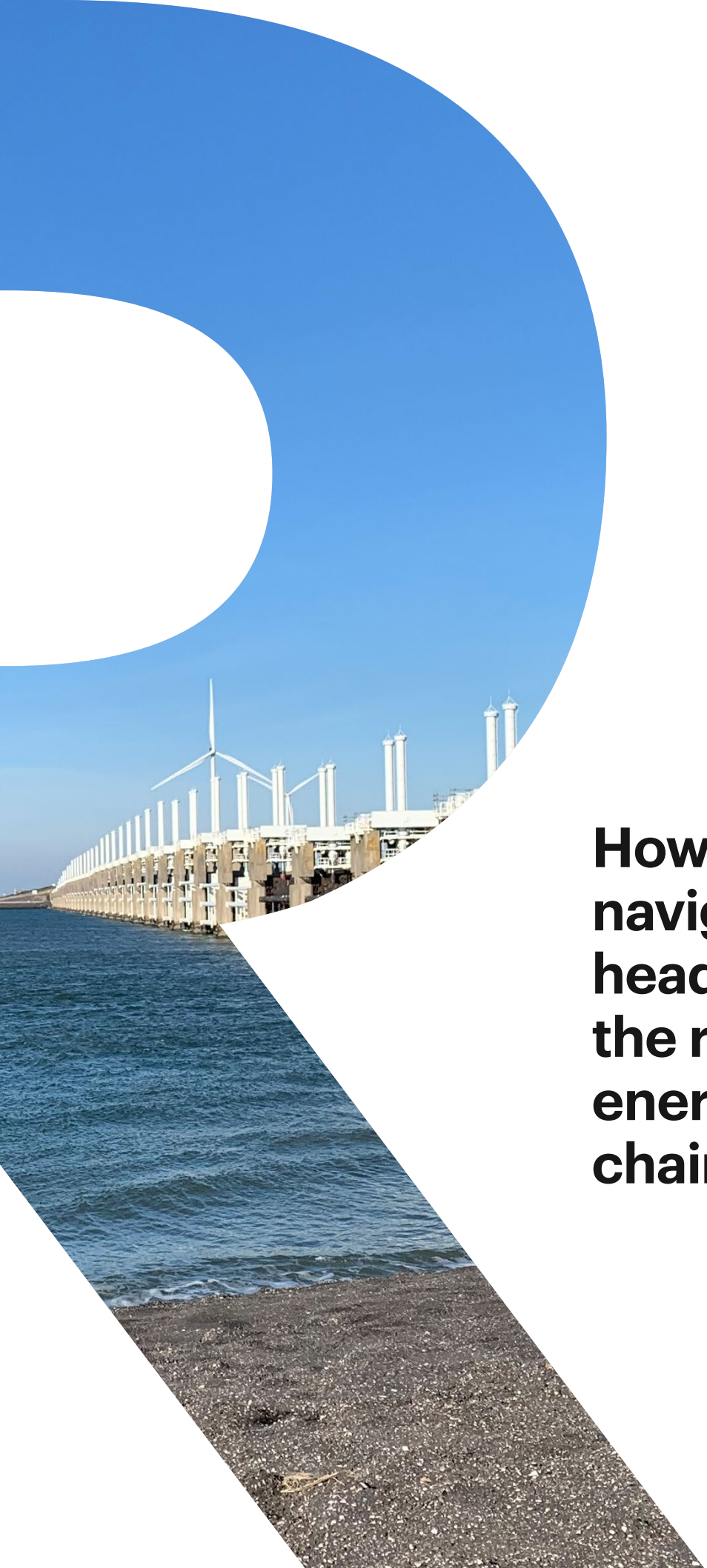

Photo by Jonas Lechner
Kearney, Munich

How to navigate the headwinds in the renewable energy supply chain

KEARNEY

The renewable energy supply chain is under pressure, with massive consequences for project developers. Demand for equipment is surging for everything from wind turbines to solar PV modules and hydrogen electrolyzers—and the supply gaps are widening.

In 2022, the global net capacity additions for renewables are expected to reach almost 320 GW—a more than 60 percent rise in yearly additions since 2019. By 2030, this increase is expected to reach between 500 GW and almost 1,200 GW per year. For comparison, the entire global renewable capacity installed over the past decades stands at about 3,000 GW. The picture looks starker for hydrogen: hundreds of gigawatts of electrolyzers are needed from today's baseline of near-zero demand.

Commodity markets are pouring even more fuel on the fire. Driven by price spikes, oil and gas companies are set to create almost $1 trillion in free cash flow in 2022. This windfall provides the capital needed to finance own renewable ambitions, with some companies targeting more than 100 GW buildouts by 2030. Finally, the US Inflation Reduction Act and Europe's REPowerEU plan have set ambitious targets and provided hefty incentives, such as a tax credit of up to $3 per kg for low-carbon hydrogen, likely driving incremental capacity additions across low-carbon energy sources.

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Renewable energy supply chains are shifting

So is supply keeping up? In some cases, the answer is no, or only with significant disruption or changes to the market structure. The solar photovoltaic (PV) market is looking the best so far, with module production capacity outstripping demand by a factor of two. However, shortages along the supply chain in critical raw materials such as polysilicon are a risk, with available capacity only about 20 percent above current demand—rendering the supply chain vulnerable to unexpected factory shutdowns, as in Xingjang. For batteries, concerns also loom on the raw materials side, with some forecasts estimating lithium shortages between 2024 and 2028. On the final product, it is estimated that production capacity will not meet supply in the short term, also driven by growing demand for electric vehicles. Some automakers are already reacting with vertical integration, a strategy that won't be available to utilities. The wind turbine supply chain is facing severe profitability troubles despite high demand. Further consolidation is probable, despite the already oligopolistic market structure with only five major western OEMs remaining. In this environment, investing in extra capacity and innovation can be challenging.

As a result, we are already seeing price increases and rationing of production volumes. Access to some top-tier battery OEM production capacity requires minimum order sizes of 1 GWh. Access to wind turbine blades can now take a year or longer. Electrolyzer manufacturers have put capacity expansions on hold because of the lack of final investment decisions (FIDs), with additional capacity taking at least 18 months to ramp up. Technologies with long-established cost curves have reversed their decline. Li–ion battery packs cost 2 percent more in 2022 year over year, after 12 years of consecutive decline at a rate of -18 percent. The wind turbine prices of some manufacturers rose more than 30 percent from 2021 to 2022.

Adapting to a changing environment

What will all this mean for renewable players, such as project developers? Without adapting your supply chain approach, it will be difficult to secure access to new technologies and volumes of renewable equipment on time and at cost. In this environment, the procurement approach will need to be tailored to the supply–demand dynamics in the respective technologies and markets (see figure 1 on page 3).

In wind energy, which is an already-concentrated industry, the balance of power will likely shift farther toward the supply side, driven by additional OEM consolidation and more entrants fragmenting the demand side, such as oil and gas companies. Similarly in solar PV, additional concentration on the supply side is probable, while the already heavily distributed demand will continue to fragment. Especially the demand for ESG-conforming panels is surging in Europe, with the EU proposing a directive for corporate sustainability due diligence along value chains. The dynamics are harder to assess for hydrogen electrolyzers, a more nascent industry. In the short term, a few OEMs have already committed to or executed capacity expansions. Therefore, they will likely make up a large share of the supply potential in the next three to five years, giving them some power to allocate scarce volumes to the highest bidder. The demand side also has some power thanks to early-mover benefits. Firm FID-backed order commitments or equity investments are valuable to OEMs, allowing them to scale production and potentially build a cost leadership position as they move down the cost curve faster than other OEMs. Flagship projects with publicly announced OEMs might also mobilize more customers. This demand-side benefit could wane in the medium term.

Figure 1

The outlook for supply and demand differs depending on the type of renewable equipment

	Solar PV (modules)	**Wind onshore** (turbines)	**Wind offshore** (turbines)	**Hydrogen** (electrolyzers)
Demand structure	— Highly fragmented; top developer annual ambitions from 1 to 5 GW (0.5–3% of production capacity) — More players entering the market, including oil and gas companies and industrials	— Highly fragmented, with no single players with significant share in the global demand — Ongoing professionalization and developer consolidation	— Concentrated; top four players with more than 50% of the pipeline — More players entering the market, including oil and gas companies	— Rather fragmented; hundreds of projects in the pipeline, though some projects on a larger scale (GW) — Many players with ambition to enter hydrogen, including utilities, chemicals, and oil and gas
Supplier structure	— The supplier structure is highly concentrated in China with 70% of global PV manufacturing capacities — The top three OEMs are Chinese and hold about 35% of the market	— Concentrated (oligopolistic) — Five major western OEMs and three major Chinese OEMs dominate their respective markets	— Highly concentrated (oligopolistic); top three OEMs with almost 55% share — Two major western OEMs and four major Chinese OEMs dominate their respective markets	— Concentrated in the short term — Top three players (ITM, Thyssen-Krupp, and Nel) with 30–50% share
Supplier market dynamics	— Further consolidation is possible, with about a third of integrated producers at moderate or high risk of bankruptcy — Technology innovation could open a path for new entrants in the longer term	— Further consolidation probable; new entrants unlikely — Strongly negative EBIT margins (around -10%; up to -25%) — Two top OEMs (GE, SGRE) shift focus further to offshore	— Additional consolidation unlikely; new entrants not expected — OEMs growth ability is constrained by poor financials — Capacity is further constrained by the upstream supply chain (components)	— Potential fragmentation of production capacity as more players scale up facilities and venture funded new entrants join
Value drivers for suppliers	— Long term, plannable, and reliable order guarantees (with large quantities) — Involvement in hybrid renewables projects (PV/wind; PV/hydrogen) to drive innovation	— Long term, plannable, and reliable order offtake — O&M contracts with high service level (full service) allowing enhanced margin	— Large and mature projects allowing to decrease specific costs — First-of-a-kind projects for increased reputation — Long-term O&M contracts	— FID-backed order commitments — Equity investments to scale production — Reputation building in flagship projects

Note: PV is photovoltaic; OEM is original equipment manufacturer; O&M is operations and maintenance; PEM is polymer electrolyte membrane; FID is final investment decisions.

Sources: IHS Markit, Global Wind Energy Council, International Energy Agency, BloombergNEF; Kearney analysis

Using the Kearney Purchasing Chessboard, supply and demand dynamics provide a valuable indicator for which supply chain strategy project developers should pursue (see figure 2). While demand power can be company-specific (think a multi-GW global utility versus a 100 MW independent developer), an industry average view showcases the big picture. Offshore wind turbines and electrolyzers are in the top-right quadrant of the Purchasing Chessboard, where both demand and supply power are high. Meanwhile, onshore wind and PV are under threat of moving farther toward the upper left—the most unfavorable combination of market forces from a buyer's perspective, where demand power is low and supply power is high.

The best way to navigate these market forces is highly dependent on the respective technology and the underlying strategic goals on the demand side as well as on the supply side (see figure 3 on page 5).

— For **PV modules**, project developers put a clear focus on securing supply in the right quality and time and at competitive cost. In addition, ESG compliance, especially regarding forced labor, is paramount. The potential for additional value creation and project optimization with suppliers is rather limited, and technology innovation is not as important as in other technologies. Consequently, pooling PV module demand into large bundles or a global framework agreement is a favorable strategy.

Figure 2

Kearney's Purchasing Chessboard can help renewable energy project developers pinpoint the ideal supply chain strategies

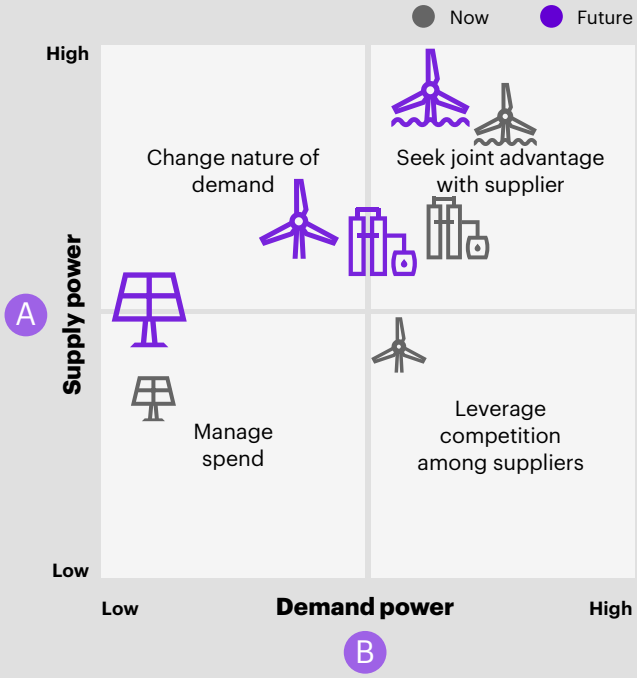
Demand and supply power

A Factors driving supply power

— Number of credible suppliers
— Split of market shares among suppliers
— Merger and acquisition dynamics in the supplier market
— Entry barriers for new suppliers
— Ease of substituting supplier
— Entry barriers for new products
— Availability of products

B Factors driving demand power

— Client's share of relevant demand (in the region)
— Growth perspectives offered to suppliers by client
— Opportunities for suppliers to further develop competencies through working with client
— Opportunities for suppliers to further develop image through working with client

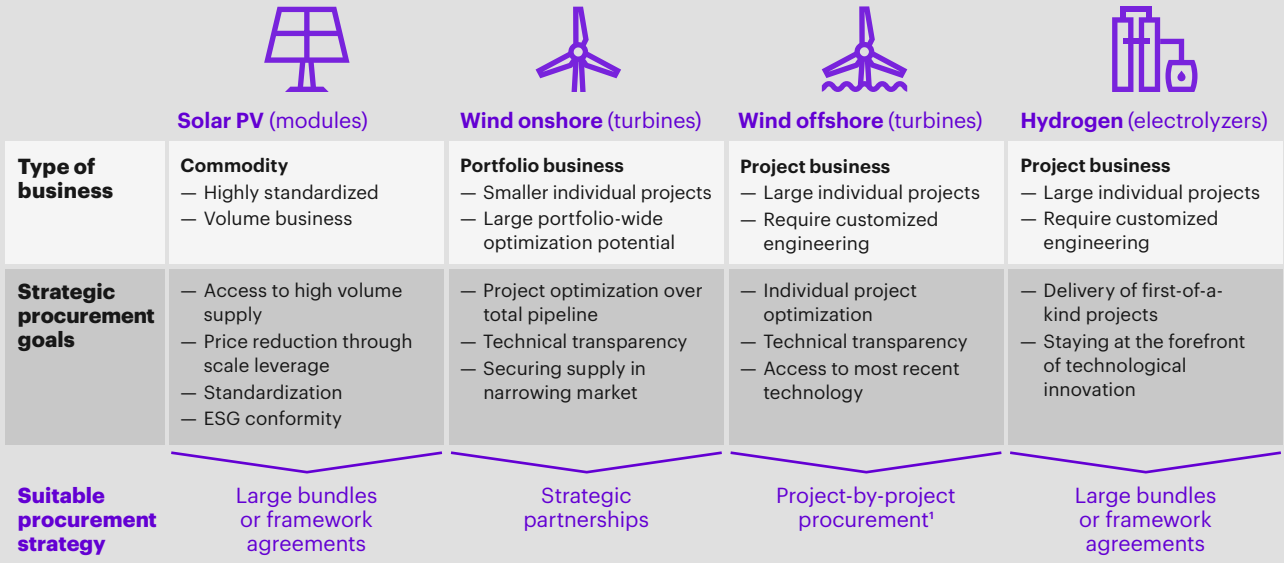


Source: Kearney analysis

Figure 3

The best way to counteract market forces will differ depending on the strategic goals of the renewable energy source

Procurement strategy overview



¹ Value and necessity of strategic partnerships also in wind offshore are growing.

Source: Kearney analysis

— In **wind energy**, a close collaboration with an OEM can unlock substantially higher value. OEMs can customize turbines and support already in early-stage project development to maximize project value, enlarging the pie for both parties. In onshore wind, with its heterogenous and relatively small projects, a formal strategic partnership agreement is necessary to enable portfolio-wide collaboration of both parties. Here, the procurement approach can be customized by regions, such as by entering a strategic partnership in Europe but procuring project by project in the United States. In offshore wind, the sheer scale of projects allows utilities to get the most—and best—out of OEM competencies, often without formal partnership agreements. However, with the above-mentioned market shifts, strategic partnerships may be about to become valuable and necessary also in offshore wind.

— **Electrolyzers** are a less-established technology in terms of supply chain strategy compared with PV and wind turbines. In procurement, the focus is a bit less on cost (as long as capex comes down as forecasted in the next few years) and more on the efficiency to require less renewable electricity. Simply gaining access to equipment volume is a key concern as well. Equity investments or technology partnerships are the go-to-strategy for electrolyzers.

Putting strategic sourcing into practice for renewables

In practice, the choice of the right procurement strategy is a highly individual decision. It requires careful analysis of a utility's specific situation and strategic goals. We recommend following these steps to ensure an optimal fit of the resulting procurement strategy:

— Conduct a thorough baselining to understand your current cost, risk, and procurement process for each of your technologies in focus.

— Identify and align your strategic objectives—both from a procurement and a business perspective.

— Understand the supply market structure and trends, and define your value proposition to the supply market.

— Develop the right sourcing strategy to enable your growth strategy, create cost competitiveness, and mitigate risks on the supply market.

Please contact us to discuss your specific situation and objectives, and we will support you in prioritizing your best next steps to navigate the turbulent renewables supply chain.

Choosing the right procurement strategy requires careful analysis of a utility's specific situation and strategic goals.

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