March 2023.¹³⁹

4.8 Michigan

The Michigan Healthy Climate Plan aims to achieve 50 percent renewable energy by 2030 and to close all coal plants by 2035.¹⁴⁰ The plan includes general goals to increase wind and solar energy generation but outlines specific targets of an additional 2.5 GW of energy storage by 2030 and 4 GW by 2040.

4.8.1 Calhoun Solar, Cereal City Solar, and Jackson County Solar

Consumers Energy Company entered into PPAs for three solar projects in 2021: 200 MW Calhoun Solar, 100 MW Cereal City Solar, and 125 MW Jackson County Solar. These projects were part of the company’s plan to add 8 GW of utility scale solar power by 2040.¹⁴¹ In November of 2022, Consumers Energy applied for amended PPAs for the three projects with price increases and extended commercial operation dates (COD).¹⁴² For Calhoun, Consumers Energy requested a \$2.18/MWh (5.82 percent) price increase at the end of each year of the contract term and extend the COD by one year from May 2022 to May 2023. For Cereal City, the developer requested an extension of the COD by six months from May 2023 to December 2023 and a reduction of the contract term to 24 years. For Jackson County, the company requested a price increase of \$3.93/MWh (11.5 percent) at the end of each year of the contract term, an extension of the COD by 18 months from December 2023 to May 2025, and a reduction of the contract term from 20 to 15 years. Consumers Energy cites supply chain disruptions and inflationary pressures as the reasons for the price increase. According to the application, the amended rates are expected to decrease the overall customer costs due to the reduced term lengths of the contracts. The Commission approved the amended PPAs.¹⁴³

¹³⁹ Indiana Office Of Utility Consumer Counselor’s Proposed Order. Ind. Utility Regulatory Com. Cause No. 45818. https://iurc.portal.in.gov/entity/sharepointdocumentlocation/dc791f9e-a4c2-ed11-83ff-001dd8070a7e/bb9c6bba-fd52-45ad-8e64-a444aef13c39?file=45818_OUCC%20Proposed%20Order_03142023.pdf

¹⁴⁰ MI Healthy Climate Plan. 2022. *Department of Environment, Great Lakes, and Energy* <https://www.michigan.gov/egle/about/organization/climate-and-energy/mi-healthy-climate-plan>

¹⁴¹ Solar Power and Landowners. 2023. *Consumers Energy*. <https://www.consumersenergy.com/company/electric-generation/renewables/solar-generation/farmers>

¹⁴² Application. Mich. Public Services Com. Case No. U-20165. <https://mi-psc.force.com/sfc/servlet.shepherd/version/download/0688y00000586oTAAQ>

¹⁴³ Order. Mich. Public Services Com. Case No. U-20165. <https://mi-psc.force.com/sfc/servlet.shepherd/version/download/0688y000006KxbAAAS>

4.9 Inflation Adjustment Mechanisms for Future Projects

In the aftermath of the recent bout of unexpectedly high inflation, some jurisdictions have implemented an inflation adjustment mechanism for future offshore wind projects. For example, New Jersey's most recent offshore wind solicitation includes an inflation adjustment with a cap of a 15 percent increase or decrease in renewable energy credit pricing.¹⁴⁴ Similarly, Connecticut and Massachusetts have both issued draft RFPs that include an inflation indexing adjustment based on a composite set of indices that are to be determined by state agencies and electric utilities.^{145,146} The evaluation team consists of the Department of Energy Resources (Public Utilities Regulatory Authority in Connecticut), the electric utility companies, and other administrative parties. In both states, the maximum suggested adjustment is set to 15 percent, similar to New Jersey. Outside of the U.S., Ireland has issued an RFP for offshore wind project bids that includes provisions for annual reconciliation payments based on the strike price and differences between forecasted inflation and actual outcomes.¹⁴⁷

¹⁴⁴ Solicitation Guidance Document. 2023. *N.J. Board of Public Utilities*.

<https://www.nj.gov/bpu/pdf/boardorders/2023/20230306/8D%20ORDER%20OSW%20Third%20Solicitation.pdf>.

¹⁴⁵ Draft Request for Proposals Offshore Wind. 2023. *Connecticut Department of Energy and Environmental Protection*.

[https://www.dpuc.state.ct.us/DEEPEnergy.nsf/c6c6d525f7cdd1168525797d0047c5bf/f3f2e2f9f0f2f76a852589f70062d3eb/\\$FILE/Draft%20RFP%20\(OSW\).pdf](https://www.dpuc.state.ct.us/DEEPEnergy.nsf/c6c6d525f7cdd1168525797d0047c5bf/f3f2e2f9f0f2f76a852589f70062d3eb/$FILE/Draft%20RFP%20(OSW).pdf).

¹⁴⁶ Request for Proposals of Long Term Contracts for Offshore Wind Energy Projects. Massachusetts Department of Public Utilities.

<https://fileservice.eea.comacloud.net/FileService.Api/file/FileRoom/17396142>.

¹⁴⁷ Terms and Conditions for the First Offshore Wind RESS Competition. 2023. *Government of Ireland*.

<https://www.gov.ie/pdf/?file=https://assets.gov.ie/252215/7eacfb9c-6702-4e72-9499-5bea86aa9d96.pdf#page=null>.

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Appendix.

IEc Qualifications

IEc Overview

Industrial Economics (IEc) is a nationally recognized economic and public policy consulting firm with a mission of developing and applying objective, practical, and analytically sound approaches to the analysis of complex economic problems and issues. IEc's work emphasizes the application of rigorous analytical thinking, the exercise of well-reasoned judgment, and responsiveness to client needs.

As climate change, geopolitics, and other factors have encouraged a transition from a fossil fuel-based economy to one that is more reliant on cleaner, renewable forms of energy, IEc assists policymakers seeking innovative ways to facilitate and encourage this transition. IEc applies its expertise in economic impact analysis, air policy, program evaluation, benefit-cost analysis, public utilities, and finance to help state and federal entities create alternative energy and energy efficiency programs that properly balance economic growth, environmental protection, and energy independence objectives. IEc's client base in the energy policy space is as diverse as our services. We have completed studies for several state agencies, including the Massachusetts Department of Energy Resources, the Oregon Department of Energy, the California Energy Commission, and the New York State Energy Research and Development Authority. We also work closely with several federal agencies whose actions affect state policy goals, including the U.S. Department of Energy, the Environmental Protection Agency, and the Department of the Interior. Finally, IEc consultants offer comprehensive program design, implementation, and evaluation services to an array of public and private clients, including those pursuing energy efficiency and renewable energy objectives.

IEc's portfolio of work also includes applying its expertise in the theory and application of various damage estimation approaches in contract, tort, and regulatory contexts. Our analyses emphasize the use of modern damages theory and techniques. We work closely with our clients to assure that the damages models we use, and the damages estimates we develop, are consistent with the legal remedies available.

IEc's experts are well versed in the standards of proof and traditional measures of damages employed by U.S. federal and state courts, including the United States Court of Claims. We have presented expert testimony in state, federal, and international adjudicatory settings, as well as in administrative hearings. IEc experts have testified on the full-range of damages issues, including lost-profit damages; property value diminution; economic benefit of noncompliance with environmental requirements (i.e., unjust enrichment); financial data analysis; government finance; and environmental damages. In addition to our in-house experts, we often work with clients to identify and manage topic-area specialists as expert witnesses and advisors.

IEc's Principals are recognized experts in their fields and have served as expert witnesses in civil proceedings, published in the peer-reviewed literature, developed analytic guidance regularly used by government agencies, and served as panelists or speakers at a number of professional conferences.

IEc

IEc Leads for This Report

Mark Ewen and Jason Price, both Principals with IEc, led the development of this report. Information on their experience and qualifications is presented below.

Mark Ewen

Mark Ewen has a strong background in applied economics, empirical methodologies, and financial analysis. As a Principal at Industrial Economics, Incorporated (IEc) with 28 years of experience, he focuses on regulatory and environmental economics, case management and economic damages estimation in a variety of litigation contexts, and financial analysis. Within his areas of expertise, Mr. Ewen has been qualified as an expert witness before judicial and regulatory bodies. Mr. Ewen participates in various proceedings concerning energy markets and regulated utilities. These efforts include working on behalf of industry and consumer intervenor groups in electricity and gas rate-making cases before public utility commissions in Pennsylvania and Rhode Island. He has also testified before the U.S. Postal Rate Commission on matters concerning cost allocation and rate design for postal services. Across his work, Mr. Ewen has analyzed a vast array of industry sectors and companies, including within the energy sector. These include, among others: off- and on-shore wind generation; waste-to-energy facilities; solar generation; fossil electricity generation; nuclear electricity generation; oil and gas production; and transportation and shipping. He also currently serves as the President of IEc.

Jason Price

Jason Price, a Principal at IEc, specializes in developing and implementing methods to assess the societal costs, benefits, and economic impacts of policies and programs related to energy development and production, energy efficiency, waste management, and air pollution policy. With 21 years of experience, Mr. Price has helped government agencies at the federal, state, and local level develop novel approaches to applying economic tools to help them better understand the implications of policy decisions. He has also developed economic and environmental modeling tools that provide client agencies with insights relevant to their policy-making needs, in particular in the context of renewable energy and offshore energy. Mr. Price has also developed technical guidance for government agencies that they have applied in their analyses of policy actions. Mr. Price has led economic and policy analyses for multiple agencies at the federal, state, and local level, including the U.S. EPA, the Bureau of Ocean Energy Management, the Bureau of Land Management, the U.S. Coast Guard, the New York State Energy Research and Development Authority, the California Energy Commission, Environment and Climate Change Canada, and the South Coast Air Quality Management District.

Overview

Mr. Ewen has a strong background in applied economics, empirical methodologies, and financial analysis. As a Principal at Industrial Economics, Incorporated (IEc), he focuses on expert case management and economic damages estimation in a variety of litigation contexts, regulatory and environmental economics, and financial analysis. Within his areas of expertise, Mr. Ewen has been qualified as an expert witness before judicial and regulatory bodies (see summary of testimony and appearances). He also currently serves as President of the firm.

Education

Master of Public Policy, University of Michigan

Bachelor of Arts, summa cum laude in Economics and Political Science, University of North Dakota

Project Experience

Mr. Ewen has participated in various proceedings concerning energy markets and regulated utilities. These efforts, which focus on issues related to cost allocation and rate design, include working on behalf of industry and consumer intervenor groups in rate-making cases before the public utility commissions in Pennsylvania and Alberta, Canada, and the U.S. Postal Rate Commission. For example, for the **PENNSYLVANIA OFFICE OF SMALL BUSINESS ADVOCATE**, he has provided consulting and analytic support relating to electricity and natural gas tariff design, revenue requirements, and other regulatory initiatives concerning electrical and natural gas distribution utilities. For the **RHODE ISLAND ATTORNEY GENERAL**, Mr. Ewen conducted a due diligence review of PPL's proposed acquisition of Narragansett Electric Company and its potential impacts on the state's ratepayers.

For the **NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY (NYSERDA) AND DEPARTMENT OF PUBLIC SERVICE (DPS)**, Mr. Ewen provided expert services assessing the economic impacts to municipal governments of extended electricity outages related to Tropical Storm Isaias. As part of this work, he constructed a model to estimate various costs of incremental staffing requirements for over 500 localities, including excess overtime, surge time (i.e., bringing on extra staff for outage response coordination and logistics), and idle time (e.g., crews waiting extended periods for downed lines to be de-energized). The review also included consideration of other direct costs, including, among others: effects to water systems; delivery of bottled water; operation of generators; and other constraints on the provision of essential governmental services. The litigation was settled to the satisfaction of the involved parties.

For the **NYSERDA AND NEW YORK DPS**, Mr. Ewen directed the development of a Generic Environmental Impact Statement (GEIS), pursuant to the requirement of the State Environmental Quality Review Act (SEQRA) that assessed the environmental and economic impacts of the "Reforming the Energy Vision" and "Clean Energy Fund" initiatives within the state. He also directed the preparation of

a Supplemental EIS to assess the environmental and economic impacts of the newly proposed Clean Energy Standard (CES). The CES is being developed to support the state's goal of supplying 50 percent of electricity demand with renewable generation resources by the year 2030. More recently, he directed the development of a model to assess the financial viability of various waste-to-energy technologies, and related social welfare benefits. This model uses detailed capital budgeting scenarios for specific facilities to generate forecast scenarios.

For the **U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF OCEAN ENERGY MANAGEMENT (BOEM)**, directing an assessment of the Bureau's approach to calculating and presenting the operating fee included in offshore wind leases under BOEM's jurisdiction. As part of this engagement, IEc provided a number of recommendations for simplifying the implementation of the operating fee formula and identified available data sources and approaches to estimating individual components of the fee formula. The review also addressed the structure and levels of fees associated with operations of renewable wind energy projects in the U.S. and worldwide. More recently, IEc has been supporting the development of Standard Operating Procedures for the fee calculation and lease management process. The overall goal is to provide information resources and a methodological approach that will allow lessees to derive accurate data for fee equation variables efficiently and consistently, and for BOEM to present the fee calculation clearly in the lease.

For the **NYSERDA**, Mr. Ewen directed the research and development of a financial model to evaluate the financial viability of five advanced waste-to-energy (WTE) technologies. This effort included a series of in-depth interviews of advanced WTE developers, investors and industry experts to identify sources of capital, operating and financial data and to develop a risk profile of advanced WTE projects. The financial model was designed to help evaluate the circumstances under which advanced WTE projects are financially feasible, and uses detailed capital budgeting scenarios for specific facilities to generate forecast scenarios. IEc also used the model to evaluate to what extent different public policy interventions can positively affect the financial feasibility and/or cost-benefit ratio of advanced WTE in New York State, using cost of carbon equivalent metrics.

For **NYSERDA**, conducting a market analysis examining the potential economic development opportunities that could accrue in New York from hydrogen playing a role in achieving components of its Climate Leadership and Community Protection Act.

For the **U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF OCEAN ENERGY MANAGEMENT**, managed the development of a model to assess the economic and fiscal impacts of offshore oil and gas activity in the Gulf of Mexico and other BOEM OCS regions. This model, the Lifecycle Impacts Model (LCIM), assesses the economic and fiscal impacts associated with a specific lease or group of leases, over the time horizon of the lease(s). IEc's framework for the model was to build a capital budgeting forecasting tool for lease development, yielding estimates of industry expenditures, OCS revenues, industry profits, and employment impacts for a single lease or a set of leases. A key component of model development was to dynamically simulate the complex and unique timing parameters of lease development, incorporating the influence of critical exogenous factors like market prices and lease geology.

For the **U.S. COAST GUARD, NATIONAL POLLUTION FUNDS CENTER**, Mr. Ewen provides ongoing support to the NPFC in adjudicating damages claims resulting from oil spills. These claims include damages for business interruption, lost profits, property damage or value diminution, increased costs, and lost wages or employment, among other categories. Cases have also included damages for contract delays to construction projects and shipping demurrage. Industry sectors that Mr. Ewen has evaluated

include: *electricity generation (nuclear and coal); railroads; cruise ships; oil ship transport; lodging and tourism; food and beverage; gambling; fisheries; marinas; real estate development, oil and gas development; and oil refining.*

Mr. Ewen's analytic work includes expert financial analysis and economic damages estimation in the context of general litigation and environmental enforcement actions. These efforts include assessing damages in breach of contract, nuisance, and cost recovery actions, and assessing the financial capabilities and economic benefit of noncompliance of firms accused of environmental violations. Clients in this area of his practice include the **U.S. DEPARTMENT OF JUSTICE, U.S. COAST GUARD, U.S. ENVIRONMENTAL PROTECTION AGENCY, STATES,** and private parties.

For the **OREGON DEPARTMENT OF ENERGY**, he evaluated the effectiveness of the state's renewable energy tax incentive program. This evaluation provided both a detailed financial review of renewable energy projects, and the effect of the tax credit on their viability. Specifically, the analysis presented a detailed reconstruction of the capital budgeting process for a representative suite of projects (e.g., solar, wind, biomass) and calculation of required internal rates of return to make the projects financially viable. In addition, the report provided an assessment of state level employment and revenue impacts. The evaluation was rated by the Pew Center on the States as the best evaluation of tax incentives in the State.

Testimony and Appearances

Mr. Ewen has provided testimony or appeared in the following cases and regulatory proceedings.

On behalf of Pennsylvania's Office of Small Business Advocate, submitting testimony before the Pennsylvania Public Utility Commission, concerning base tariff rate development for Columbia Gas of Pennsylvania, including issues of cost allocation, revenue allocation, and rate design. (Docket No. R-2022-3031211, June/July 2022)

On behalf of Attorney General of the State of Rhode Island, submitted testimony before the Rhode Island Division of Public Utilities and Carriers concerning due diligence and related reviews of PPL Corporation's proposed acquisition of Narragansett Electric Company from National Grid USA (Docket No. D-21-09, November 2021).

Expert reports and deposition testimony on bankruptcy reorganization plan feasibility and related financial matters, *in re: First Energy Solutions Corp., et al., Debtors, Case No. 18-50757*; expert reports filed July 2019, deposition testimony given August 9, 2019.

Expert declaration concerning economic damages and related financial matters, *in re: Outer Banks Power Outage Litigation, all actions, No. 4:17-CV-141-D*, March 2018.

On behalf of Pennsylvania's Office of Small Business Advocate, submitting testimony before the Pennsylvania Public Utility Commission, concerning tariff design issues for Columbia Gas of Pennsylvania (Docket No. R-00049783, May 2005).

On behalf of Pennsylvania's Office of Small Business Advocate, submitting testimony before the Pennsylvania Public Utility Commission, concerning cost allocation, revenue assignment, and rate design for Pennsylvania Power and Light (Docket No. R-00049255, August 2004).

On behalf of Pennsylvania's Office of Small Business Advocate, submitting testimony before the Pennsylvania Public Utility Commission, concerning recovery of purchased gas costs and revenue sharing for PFG Gas and Northern Penn Gas (Docket No. R-00027389, July 2002).

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On behalf of Pennsylvania's Office of Small Business Advocate, submitting testimony before the Pennsylvania Public Utility Commission, concerning recovery of purchased gas costs and revenue sharing for National Fuel Gas Distribution Corporation (Docket No. R-00016789, March 2002).

On behalf of the Office of the Consumer Advocate, providing testimony before the United States Postal Rate Commission regarding cost allocation of city carrier street time costs. Docket No. R2000-1, July 11, 2000.

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Overview

Mr. Price has a diverse background in applied economics and policy analysis. As a Principal at Industrial Economics, Incorporated (IEc), Mr. Price specializes in the development and implementation of methods to assess the costs, benefits, and economic impacts of policies and programs related to energy development and production, air pollution policy, and climate change.

Education

Master of Public Policy, Gerald R. Ford School of Public Policy, University of Michigan

B.A., summa cum laude, with Honors in political science and international relations, Syracuse University.

Project Experience

For the **U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF OCEAN ENERGY MANAGEMENT**, developed recommendations on how to calculate individual components of the operating fee formula included in BOEM OCS wind leases, as well as recommendations on how the Bureau might better present the operating fee formula in future wind leases. As part of this effort, Mr. Price advised BOEM on methods for specifying an offshore wind facility's capacity factor and for identifying or calculating the appropriate wholesale electricity price to use in estimating a facility's annual revenue.

For the **U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF OCEAN ENERGY MANAGEMENT**, directed the development of a model to assess the benefits of offshore wind projects in Federal waters. Based on benefits estimates for approximately 900 representative offshore wind projects, Ben-Wind estimates the air quality and energy system benefits associated with user-specified offshore wind projects defined according to their size, location, and timing, among other factors. The benefits for the 900 scenarios are based on electricity market simulations performed with the Engineering, Economic, and Environmental Electricity Simulation Tool ("E4ST") and the AP2 integrated air quality assessment model.

For the **NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY (NYSERDA)**, directed IEc's efforts to support the development of a pipeline of offshore wind projects in the northeastern U.S. Specifically, Mr. Price is overseeing IEc's assessment of policy strategies that New York, Massachusetts, Maine, and Rhode Island can pursue to streamline the Federal permitting process for offshore wind in Federal waters.

For the **U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF OCEAN ENERGY MANAGEMENT**, managed the redesign of the MarketSim multi-market partial equilibrium model to assist BOEM in analyses of the energy market impacts of oil and gas development on the outer continental shelf (OCS). The model includes a detailed representation of energy supply and demand, with production and consumption modeled separately for oil, gas, electricity, and coal. Outputs generated by the model include changes in prices, consumption, and production by fuel, as well as changes in consumer surplus. Mr. Price oversaw

the development of the model's design and programming, the identification and selection of elasticity values, and the incorporation of data from the Energy Information Administration's National Energy Modeling System (NEMS).

For the **U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF OCEAN ENERGY MANAGEMENT**, directed the development of two models to assess the economic and fiscal impacts of offshore oil and gas activity in the Gulf of Mexico and other BOEM OCS regions. The first model, the Cumulative Impacts Model, assesses the impacts of all offshore oil and gas activity occurring within a region over a user-defined timeframe. The second model, the Lifecycle Impacts Model, assesses the economic and fiscal impacts associated with a specific lease or group of leases. Both models include a detailed representation of the fiscal terms associated with BOEM leases inclusive of royalties, bonus bids, and rents, as well as federal and state taxes on corporate profits and dividends. The models rely on a wealth of data compiled and processed by IEc, including, but not limited to, data on the unit costs of individual offshore oil and gas activities (e.g., exploratory well drilling), historical data on these activities, effective corporate income tax rates at the state and federal level, and the distribution of OCS expenditures across industries and geographic areas.

For the **U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF OCEAN ENERGY MANAGEMENT**, oversaw the development of the Offshore Environmental Cost Model (OECM) to assist the Bureau with assessments of the environmental and social impacts of oil and gas development on the Outer Continental Shelf (OCS). For a given exploration and development scenario, the OECM estimates impacts to air quality, commercial fishing, recreation, coastal property value, marine life, and subsistence use.

For the **CALIFORNIA ENERGY COMMISSION**, directed development of the Electric Program Investment Charge Program (EPIC) Emissions Calculator. The tool calculates the changes in emissions from EPIC projects that increase the use of renewable electricity generating sources in California, reduce or shift demand for electricity, and reduce consumption of gas and oil through various electrification measures. The tool reflects the projected emissions profile of generating resources on margin by region (within California), season, and time slice (within a given season), inclusive of imports. Outputs generated by the tool include changes in emissions by pollutant, year, and air basin within California.

Provided economics support to the **U.S. COAST GUARD** for the adjudication of electricity producer lost profit claims associated with oil spills in U.S. waterways. To assess the robustness of these claims, designed and performed screening analyses of regional electricity markets' response to each spill. Through these analyses, showed that the reduced output from claimants' plants was partially offset by increased production at other claimant plants in the same regional electricity market.

For the **U.S. ENVIRONMENTAL PROTECTION AGENCY, CLEAN AIR MARKETS DIVISION**, directed the peer review of EPA's Integrated Planning Model Power Sector Modeling Platform, version 6. Mr. Price identified and recruited the peer review panel, assisted EPA in development of the peer review charge, facilitated structured interactions between the peer review panel and EPA, coordinated with the peer review panel chair in making assignments to individual reviewers, and assisted the chair in drafting the peer review report based on charge question responses prepared by members of the panel.

For the **U.S. ENVIRONMENTAL PROTECTION AGENCY, OFFICE OF AIR AND RADIATION**, provided analytic support on a range of methodological issues related to the Agency's benefit-cost analysis of the Clean Air Act Amendments of 1990. As part of this effort, developed a strategy for using a computable general equilibrium macroeconomic model to estimate the economic impacts of the Amendments, designed and implemented an approach for incorporating learning curve impacts into EPA's estimates of

the costs associated with the Amendments, and assessed the implications of tax interaction effects and their relevance to EPA's analysis of the Amendments. Presented the methods and results of the analysis to the EPA Science Advisory Board's Council on Clean Air Compliance Analysis.

Select Reports and Publications

The Benefits, Costs, and Economic Impacts of Undergrounding New York's Electric Grid, prepared for New York State Department of Public Service and New York State Energy Research and Development Authority, June 2023.

Employment Impacts of Achieving Net-Zero Emissions by 2050, prepared for Third Way, May 2022.

Consumer Surplus and Energy Substitutes for OCS Oil and Gas Production: The 2021 Revised Market Simulation Model (MarketSim), prepared for the Department of the Interior, Bureau of Ocean Energy Management, OCS Study BOEM 2021-072. November 2021.

[*Guidelines for Regulatory Impact Analysis Supplement: Addressing International Effects*](#). U.S. Department of Health and Human Services. Prepared by Jason Price, Jennifer Baxter, and Lisa Robinson, October 1, 2021.

Peer Review of EPA's Power Sector Modeling Platform v6 using Integrated Planning Model. [ed.], prepared for U.S. Environmental Protection Agency, March 2020.

Cumulative Impacts Model and Lifecycle Impacts Model for Assessing Economic and Fiscal Impacts of Offshore Oil and Gas Activities, prepared for the Department of the Interior, Bureau of Ocean Energy Management, OCS Study BOEM 2020-032. August 2020.

Implementation Recommendations for Offshore Wind Development Operating Fee, prepared for the Department of the Interior, Bureau of Ocean Energy Management, June 2019.

Forecasting Environmental and Social Externalities Associated with Outer Continental Shelf (OCS) Oil and Gas Development, Volume 1: The 2018 Revised Offshore Environmental Cost Model (OECM), prepared for the Department of the Interior, Bureau of Ocean Energy Management, 2018.

Methods for Estimating Secondary Cost Impacts of Maritime Regulations, prepared for U.S. Coast Guard, June 2017.

Expert Declaration on the Employment Impacts of the Clean Power Plan, State of West Virginia, et al., Petitioners v. Environmental Protection Agency, U.S. Court of Appeals for the District of Columbia Circuit, Case No. 15-1363 (and consolidated cases), December 2015.

Select Speaking Engagements

Society for Benefit-Cost Analysis, Organizer and Presenter for Estimating Costs professional development workshop. September 7-8, 2023.

National Association for Business Economics, 64th Annual Meeting. October 9-11, 2022. Panelist, Net Zero as an Engine for Job Growth.

U.S. Association for Energy Economics, 2018 Annual Conference, September 23-26, 2018. Estimating the Economic and Fiscal Impacts of Oil and Gas Activities on the Outer Continental Shelf.

Appendix C: Confidential Information Regarding Bid Prices in NYSERDA Solicitations

(The contents of this Appendix are redacted)