Q1 2022 | Renewables Market Update

INSIDE THIS REPORT:

- PPA Pricing Trends and Project Availability
- U.S. Renewable Energy Market Trends
- Wholesale Markets Roundup
- European Renewable Energy Marketplace
- Perspectives Roundup

EDISON energy®

Meet the Contributors

John Egbuta | Utrecht, NL
As a Clean Energy Advisor on our European team, John helps navigate clients through their renewable procurement process, from early education and strategy development, all the way through contracting. He supports clients in balancing their particular priorities, risk tolerance and carbon reduction goals.

Mary Kate Francis | Boston, MA
As the Senior Director of Energy Sourcing, Mary Kate leads the team responsible for renewables procurement. She works with project developers to find the right solution for each client to achieve their renewable energy goals.

Chase Collins | Boston, MA
As a Clean Energy Analyst, Chase is responsible for analyzing renewable energy market risks and opportunities, including policy and regulation, and administration of the project database for market evaluation and diligence.

Kristi Ghosh | Utrecht, NL
As a Clean Energy Analyst on our European team, Kristi is responsible for analyzing renewable energy market risks and opportunities, including policy and regulation, and administration of the project database for market evaluation and diligence.

Avery Hammond | Boston, MA
As an Analyst on the Clean Energy Sourcing team, Avery focuses on following key policy and market drivers impacting PPA and REC procurement in North America.

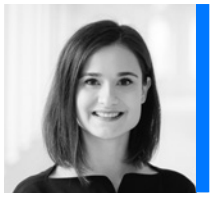
Charlotte Caldwell| Boston, MA
As a Senior Analyst on the Clean Energy Sourcing team at Edison, Charlotte advises clients on renewable energy strategy and economics. She leads the design and development of project economic models and communicates regularly with renewable energy suppliers across all of Edison's major markets in the United States and Europe.

Yasiru Jayakody | New York, NY
As a Sales Analyst, Yasiru is responsible for leading prospective client research and staying on top of the latest trends in corporate renewable procurement and broader decarbonization activities.

Elana Knopp | New York, NY
As a Senior Content Writer, Elana is responsible for leading content development, creating thought leadership pieces with Edison team members and industry experts, and crafting client engagement & communications strategies. Having been an investigative reporter for most of her career, Elana has covered topics from New Jersey politics, social justice issues, education, and the environment.

Meet the Contributors

Jacqui Levere | Boston, MA
As Environmental Commodities Manager, Jacqui supports clients in the purchase or sale of environmental attributes that help them to achieve their sustainability goals. These attributes include U.S. Renewable Energy Certificates (RECs) and global Energy Attribute Certificates (EACs) to offset Scope 2 Emissions, and voluntary carbon credits to offset Scope 1 and 3 Emissions.

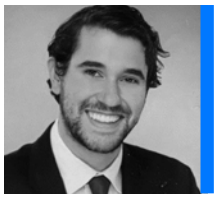


Corina Melchor | Bucharest, RO
As a Clean Energy Advisor on our European team, Corina manages client relationships by bringing insights to life across our customer's decarbonization journey. Corina's role is to understand the implications and interdependencies (risk, collaterals, etc) that lie in a PPA acquisition and ensure that our tailored solutions meet their sustainability, financial, and strategic goals.

Grace Morrissey | Boston, MA
As a Manager on the Clean Energy Sourcing team at Edison, Grace works with a variety of clients pursuing offsite renewables procurement by advising them on strategic planning, goal setting, market education, competitive solicitation, analysis, and project selection.

Andor Savelkouls | Utrecht, NL
As Senior Director of European Energy Advisory, Andor leads our European team (operating as Altenex Energy, a subsidiary of Edison Energy), focusing on both the business development and operational aspects of the company's consulting activities across Europe.

Shannon Weigel | Chicago, IL
As the Head of Policy, Shannon tracks regulatory, legislative and administrative proceedings in North America and uses this information to help our clients make better energy procurement decisions.



Austin Zaelke | Boston, MA
As a Senior Analyst on the Clean Energy Sourcing team, Austin is responsible for educating clients on market trends and running competitive procurements through the Edison Energy Insights platform. Austin performs financial modeling and qualitative due diligence assessments to support clients in selecting the best risk-adjusted renewable energy projects to meet their goals.

Tim Hogan | Dublin, OH
As the Senior Energy Manager for the Clean Energy Advisory, Tim develops and manages client relationships and guides them through their clean energy journey. In this role, Tim supports clients with their clean energy strategy, analysis, and execution while balancing their internal and external complexities.

Ronny Tempel | Leamington, UK
As the Manager of European Market Insights & Analytics, Ronny uses his understanding of market evolution to support and educate clients as they set their sustainability strategy, evaluate on-site energy use, and sign renewable power purchase agreements

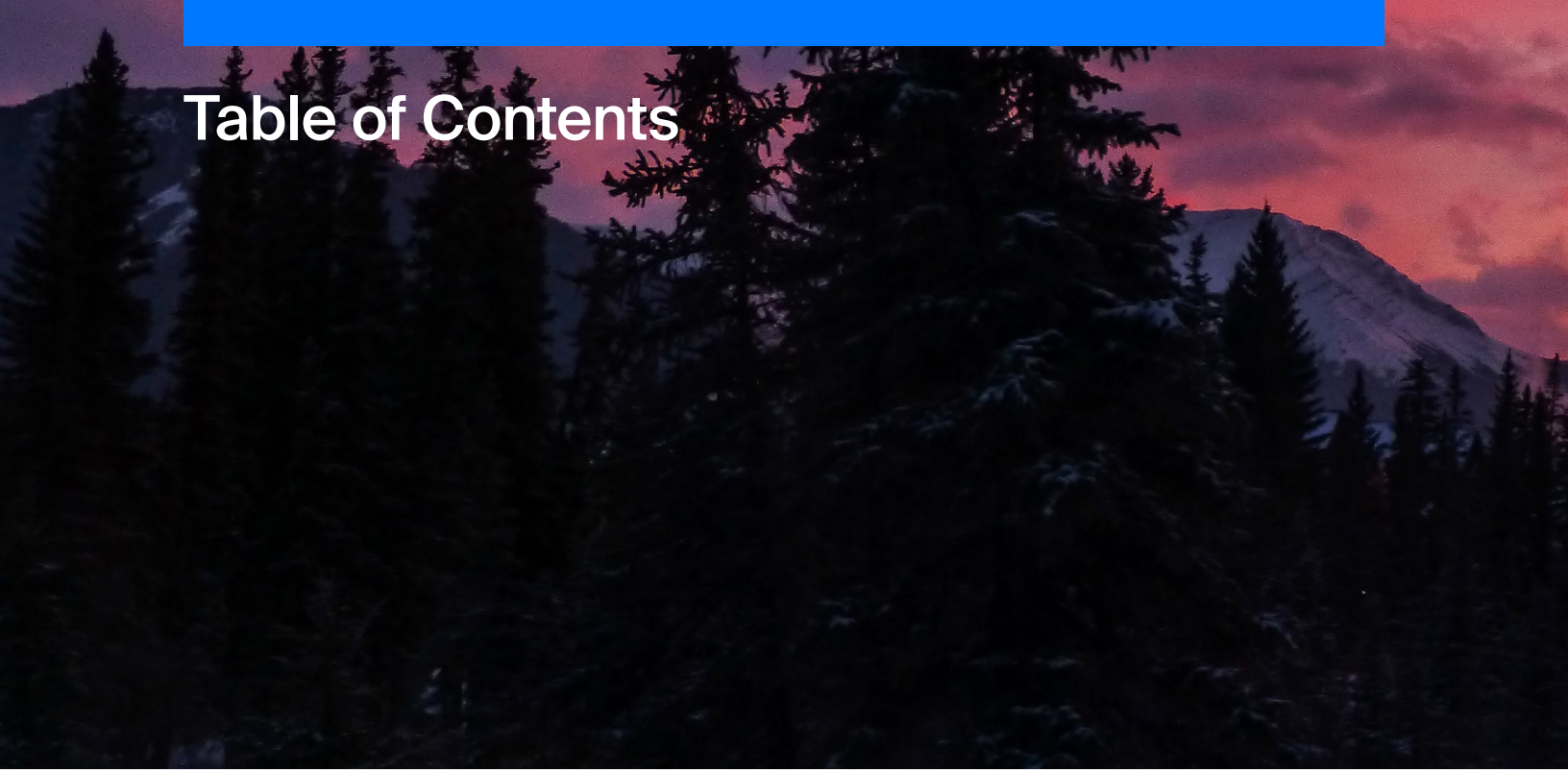
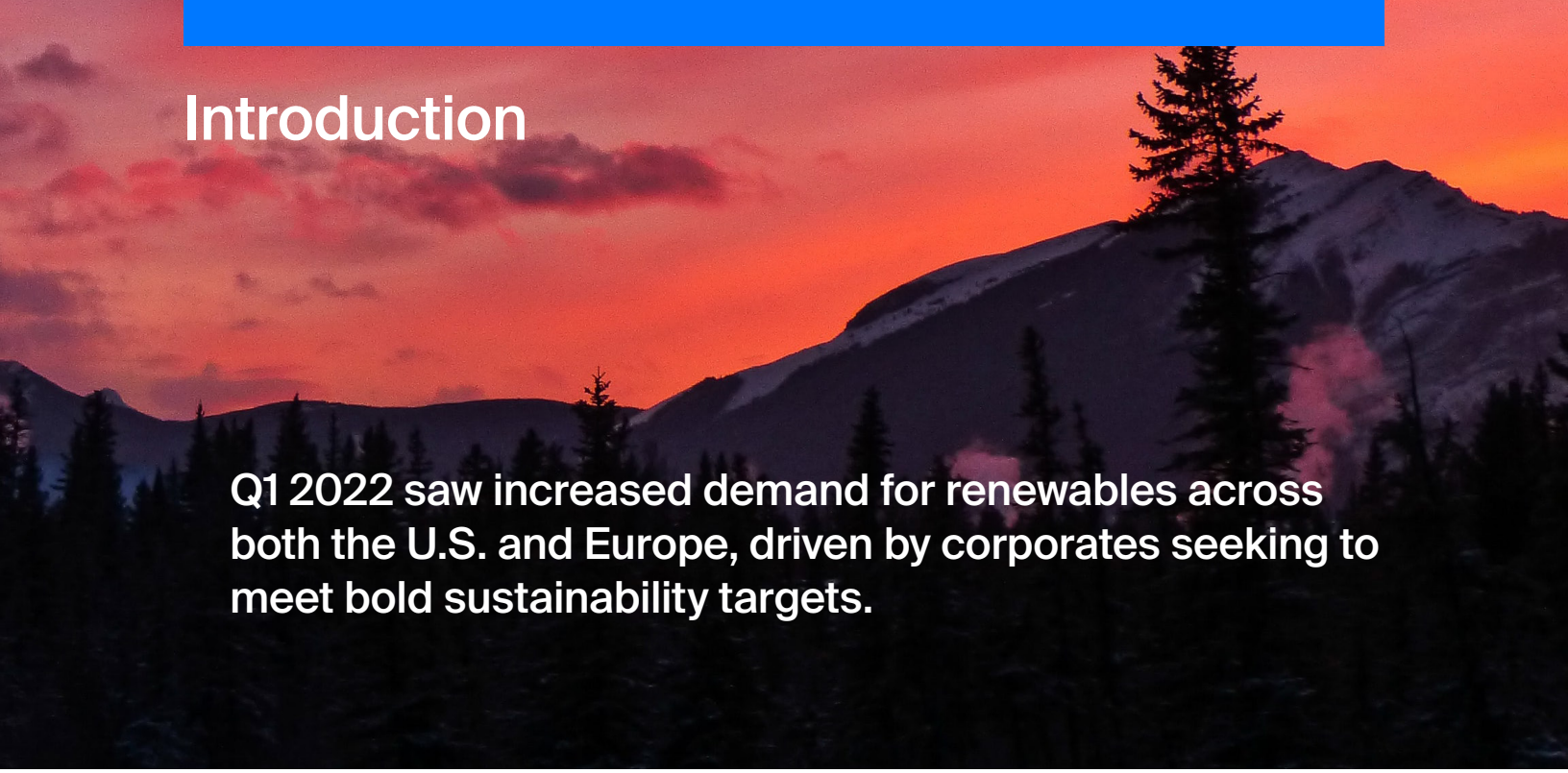


Table of Contents



Introduction

Q1 2022 saw increased demand for renewables across both the U.S. and Europe, driven by corporates seeking to meet bold sustainability targets.

The U.S. has seen a rise in PPA pricing for wind and solar as it faces supply and demand imbalance. This disparity has been driven by rising cost inputs, coupled with uncertainty in the market due to the launch of a federal investigation into alleged solar panel tariff circumvention. This is expected to put the availability and cost of the majority of module supply in question for the foreseeable future. With these factors projected to result in increased costs to offtakers, developers and buyers have been seeking non-standard contract structures to mitigate financial risk.

A similar scenario has played out in Europe, with supply expected to be challenged in the short term due to the ongoing energy crisis, skyrocketing gas prices, and geopolitical unrest. These factors have also resulted in higher PPA prices across Europe, with developers offering different price structures as a way to de-risk projects.

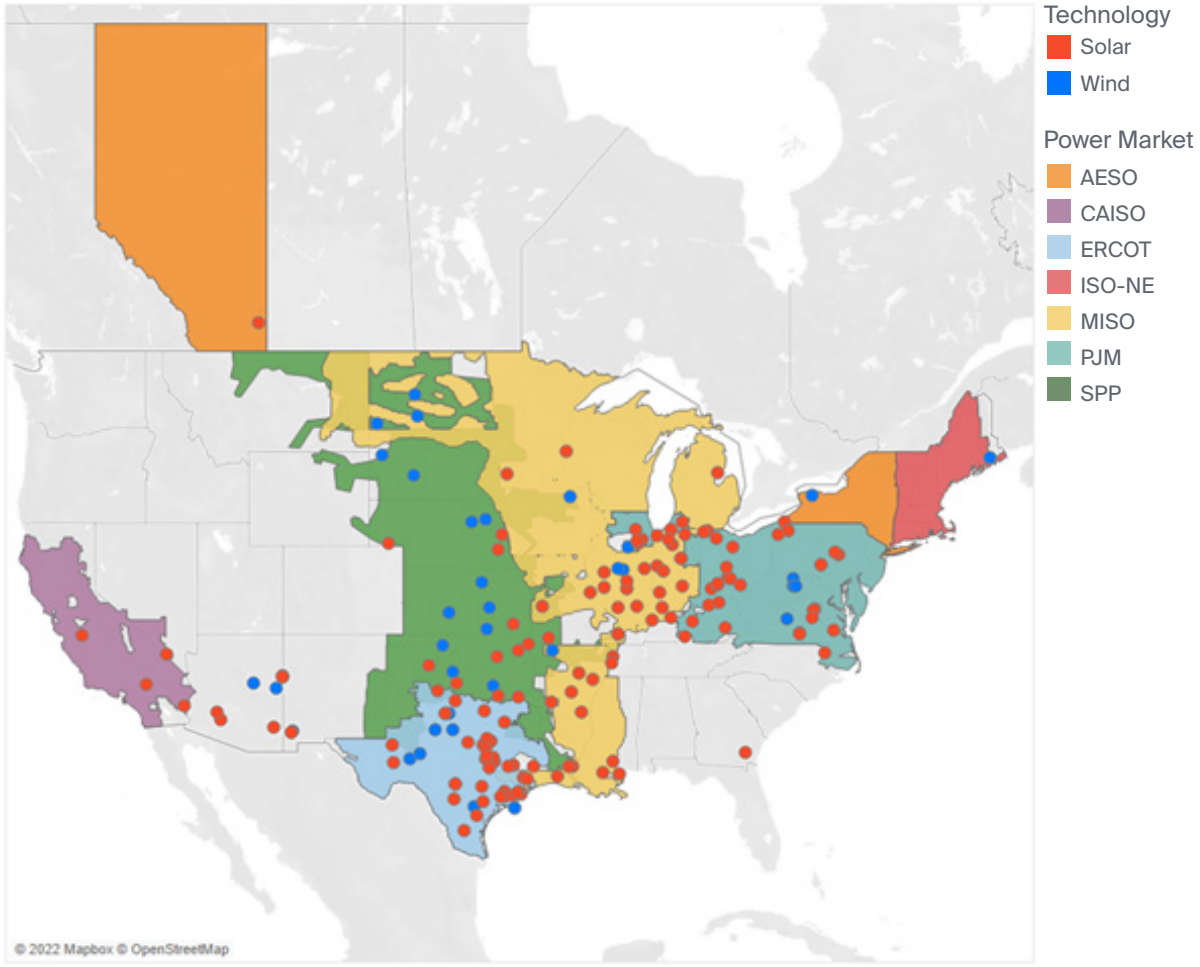
U.S. REC markets saw volatility in the first quarter of this year, possibly driven by trader uncertainty generated by the war in Ukraine. Significant investments and policy updates in 2021 led to major market demand for carbon offsets, with prices on projects often tripling when compared to previous years.

European markets continue to face headwinds, with short-term PPA markets taking a hit due to surging hardware supply chain issues and increased permitting delays. As the energy crisis continues and the war in Ukraine rages on, regulators and market players are considering a redesign of European energy markets, potentially leading to increased opportunities for PPAs. Despite the conflict in Ukraine, however, European countries are expected to accelerate renewable energy system buildout, while corporate demand for GOs is slated to increase in the long term.

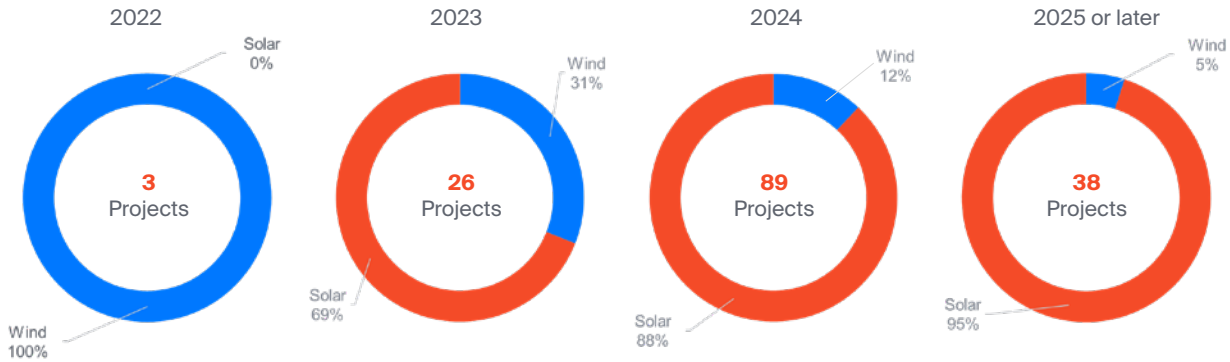
U.S. Renewable Energy Marketplace

Project Availability

Figure 1. Edison Energy's North American Renewable Energy Marketplace – Available utility-scale projects in Q1 2022



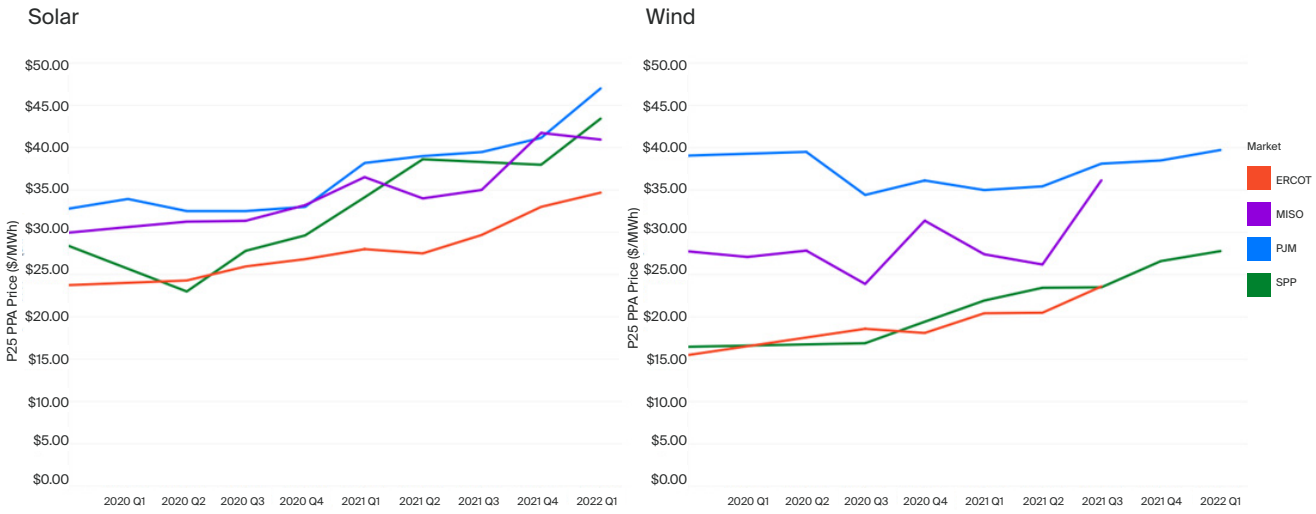
Anticipated Online Dates



U.S. Renewable Energy Marketplace

PPA Pricing Trends

Figures 2 & 3. Trends in PPA Prices



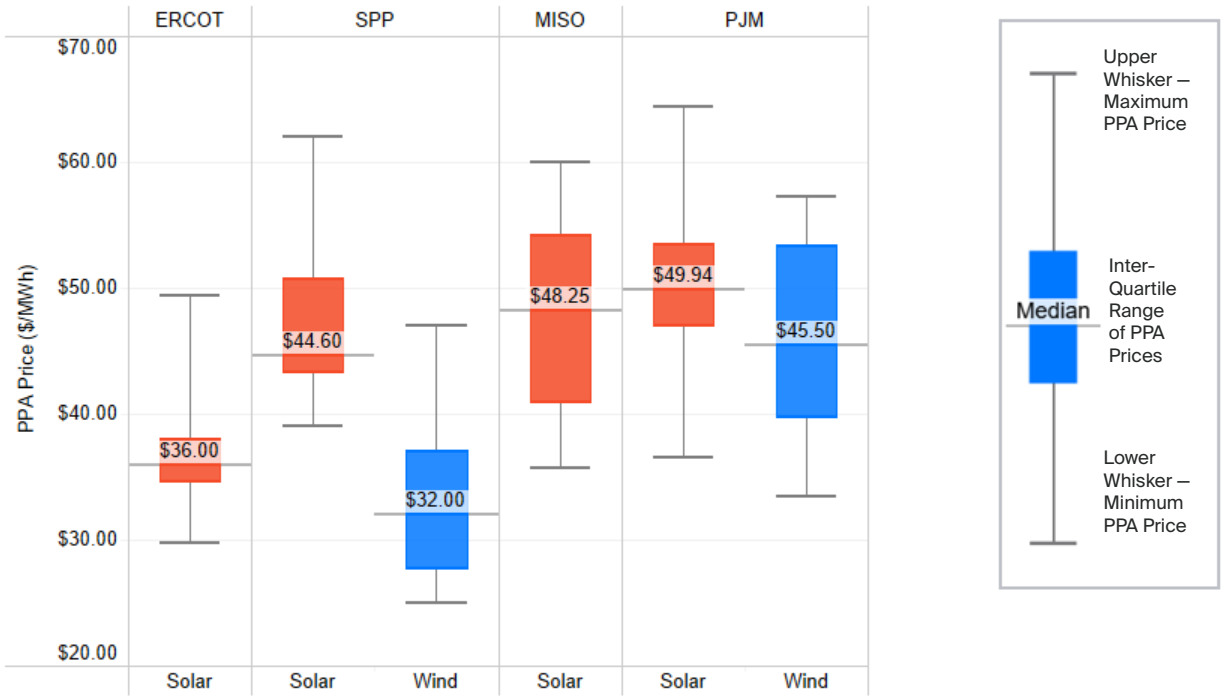
Prices shown reflect the 25th percentile of flat, hub-settled, unit contingent offers received over time. Markets and technologies with offers from fewer than five distinct projects in a given quarter are not shown.

- **Between Q4 2021 and Q1 2022, Edison Energy saw p25 prices increase in most markets, though the rates of change showed divergence.** All markets and technologies except MISO solar experienced rising PPA prices. ERCOT's p25 solar price growth rate slowed, while PJM and SPP solar each saw a 14% price increase. In contrast, median PPA prices, not shown here, moved moderately upward across all markets. This trend suggests a combination of the most competitive projects being contracted in the past quarter and a reassessment of lower-priced offers to align to developers' most recent- and more expensive-cost assumptions.
- **ERCOT solar p25 PPA pricing increased by 5%.** After two consecutive quarters of ~10% increases, ERCOT solar climbed just over 5% in Q1, for an increase of $2/MWh. The p25 price of ERCOT solar revenue share offers, not shown here, likewise rose almost 5% following 8-15% increases in the previous two quarters.
- **PJM's p25 solar price jumped 14%** after several quarters of modest growth, experiencing a PPA price increase of $6 from Q4 2021. In a region that already has high costs of development, global supply chain constraints converged with interconnection queue reform delays to give PJM solar its largest p25 price increase since the beginning of 2021.
- **MISO solar p25 PPA price fell 2%**--its first decrease since Q2 of last year. MISO solar, which followed a 7% drop in Q2 of 2021 with a 19% increase in Q4, has fluctuated more than most other markets in recent quarters. In keeping with that trend, MISO solar's p25 price experienced a $1 reduction this quarter, the only decrease across all markets and technologies. MISO wind project inventory has dwindled recently, with the past two quarters seeing offers from fewer than five projects each.
- **SPP solar continued to see large price increases quarter over quarter and wind prices went up slightly.** For the third time since the beginning of 2021, the p25 price of SPP solar climbed more than $4/MWh in a single quarter. Following a slight dip in Q4, SPP solar pricing rebounded, with an increase of over $5, or 14%. In contrast, the SPP wind p25 price rose approximately 4% ($1) for a second consecutive quarter of stable growth.

U.S. Renewable Energy Marketplace

PPA Prices and Forecasted Economics

Figure 4. Current PPA Prices: Q1 2022



PPA prices shown above reflect flat, hub-settled, unit contingent offers received in Q1 2022. Markets and technologies with offers from fewer than five distinct projects are not shown. Some offers shown may no longer be on the market.

Prospective buyers need to understand two components of the PPA market: raw pricing, and the forecasted performance of PPA contracts against wholesale market prices. The range of PPA prices available on the market in Q1 2022 is shown in Figure 4, while Figure 5 hones in on the forecasted economic performance of the 25th percentile of forecasted PPA cash flows, under five scenarios.

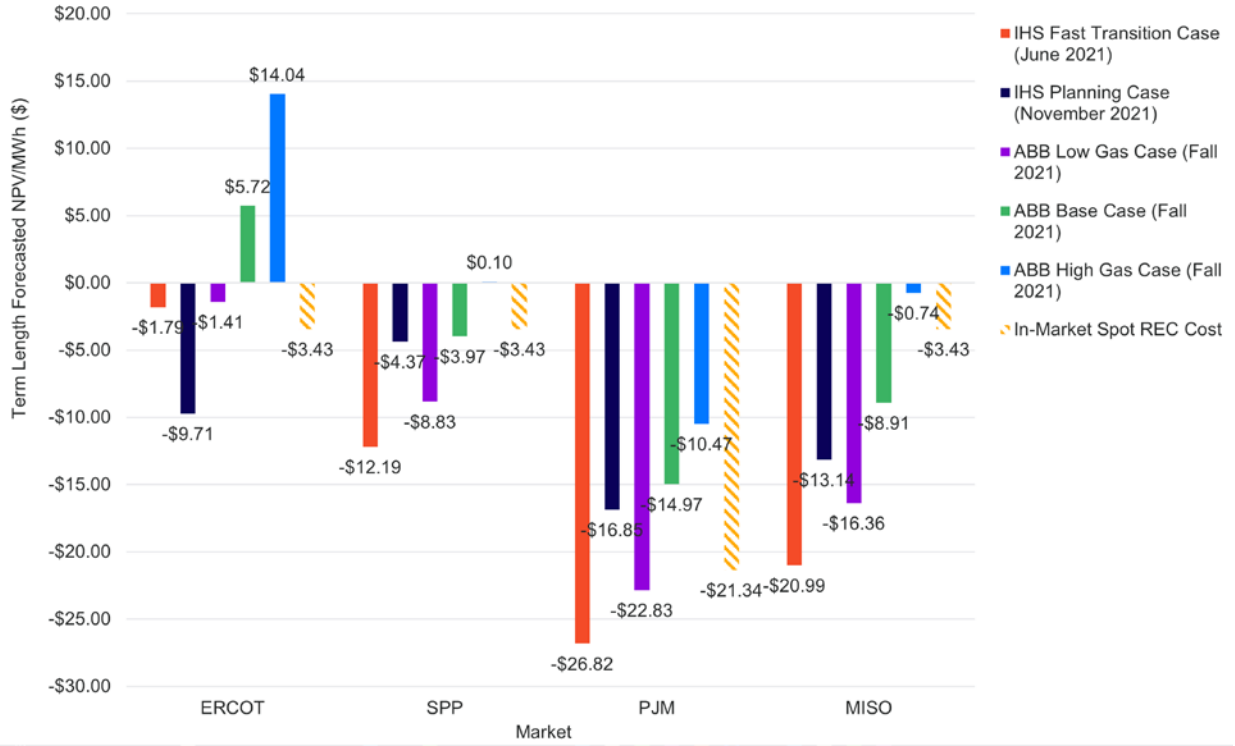
Buyers often weigh the tradeoff between the forecasted cash flows they would expect from a long-term renewable energy PPA and the cost of purchasing RECs from the current spot market. Figure 5 illustrates those tradeoffs, with the yellow striped bar showing the current spot REC price for that market and the other bars indicating scenarios for cash flow over the contract term. Takeaways from the comparison are:

- **ERCOT boasts the strongest forecasted renewable VPPA economics of any major U.S. market.** Higher on-peak market prices and anticipated price spikes at times of scarcity result in generally higher capture prices for renewable VPPAs in ERCOT. Solar is the dominant technology in ERCOT, and its on-peak production profile results in strong forecasted bid economics.
- **In ERCOT, IHS Planning Case offers prospective buyers the most conservative view.** The November 2021 IHS Planning Case in ERCOT generally shows lower on-peak market prices, as it assumes higher levels of renewable penetration and changes in market fundamentals. While the IHS Fast Transition case offers the most conservative view in other markets, the more recently published Planning Case provides an ERCOT scenario where significant market changes would pose the greatest cash flow risk to buyers.

U.S. Renewable Energy Marketplace

PPA Prices and Forecasted Economics

Figure 5. Q1 2022 p25 Bid Economics Across Third-Party Forecasts by Market



Forecasted economics shown above reflect p25 bids for flat, hub-settled, unit contingent offers received in Q1 2022. Markets with offers from fewer than five distinct projects are not shown. Forecasted economics do not differentiate between solar or wind offers. Some offers shown may no longer be on the market. Term NPV/MWh values assume an 8% discount rate. Spot REC costs are for 2022 vintages as of March 25, 2022, as published by S&P Capital IQ.

- **SPP is forecasted to offer the next best project economics.** While SPP follows ERCOT in terms of forecasted economics, the step down in NPV/MWh from ERCOT to SPP is significant under four out of five scenarios. The exception is the IHS Planning Case, which forecasts the p25 cash flow in SPP to outperform that in ERCOT. In SPP, the dominant technology on the market is wind, which tends to capture more off-peak pricing than solar and experience higher levels of market price suppression as a result of renewable penetration.
- **ERCOT and PJM bid economics are comparable to unbundled REC costs.** RECs across ERCOT, SPP, and MISO are selling for around $4.00/REC as of the end of Q1 2022, while RECs in PJM are trading around $21.00/REC. At these price points, only ERCOT and PJM bid economics are forecasted to offer comparable value to unbundled in-market RECs. SPP and MISO bid economics are expected to be more expensive than today's unbundled in-market RECs in nearly all scenarios.

U.S. Renewable Energy Marketplace

Uncertainty Spiking in the Solar Market

Reflecting on Q1 2022, the following trends are prominent in the U.S. renewables market:

PPA prices continue to rise, facing supply and demand imbalance

In line with their upward trend over the past two years, PPA prices for wind and solar continued to increase during Q1 2022. Demand for renewables remains strong, with corporations having ambitious, publicly-stated renewables procurement goals, retailers seeking to offer renewable products, and utilities fulfilling renewables requirements.

On the supply side, while projects are being marketed, those that are able commit to firm prices without sharing significant risks are hard to find. Developers are frequently finding cost inputs to be on the rise and challenging to hedge. One example is transportation, where some equipment manufacturers have made the cost of shipping a market-indexed, rather than a fixed price. Uncertainty is another variable at play, as the quarter closed out with the opening of a federal government investigation into solar panel tariff circumvention, which is expected to put the availability and cost of approximately 80% of module supply in question for multiple months.

Solar developers struggle with uncertainty in the wake of Commerce's tariff circumvention investigation

Many solar projects' prices, panel supplies, and online dates are in limbo following the U.S. Department of Commerce's announcement at the end of Q1 that they will investigate an allegation of tariff circumvention. The U.S. government began imposing tariffs on solar panels imported from China in 2018, and further extended these tariffs through 2026 this past February.

The petition Commerce is investigating alleges that Chinese manufacturers have circumvented the tariff by shifting minor final production steps to Thailand, Malaysia, Vietnam, and Cambodia. The petition requests antidumping/countervailing duties be imposed in the range of 19% to 525%. Commerce's preliminary findings are due on August 29th. In an effort to assess the potential outcome, some project developers have rescinded their solar bids from buyers' consideration. Additionally, contracted projects that are still under development and do not yet have U.S.-manufactured or warehoused panels allocated to them are at risk of schedule delays.

Forced labor prevention law targets solar supply chain

Another headwind the solar manufacturing sector faces is a U.S. law targeting forced labor prevention in China. The Uyghur Forced Labor Prevention Act, which will be enforced starting in June, requires U.S. Customs and Border Protection to assume that goods from the Xinjiang region of China were manufactured using forced labor. Importers may produce evidence to rebut this assumption, but a high burden of proof prevails due to the opacity of today's solar supply chain. This law, as well as the tariffs on Chinese panels, incentivize developers to select domestically manufactured panels, but cost and availability are a concern, as domestic manufacturing capacity is small relative to the size of the U.S. solar development pipeline.

Most commonly marketed online dates are in 2024 and beyond

While buyers are often interested in nearer-term online dates, relatively few projects on the market today meet that criteria. Compared to Q4 2021, there were 30% fewer projects offering anticipated online dates in 2023 and a 30% increase in those offering anticipated 2024 online dates. The number of projects expecting to come online in 2025 or later spiked by 90%. Most of the projects expected to come online in the later timeframe were offered in PJM, where interconnection queue reform has delayed some project timelines by several years.

Regarding all markets, multiple developers have noted gaps in their development pipelines, either due to solar panel supply being unavailable, or due to the pandemic's impact on the development process, which has slowed the progress of in-person meetings, onsite reviews, and other critical components to moving a project forward.

U.S. Renewable Energy Marketplace

Structuring Contracts to Mitigate Risk

Buyers explore different contract structures to mitigate cash flow risk

With PPA prices on the rise and economic performance forecasted to result in a cost to the offtaker under most scenarios (see Figure 5), developers and buyers are working together on non-standard contract structures that can mitigate a buyer's financial risk.

One structure, the revenue share, reduces a buyer's downside risk. The developer offers a lower PPA price in exchange for a percentage of the upside realized by the project. The appeal of this structure is that a buyer is exposed to a narrower range of market prices, those between the minimum floating price and PPA price, as the PPA price is lower than it would be under a standard structure. However, as PPA prices have gone up on the whole, this structure has become less attractive to buyers. A similar structure, a fixed or indexed market discount, has a floor price, and offers upside sharing through settlement against a fixed or indexed discount to the market price. This structure has been more commonly offered in Europe than in the U.S. thus far.

Another structure, a hedged PPA, locks in known cost for the buyer. Under a hedged PPA, sellers--typically developers who also have trading desks, or retailers or banks--manage the energy price risk and sell the project's RECs to the buyer at a fixed cost. This structure is attractive to buyers who are able to budget for RECs for an extended period of time, typically 10 to 15 years. While it is not known where unbundled REC prices will be over the course of this term, the hedged structure enables buyers to budget for a fixed price and not contend with the volatility of the wholesale energy market or the REC market.

A third structure locks in a known cost for RECs in the short term and reduces a buyer's downside risk on a PPA in the longer term. Under this structure, a buyer would contract a fixed price for project-specific RECs for a short term--for example, three years--while the developer sells the project's energy to a different offtaker. The revenue earned in these early years enables the developer to offer a lower 10 to 15-year PPA to the corporate buyer, beginning a few years into the project's life. As with the revenue share structure, this is appealing to buyers seeking to reduce their downside exposure and tighten the gap between minimum floating price and PPA price.

U.S. Renewable Energy Marketplace

Environmental Commodity Prices Fluctuated in Q1

Compliance RECs hit historic highs while National RECs fell in a volatile Q1

After a very steady Q4 2021, REC markets saw volatility in Q1 2022. As seen in Figure 6, National RECs priced between $4 to $5/REC at the outset of the year, fell precipitously at the end of February, and bottomed out below $3/REC towards the end of the quarter.

There are several theories for this drop, including traders selling off environmental commodities in reaction to the uncertainty and turmoil brought on by the war in Ukraine, but there were no major market changes that caused this disruption. Conversely, compliance RECs in PJM reached all-time highs at the beginning of Q1, with NJ, MD, and PA Tier 1s surpassing $22 at the peak. While those Tier 1 PJM RECs also declined in the earlier part of March, they have already begun to rebound significantly.

Figure 6. National REC Prices, 2022

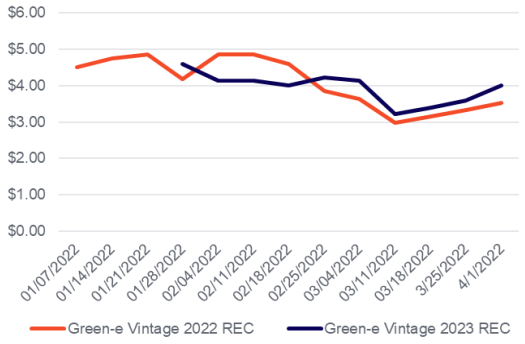


Figure 7. PJM Tier 1 REC Prices, 2022

After relentless price increases, the carbon offset market dipped in Q1 2022

Due to significant investments and policy updates in 2021, the market for carbon offsets has exploded, with prices on projects often tripling compared to the previous year's prices. While there is an increase in demand from end-users, the jump in prices is attributed more to increased activity from traders and speculators.

With the political turmoil of the war in Ukraine, many traders sold their positions in the carbon market, leading to a significant decline in prices. This decline was mostly realized in the "baseline" types of projects that are commoditized, rather than in premium carbon offset projects' prices, which have remained largely unaffected by the drop. In the big picture, current pricing remains far above historic pricing of 2020 or early 2021.

U.S. Renewable Energy Marketplace

Wholesale Markets Roundup

PJM procurement options limited as queue reform proposal takes shape

Prospective buyers in PJM will find few projects available to come online sooner than 2025 due to a queue reform process that may begin later this year. While the reform process must first be approved by the Federal Energy Regulatory Commission (FERC), the draft proposal involves accepting no new interconnection applications for nearly two years while PJM clears the backlog of projects awaiting review and implements a new approach to conducting interconnection studies.

Buyers seeking to source PJM projects must pay careful attention to the project's queue position. The current reform proposal prioritizes queue positions AG1 or earlier, as well as a few "fast track" exceptions for projects with low upgrade costs. The next positions, AG2 and AH1, would not be scheduled to start review until Q3 2024. Projects with mature queue positions are expected to be contracted quickly due to their relatively de-risked interconnection status.

In ERCOT, contracts move forward with caveat for change in law

While ERCOT remains an attractive market for renewable buyers, ongoing regulatory proceedings have caused uncertainty around contract economics that could impact both buyers and sellers. The Public Utility Commission of Texas (PUCT) is expected to continue redesigning some fundamental elements of the ERCOT market through the first half of this year. Despite the uncertainty of what the final product will look like, Edison Energy has seen parties find creative solutions to contract around the risk of regulatory changes and expects to be able to continue to do so going forward.

SPP sets renewable penetration record and seeks to ease congestion constraints

SPP, with its plentiful wind resource, set renewable generation records in Q1 and continued to be the hottest market for wind project development in the country. Prospective buyers will want to be aware of the pricing fundamentals in this market, as well as the interconnection delays that some development-stage projects are facing in the region.

Buyers will want to include negative pricing protection in SPP contracts due to the frequency of wholesale market prices dropping below $0. The large amount of wind generators operating in southern SPP has caused considerable congestion, driving these negative prices. With 5 GW of additional wind generation slated to enter the generation mix in the remainder of 2022, this risk for congestion and negative pricing is not expected to wane. While SPP's renewables generation is record-setting – serving over 90% of its load with renewable energy and achieving 88.5% renewables penetration at times in Q1 2022 – transmission improvements are needed to better manage the wealth of renewable power on the system.

An effort at transmission improvements is in the early stages in SPP, but buyers should be aware that this could delay online dates for some projects under development. The MISO-SPP seam study was released in early March with a goal of helping to alleviate the congestion along the constrained border between MISO and SPP, thus allowing more generators to connect to the grid.

The transmission project is expected to enable between 28 and 53 GW of additional generation across the two regions to help solve a host of reliability constraints. The new transmission will allow generators - previously unable to afford expensive upgrades on their own and potentially dropping out of SPP's interconnection queue - to connect to the grid. These upgrades are expected to allow more renewable generation to clear the SPP queue and meet growing demand. The project is still awaiting approval from the boards of both MISO and SPP. Additionally, future financing still needs to be secured, a topic to be discussed during workshops planned for Spring 2022.

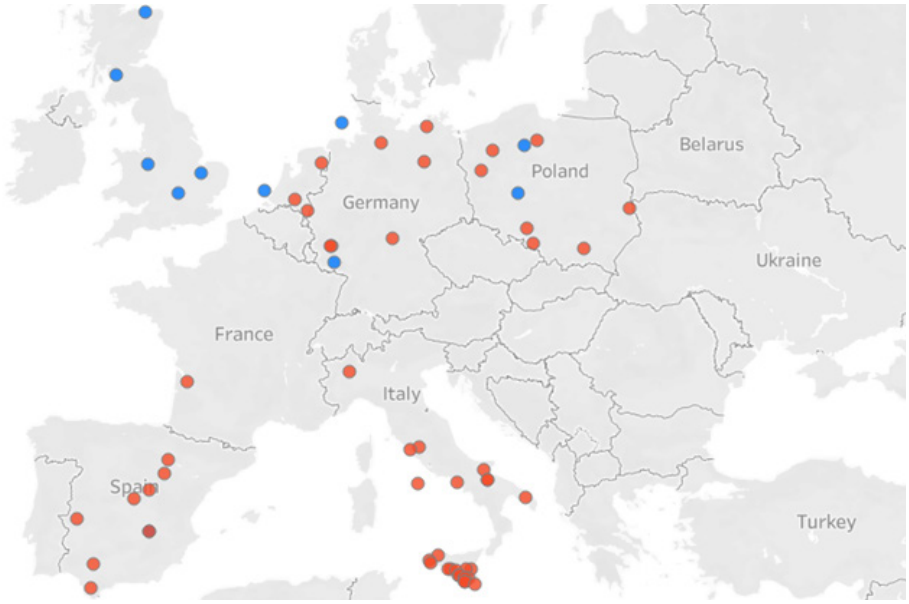
Interest in MISO has picked up as buyers look to diversify renewable energy portfolios

In Q1, MISO stood out as a market of interest for experienced buyers looking to diversify their PPA portfolios. While northern MISO has historically offered a wealth of wind project options, the projects on the market in Q1 were primarily solar. The solar projects were mostly concentrated in Illinois, Indiana, and Arkansas, as well as the southern portion of Louisiana. Most of the projects on the market are fairly early-stage development assets, with interconnection being the longest lead item.

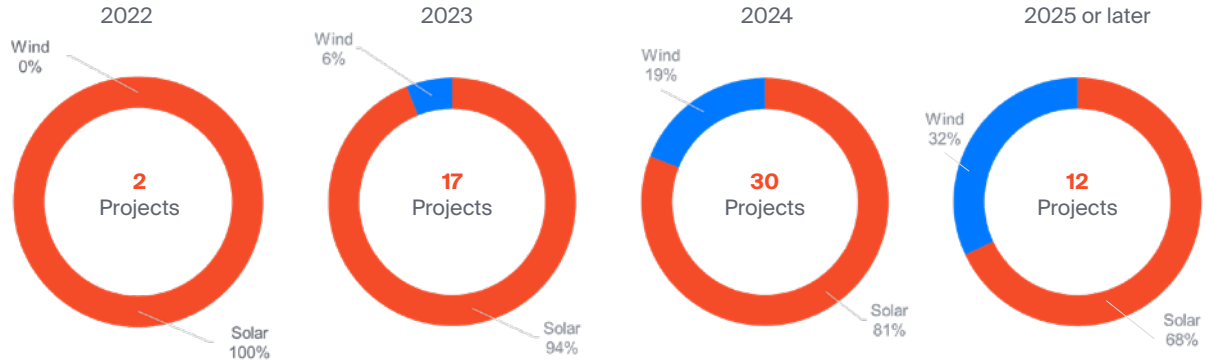
European Renewable Energy Marketplace

Project Availability

Figure 8. Altenex Energy's European Renewable Energy Marketplace – Available utility-scale projects in Q1 2022



Anticipated Online Dates



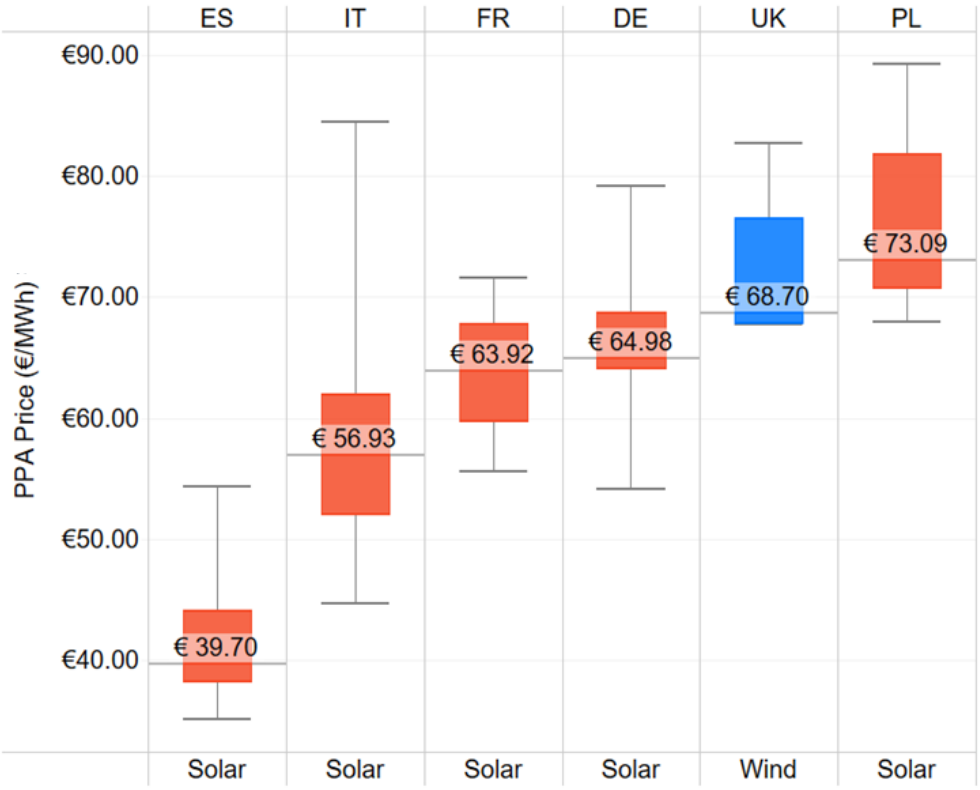
In Q1 2022, the many challenges facing the energy market continued to take a toll on the renewable energy industry. Despite these challenges, however, corporate buyers continue to show an increased appetite for renewable power, GOs, and carbon offsets. Altenex Energy has seen the following trends:

- **Renewable energy PPA prices increased significantly in 2022**, in line with pricing across the broader ecosystem.
- **Supply of renewables is constrained**, as developers aim to leverage high spot market prices.
- **Challenges persist across supply chains** due to uncertainty around the U.S. solar import tariff investigation.
- **Mixed regulatory regime signals persist**, with the REPowerEU framework driving renewable adoption. Local regulation, however, includes increased levies on renewable revenues in certain geographies.
- **Volatility continues to translate into the GO** market, echoing power and gas markets.

European Renewable Energy Marketplace

PPA Pricing Trends

Figure 9 Current PPA Prices: Q1 2022



PPA prices shown above reflect flat, market-settled, unit contingent offers received in Q1 2022. Markets and technologies with a small number of projects offered are not shown. Some offers shown may no longer be on the market.

In light of the increase of wholesale market prices, PPA pricing across Europe has also seen an upwards trend across most of the geographies.

- **Spain continues to show some of the strongest economics for renewable projects** across the continent, averaging around €40/MWh. This leadership position is built mainly on good solar resources, a considerable supply pipeline, and a government support scheme towards energy intensive companies in signing a PPA.
- **Italy is showing a very wide range of pricing, reflective of the regulatory uncertainty in that market.** Significant permitting delays, coupled with likely government intervention, among other factors, are making developers add a risk premium into their bids to varying degrees. As such, median pricing stands around €57/MWh, but ranges vary significantly.
- **France and Germany are somewhat comparable** in terms of pricing, and fall within the €64-65/MWh range.
- **UK and Poland remain some of the more premium markets for corporate PPAs**, with pricing reaching €73/MWh in Q1 2022.

As an industry, we've seen developers re-pricing and re-adjusting bids more frequently.

European Renewable Energy Marketplace

PPA Landscape Across Europe

Europe sees high PPA prices

Mirroring the high wholesale energy prices, PPA prices have increased across Europe overall. To align with this shift, developers began offering floating price structures as a way to de-risk projects. Such structures closely track the market price and limit the risk of price volatility for the seller on the upward swings. Similarly, we've seen an increase in hybrid structures, which entail a combination of fixed price and floating price-all with the aim to split the risk between the buyer and seller in the current environment.

Spain maintained its position as the most attractive renewable energy market with competitive PPA pricing for solar energy projects, resulting in the largest number of volumes contracted there. At the same time, emerging markets such as Romania saw the launch of first-time corporate PPAs, while Hungary signed its largest corporate PPA agreement at 26 MW.

Buyers remain interested in renewable energy contracting

Corporate interest in meeting sustainability targets resulted in continued demand for renewable energy sourcing. However, supply could be challenged in the short term. This is being driven by the ongoing energy crisis, skyrocketing gas prices, and geopolitical unrest. Buyers looking to secure long-term projects to cover their green electricity needs are indirectly competing against potentially reduced supply, as developers are looking to capitalize on the high energy prices by leaving more room in their portfolio for merchant strategies.

The high energy prices, however, are driving certain customers--notably energy-intensive manufacturing industries--to seek long-term contracts to help mitigate the impacts of the high-pricing environment in the long term. For example, large manufacturing operations require similarly sized energy consumption, coupled with a large share of energy costs out of total production costs. This makes this market segment more exposed to the volatility and market uncertainties currently at play in the energy market. PPAs are one of the fundamental tools for a long-term solution that would enable these players to sustain operations in a profitable and predictable manner.

One recent example involves a large aluminum producer that has signed a 10-year PPA in the Spanish market for a sizeable annual volume of 1,300 GWh. This has enabled the company's smelter facilities to resume and reactivate operations after two years of interruptions due to rising electricity prices. Altenex Energy is seeing these large industrial producers continue to engage in long-term and fixed-price transactions moving forward. Supply chain constraints will continue to put more pressure on the development of renewable projects, exponentially triggered by geopolitical tensions. This will further limit the supply and availability of renewable projects available for corporate PPAs.

European Renewable Energy Marketplace

Environmental Commodities Markets

Market turbulence persists for European Guarantees of Origin (GO)

The Russian war in Ukraine and the ripple effect of sanctions on the GO market has manifested with generic EU GO prices dipping significantly. This is despite an initial price increase at the beginning of 2022, which saw pricing rise from ~€1.70/MWh, peak at ~€2.40/MWh, and then dip to ~€1.60/MWh.

These dips in GO pricing have been aided by rising European power prices that have incentivized hydropower producers to increase generation. Further dips in GO prices are expected, as long as volatility in energy markets persists. This volatility is expected to shift liquidity from GOs to physical power and gas commodities.

Despite headwinds, market activity for GOs increased at the start of Q1 2022 due to looming electricity disclosure deadlines scheduled for the end of Q1 2022 for most European countries. Corporate buyers remain interested in forward year production GOs for 2023-2025.

There are indications that the UK BEIS will initiate consultations for the removal of GOs, feed-in tariffs (FiT), and CfD levy exemptions for electricity imported from the EU. This is in response to the lack of reciprocity for UK REGOs in the EU. The UK BEIS has proposed a timeline for the implementation of these changes to begin in Q4 2022 or Q2 2023. If this consultation becomes legislation, Altenex Energy anticipates an increase in REGO prices, as EU GOs constitute ~35% of UK total demand for green electricity.

Earlier this year, several Eastern European countries launched a project to create an electronic system for GOs slated to launch in June of this year. If the project does come to fruition, it is expected to increase GO cancellation in the region (mostly net importer countries), which may put upward pressure on GO prices overall.

Carbon market pricing fell in the past quarter

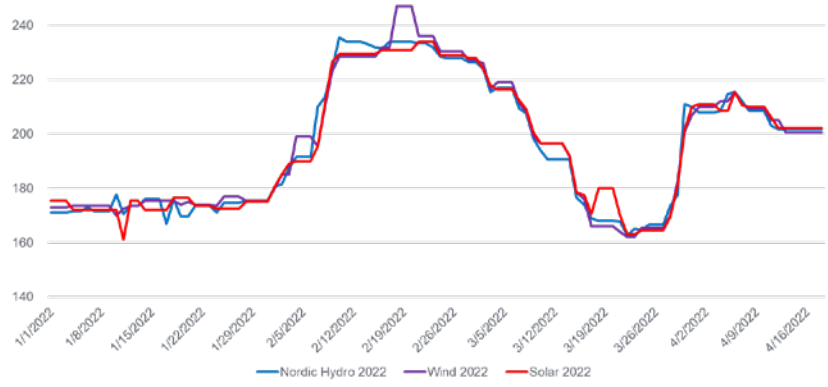
Due in major part to the war in Ukraine, both compliance and voluntary carbon markets pricing dropped significantly during the first quarter of 2022. The compliance market in Europe, or EUAs, dropped rapidly from nearly €100/tonne to around €60/tonne before bouncing back to the current around €80/tonne level.

Because Europe now wants to expedite its shift from natural gas, stronger support for renewables has had negative pricing impacts on EUAs. While these drops have been significant, pricing remains far above early 2021 pricing.

While coal will increase its position in the short-term generation mix, existing renewables targets will increase at a faster rate.

On the voluntary carbon markets, standard projects (those without strong co-benefits) are also trading above early 2021 pricing, starting at around $6/tonne. Notably, price drops directly impact more tradeable products on the voluntary market, with high-impact, high-demand projects able to maintain and raise prices despite overall market drops. This may be particularly true of Europe, which has a higher percentage of niche, new-technology projects.

Figure 10. GO Pricing (Eurocents)



Source: Greenfact

European Renewable Energy Marketplace

Country Overviews

Spain is progressing towards renewable stewardship

Spain continues to be the frontrunner in renewable corporate PPA adoption, aided by some of the most favorable corporate PPA economics. As such, it has been cited by the EU as a model that can help guide countries seeking to decarbonize. Separately, Spain has continued to support renewable development, most recently through their economic recovery investment package, which allocates close to 7 billion euros to the energy transition.

Corporate offtakers will find a wide range of PPA opportunities in Spain. Variety exists around several different price structures, including additional and traditional fixed-price offers and a discount-to-market with floor structure, which is currently popular across Spain. The Spanish PPA market appears to be flexible around offtake structures, including the traditional pay-as-produced and baseload structures, while corporate offtakers may seek out hybrid power plants such as solar PV plus onshore wind.

Spain has set an ambitious offshore wind target of 3 GW by 2030, which will be met primarily via floating installations. The government has also requested EU leaders to deploy a new national energy market design that allows for the decoupling of renewable energy and gas generation prices. Such an approach conflicts with the EU framework and guidelines, with further debate expected.

Significant steps in renewable adoption in Italy

Italy has been taking significant steps to become one of the most competitive markets in Europe. As a country that relies heavily on gas imports, its renewable energy adoption has been stalled by cumbersome permitting procedures and restrictions around development on agricultural land.

With highly competitive PPA prices, the Italian PPA market provides corporate offtakers with various price structures, tenors, and sizes for the projects. Although most of the projects are solar, some wind projects are also available.

One of the biggest challenges that we have seen across the market is permitting delays. Therefore, offtakers should consider this when creating their procurement strategies. However, we have recently seen the Italian government be more responsive to permitting requests in the wake of the Russia-Ukraine war. As an example, construction approval was granted to six wind farms with a total capacity of 420 MW. These are encouraging signs for the industry overall, as Italy currently has more than 130 GW in the pipeline waiting for permitting authorization.

In January, the Italian government proposed law DL Sostegni Ter 04/2022 to mitigate the impacts of soaring prices, including a clawback mechanism for renewable power plants, among other measures. A revised version limited the clawback payments to subsidized solar plants and unsubsidized older plants that predate 2010. Additionally, the government is considering a 10% one-time tax on profits earned by energy companies of a certain size and within a specific timeframe. Further developments are expected later this year.

Eastern and Southeastern Europe Overview

Prior to the current geopolitical upheaval, Eastern Europe was emerging as a promising market for corporate PPAs. Many countries were on the verge of holding renewable auctions with government support to meet their goals. Plans are set in place to join the GO certification system in phases slated to start later this year. Slovenia and Serbia are planning to establish the first regional power exchange for Central and South-

European Renewable Energy Marketplace
Country Overviews

Eastern Europe. Other countries are signing many firsts in the realm of corporate PPAs. As the market is still in its infancy, the current disruptions could alter the course of the region in terms of renewables procurement.

Significant renewable pipeline for Albania

Albania's TSO expects that wind and solar connections will exceed 220 MW next year. That level is up to 10 times its current wind and solar installed capacity. Currently, Albania does not have wind power plants, although there are 7 GW of potential renewable capacity, according to IRENA — up to three times more than the current total installed capacity. To support this, the government is conducting an onshore wind tender to secure up to 150 MW, with bids currently underway. Due to ongoing uncertainties in the market, the dea dline has been extended to Q2 2023.

With a mostly hydropower fleet, the country relies on imports when conditions are not favorable (in low rainfall years, imports have reached 40%). A predominantly renewable energy mix would bring more fluctuations in supply and voltage. The government is considering alternative solutions to mitigate these impacts, including interconnection points, energy storage, and demand response mechanisms. The country is also considering adding offshore wind projects, although these are currently in the research phase.

Bulgaria sees its first sleeved PPA agreement

Among other firsts in the Eastern European market, we have seen the first sleeving agreement on the Bulgarian market. This PPA structure was signed by a telecom provider to secure 20 GWh/year of output from a 33 MW solar farm for 10 years. The renewable developer will also firm the volume from the pay-as-produced profile to a client load profile.

Large renewable auction to take place later this year in Croatia

Several key legislations were adopted in 2021, including the Low Carbon Development Strategy until 2030, with a view to 2050, and the Renewable Energy Sources Act. Both laws strengthen the position of renewable energy projects and set more ambitious national targets.

Croatia is looking to conduct its first large renewable auction supported by the government in Q3 of this year. Initial interest from investors is high, with over 2 GW of capacity requests submitted so far.

Overall estimated investment is expected to reach 1 billion euros in 2022. The Croatian renewable energy pipeline includes more than 1,100 MW to be installed over the coming years. Corporate offtakers can expect PPA pricing to range between €55-65/MWh. In December, the first Commercial PPA deal was made between wpd and Danske Commodities, opening the market for more renewable energy opportunities.

Hungary signs its largest corporate PPA to date

Altenex Energy is also seeing a growing number of large industrial producers engage in long-term transactions with fixed prices. For example, a construction company signed one of Hungary's first and largest PPA agreements signed for a 26 MW solar farm for 15 years.

Montenegro to hold government auction to support renewable development

Montenegro will join other countries that use auctions as an avenue to support renewable development, with a new law slated to support development and transition mechanisms to a day-ahead market. This comes in the aftermath of last year's decision to stop the FiT scheme, as it surpassed its renewable energy target of 33% for two years in a row.

Romania sees its first long-term corporate PPA transaction

Romania will hold its first renewables tender in the first half of 2022, with plans for at least 3 GW of renewable capacity to be added by 2026. The country also saw its first long-term corporate PPA transaction in Q1 2022, when an automotive manufacturer entered into a contract to purchase 70 GWh of electricity from a 226 MW wind farm in Casimcea.

Uncertainties within the regulatory regime of bilateral PPAs has been the root cause of sluggish PPA adoption in the Romanian market, although a legal amendment formally allowing such contracts has been announced.

However, the Romanian government has decided to extend the windfall tax to March 2023 in order to finance consumer subsidies for power and gas bills. This tax imposes an 80% tax of realized revenues for renewable developers when the spot price exceeds €91/MWh.

European Renewable Energy Marketplace

Significant Disruption and Uncertainties May Persist

As 2022 progresses, Altenex Energy anticipates the following trends

High pricing environment

While the energy crisis continues to grip Europe, it has had some positive impacts on renewables in general, and PPAs in particular. The recently launched REPowerEU platform is a testament to the commitment that the region is showing towards long-term decarbonization.

The short-term PPA markets have taken hits due to increased supply chain issues on hardware and rising permitting delays, among other factors. As the war in Ukraine rages on, regulators and market players are re-thinking and re-designing European energy markets. This will lead to more opportunities for PPAs, which will play a primary role in this new design. These opportunities are not limited to PPAs: onsite renewables are a way to maximize benefits in the midterm, aided by improved economics when current market prices are considered. The same holds true for energy efficiency projects. Local flexibility and potentially spot markets are spearpoints for TSOs and DSOs to deal with grid congestion as a midterm solution. Beginning in the midterm, we are starting to see the large-scale benefits of hydrogen as one of the primary ways to reduce Europe's reliance on natural gas from Russia.

Coal will linger a while longer

Due to persistent high gas prices in Europe, driven by the war in Ukraine and general supply constraints, we expect coal to overtake gas in the generation mix for most of 2022. Coal prices and/or carbon prices would have to increase while gas prices fall to spur a fuel switch. This anticipated rise in coal use will see a potential increase in emissions in countries with higher shares of coal capacity if no countermeasures are pursued.

Additionally, EU governments are also discussing the potential delay of planned coal and nuclear phase-outs due to security of supply concerns around reduced gas generation. Countries with high dependence on gas and coal imports are looking to quickly replace Russian sources with alternatives, although this may come with a higher price tag.

Policy changes to accommodate high pricing

The EU recently released the REPowerEU platform to reduce its purchase of Russian gas by two-thirds before the end of the year and replace it completely by 2027. Among several measures aimed at achieving this goal, the EU is proposing to accelerate the rollout of renewables, speed up permitting processes associated with renewables, and provide financing mechanisms to enable PPAs in Europe. This will position the EU for the industry-wide goal of greater energy independence in the long term. Further information is expected to be released this summer.

Repower EU

Accelerate renewables and energy savings	• Insulates homes • Frontload investments • Speed up completion of wind parks and solar power plants
Accelerate renewables and energy savings	• Insulates homes • Frontload investments • Speed up completion of wind parks and solar power plants
Accelerate renewables and energy savings	• Complete critical links (PT-ES-FR, BG-EL) • Full synchronization of power grids (Baltics) • Financing and technical assistance

European Renewable Energy Marketplace

Significant Disruption and Uncertainties May Persist

Targets in Germany, France, and the Netherlands

Over recent months, several countries have updated their climate targets, notably Germany, France, and the Netherlands, due to newly elected governments or upcoming elections.

The new German government is aiming to supply 80% of electricity demand from renewable energy by 2030. Tender volumes are being updated accordingly to target an installed capacity of 200 GW of solar PV, 30 GW of offshore wind, and approximately 90-120 GW of onshore wind.

After a record nine- month negotiation, a new Dutch government was formed in January. Accordingly, national climate targets have also been updated, with 22 GW of offshore wind now being targeted by 2030--nearly double the previous target of 11.5 GW. A 35 billion euros Climate Fund is also being established to support the decarbonization of heating, the development of hydrogen infrastructure, and the expansion of electricity grids. In addition, it was announced that the flagship subsidy scheme SDE++ will have 13 billion euros allocated for this year's auctions for various hydrogen and CCS projects, among others.

In February, French President Emmanuel Macron announced new renewable targets for 2050, aiming for 100 GW of solar PV and 50 GW of offshore wind. Unfortunately, the onshore wind target of 37 GW has been pushed out from 2030 to 2050.

Overall, a push from the EU and member states for more renewables shows there is domestic opportunity to replace fossil fuel imports, as well as an opportunity for developers and offtakers to drive the decarbonization of the energy sector.

Clawback policies act as a short term disruption

As the high energy prices continue to strain consumers in Europe, governments are looking to put in place measures to protect consumers and mitigate this impact. One avenue includes a windfall tax on profits, which are profits that renewable projects will garner based on the current high-pricing environment. This flips the paradigm of government subsidies being utilized to temporarily bridge the cost gap for renewables.

To ease the short-term burden that consumers will face as a result of the REPowerEU framework, the EU has enabled member states to take actions that include levying temporary taxes on windfall profits of energy companies, as long as these actions do not apply to PPAs or bilateral transactions and do not create market distortion. As a result, many states have either proposed or extended laws to tax extra profits.

The Italian government has also proposed a law to clawback income above a historical average until the end of 2022 for renewable power plants that may or may not benefit from governmental support. The industry has pushed back successfully against the proposal—with support from trade associations-- to oppose this form of market intervention, claiming that it prevents countries from reaching Fit for 55 goals and stalls renewable development by decreasing investor confidence in the sector. As we continue to see uncertainty across the energy sector, countries are expected to enact various packages to mitigate the high-pricing environment and political ramifications in the long term.

Perspectives Round Up

You Don't Want to Miss This Expertise From Our Team...

Driving emissions reductions through fleet electrification

We meet our clients wherever they are in their electrification journey. Fill out the form below to get in contact with a member of our team and learn more about our work in the eMobility space.

Get in touch

[Driving Your Fleet Towards Electrification – A Fleet Mangers Guide to Electric Vehicles]

[Innovative deal structures will be key to growing corporate renewable energy PPAs in parts of Asia]

By Elana Knopp, Senior Content Writer

[Two years after the launch of the Blooming Grove Wind farm, a small town in America's heartland is thriving: "The school is now financially stable"]

By Elana Knopp, Senior Content Writer

[Five Key Takeaways on the SBTi Net-Zero Standard]

By Meg DiPoto, Sustainability Analyst

[Edison Energy's inaugural ESJ forum highlights the trailblazers driving a just and equitable energy future]

By Elana Knopp, Senior Content Writer

[With growing corporate demand and progressive policies, Canada could be the next big thing for renewables]

By Elana Knopp, Senior Content Writer

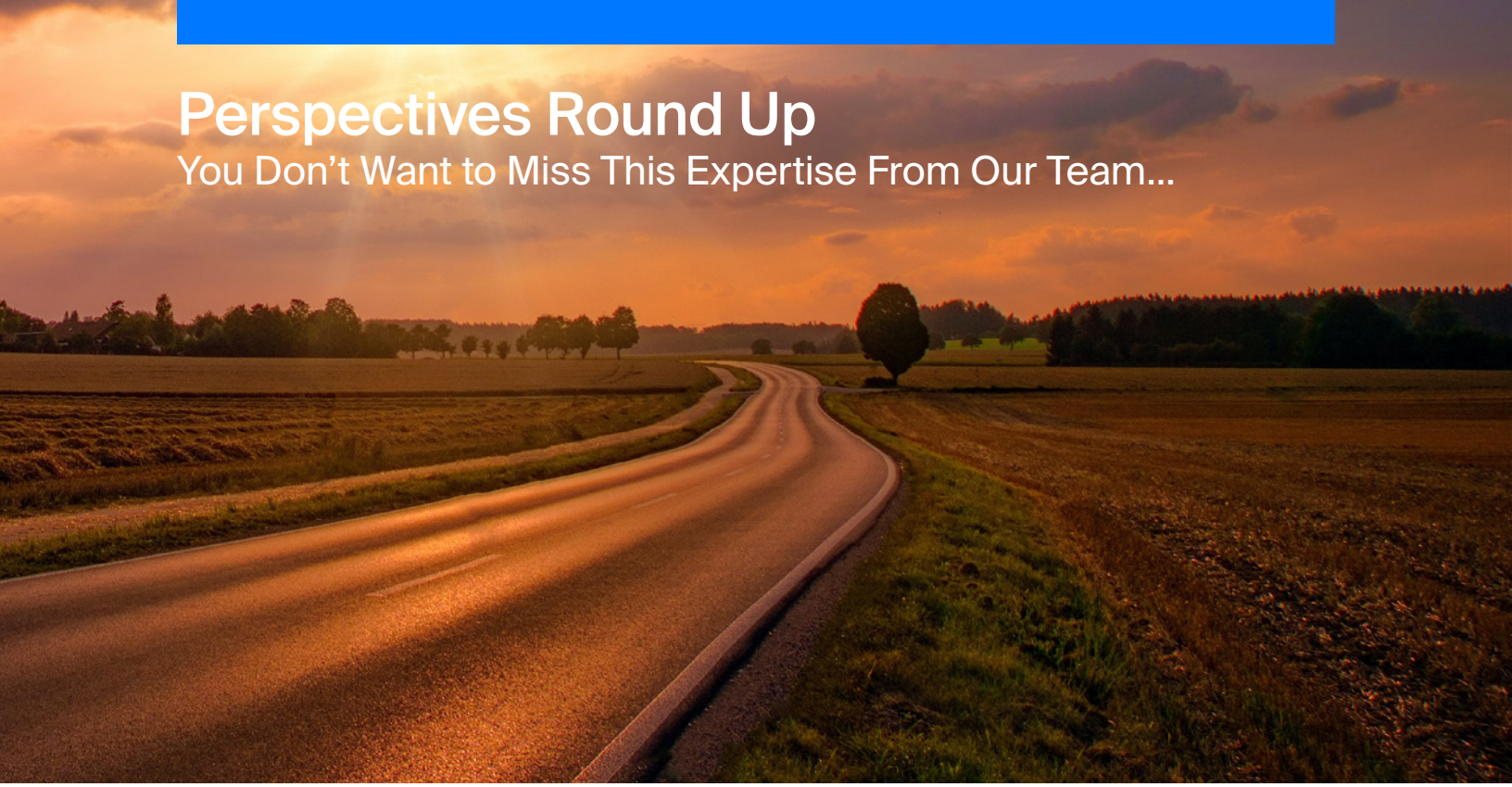
[Overview of the new SEC proposed mandate on climate risk disclosure]

[Unpacking the Infrastructure Bill's 5 Key Climate Investments]

By Shannon Weigel, Head of Policy

[These two trailblazing entrepreneurs are getting EV charging stations and people back to work]

By Elana Knopp, Senior Content Writer



Perspectives Round Up

You Don't Want to Miss This Expertise From Our Team...

[Enabling traceability will be key to Mexico's clean energy transition]

By Alberto Campos, Senior Energy Manager

[Market innovation, flexibility will be key to driving 24/7 carbon-free energy]

By Elana Knopp, Senior Content Writer

[With increased self-determination and years of advocacy, tribal nations are poised to play a major role in the clean energy transition]

By Elana Knopp, Senior Content Writer

[Greening the Grid: The evolution of emissions from purchased electricity]

By Erin Williamson, Manager, Energy & Sustainability Strategy

[Accelerate Auto Program will help drive decarbonization across the auto supply chain: "The barriers have always been capital and complexity"]

By Elana Knopp, Senior Content Writer

Looking for more insights?

Check out these ongoing series on our website:

Edison Plugged In shines a spotlight on the people, projects, and perspectives of the Edison Energy team.

Check out Edison Plugged In

Our **Visionary Voices** series features conversations with leading experts from across the industry. These thought leaders are driving innovation in energy markets and available solutions for commercial, industrial and institutional energy buyers. Their diverse perspectives and experience offer a real-time view into the transformation happening in the market today.

Check out Visionary Voices

EDISON energy®

GET IN TOUCH

Hannah Badrei
Vice President, Energy Supply Advisory
+1-206-718-6828
Hannah.Badrei@EdisonEnergy.com

Andor Savelkouls
Senior Director, European Energy Advisory,
Altenex Energy, BV
+31-30-800-9276
Andor.Savelkouls@AltenexEnergy.com

Shannon Weigel
Head of Policy
+1-773-897-3907
Shannon.Weigel@EdisonEnergy.com

Emily Williams
Vice President, Strategy & Sustainability
+1-617-681-4208
Emily.Williams@EdisonEnergy.com

Edison Energy provides independent, expert advice and solutions to help large corporate, industrial, and institutional clients better understand and navigate the choices and risks of managing energy. We enable decision-makers in organizations to deliver on their strategic, financial, and sustainability goals.

Through a comprehensive portfolio approach, we work with our clients to help them resolve the key challenges of cost, carbon, and the increasingly complex choices in energy.

For more information about Edison Energy visit www.edisonenergy.com.

DID YOU KNOW

Edison Energy operates under the name of Altenex Energy in Europe? With locations across The Netherlands, UK, Spain, and Romania, our team specializes in delivering integrated strategies that best meet the needs, goals, and objectives of our European clients in an evolving energy market.

Visit www.altenexenergy.com to learn more.

Edison Energy, LLC and its affiliate, Altenex, LLC, are registered as Commodity Trading Advisors ("CTA") with the Commodity Future Trading Commission ("CFTC") and additional information on Edison Energy and Altenex is available at https://www.nfa.futures.org.

April 2022

Exchange Place, 53 State Street, Suite 3802 | Boston, MA 02109

Global presence in: North & South America, Europe and Asia-Pacific