Analysis of Global Wind Turbine Market Concentration by Installed Capacity (2024)

I. Executive Summary

This report analyzes the market concentration of the global wind turbine industry for the year 2024, utilizing the Herfindahl-Hirschman Index (HHI) calculated based on Original Equipment Manufacturer (OEM) installed capacity in megawatts (MW). The analysis segments the market by continent (Asia, Europe, North America) and installation type (onshore and offshore) to provide a nuanced understanding of competitive dynamics. Data is primarily sourced from industry reports by BloombergNEF (BNEF) and Wood Mackenzie covering 2024 installations, supplemented by 2023 data where necessary.

The global wind turbine market experienced record installations in 2024, driven overwhelmingly by the Chinese market. This geographic skew significantly influences global market concentration metrics. Key findings indicate:

- **Global Market Structure:** The overall global market appears moderately concentrated based on HHI calculations derived from leading players. However, this global figure masks significant regional disparities.
- **Chinese Dominance:** Chinese OEMs (Goldwind, Envision, Mingyang, Windey) secured the top global positions in 2024 based on installed capacity, a historic shift displacing traditional Western leaders like Vestas, Siemens Gamesa Renewable Energy (SGRE), and GE Vernova from the top three spots globally.[1] This dominance is largely fueled by China's massive domestic market, which accounted for over 60-70% of global installations.[1]
- **Regional Bifurcation:** Market concentration is significantly higher within China/Asia compared to the global average, reflecting the dominance of local players. Conversely, markets outside China (primarily Europe and North America) remain highly concentrated among a few Western OEMs (Vestas, SGRE, GE Vernova, Nordex), although these players face increasing pressure and declining installations in these regions.[2]
- **Onshore vs. Offshore:** The offshore wind segment generally exhibits higher concentration globally compared to the onshore segment, particularly outside of China where SGRE holds a commanding share.[1] This reflects higher technological, capital, and logistical barriers to entry in the offshore market.[5]
- **Data Considerations:** HHI calculations are based on available data for leading OEMs, which cover a substantial but not complete portion of the market. The concentration levels reported should be interpreted with this limitation in mind.

The analysis underscores a pivotal moment in the wind industry, characterized by the rapid ascent of Chinese manufacturers on the global stage and strategic adaptations by established Western players navigating a complex landscape of policy drivers, cost pressures, and evolving supply chains.

II. Global Wind Turbine Market Concentration (2024)

A. Overview of Global Installed Capacity (2024)

The global wind power industry achieved a second consecutive year of record installations in 2024. According to BloombergNEF (BNEF), developers commissioned 121.6 GW of wind turbine capacity worldwide, a figure double the capacity installed just five years prior in 2019.[1] This growth builds upon the 118 GW installed in 2023 [9] and the 117 GW reported by GWEC for 2023 [10], surpassing the symbolic 1 Terawatt (TW) mark for total cumulative global capacity (estimated at 1,021 GW end-2023 [14], 1,136 GW end-2024 [10]).

The vast majority of 2024 installations were onshore, accounting for 109.9 GW or approximately 90% of the total capacity added. Offshore installations contributed the remaining 11.7 GW, or about 10%.[1] This distribution is consistent with 2023 figures, which saw 107 GW onshore and 11 GW offshore.[9]

The surge in installations was overwhelmingly driven by mainland China, which accounted for an estimated 70% (BNEF) [1] to over 60% (Wood Mackenzie) [2] of the global total. Wood Mackenzie reported China's market grew nearly 12% year-over-year to a record of over 80 GW in 2024.[2] Conversely, installations outside of China experienced a decline, falling 9% (Wood Mackenzie) [2] or 10% (BNEF) [1] compared to 2023 levels. This highlights the critical role of the Chinese market in shaping global installation figures and OEM rankings.

B. Leading Manufacturers: Global Market Share (2024)

The competitive landscape of global wind turbine manufacturing underwent a significant transformation in 2024. For the first time, Chinese OEMs secured the top four positions in global rankings based on installed capacity, displacing European and US manufacturers from the top three, a position they had consistently held.[1] Wood Mackenzie similarly reported Chinese OEMs sweeping the top three global positions for the first time.[2]

Based on BNEF data for 2024 installations (121.6 GW total) [1]:

1. **Goldwind (China):** Maintained its leading position for the third consecutive year,

installing 19.3 GW, representing approximately 15.9% of the global market. Wood Mackenzie reported a slightly higher figure of 20 GW for Goldwind.[2] This follows 16.4 GW (13.8% share of 118 GW) in 2023.[4]

2. **Envision (China):** Retained second place with 14.5 GW installed, capturing about 11.9% of the market. This compares to 15.4 GW (13.1% share) in 2023.[9]
3. **Windey (China):** Ranked third with 12.5 GW installed, equating to roughly 10.3% market share. This marks a rise from its fourth-place ranking in 2023 (10.1 GW, 8.6% share).[4]
4. **Mingyang (China):** Ranked fourth, adding 12.2 GW for approximately 10.0% market share. This is a slight shift from its fifth-place ranking in 2023 (9.9 GW, 8.4% share).[4] *Note: Wood Mackenzie ranked Mingyang third globally in 2024*.[2]
5. **Vestas (Denmark):** Ranked fifth, installing over 10 GW (estimated 10.2 GW for calculation purposes, ~8.4% share).[1] While dropping from its third-place rank in 2023 (13.4 GW, 11.4% share) [9], Vestas remained the leading non-Chinese OEM and dominated markets outside China.[2]

Other manufacturers featuring in the top 10, according to Wood Mackenzie [3], include SANY (China), Dongfang Electric Corporation (DEC, China), Siemens Gamesa Renewable Energy (SGRE, Spain/Germany), Nordex Group (Germany), and GE Vernova (USA). BNEF noted that six of the top ten turbine makers worldwide were based in mainland China.[1] These rankings highlight the significant scale achieved by Chinese manufacturers, largely due to their extensive domestic market. BNEF reported that Chinese manufacturers remained heavily reliant on their home market, which delivered almost all their capacity additions in 2024 [1], consistent with 2023 findings where 95-98% of top Chinese OEM installations were domestic.[9]

C. Global HHI Calculation and Analysis (Overall, Onshore, Offshore)

The Herfindahl-Hirschman Index (HHI) is a standard measure of market concentration, calculated by summing the squares of the market shares of all firms in the market. HHI values range from near 0 (perfect competition) to 10,000 (monopoly). Generally, HHI < 1500 indicates an unconcentrated market, 1500-2500 indicates moderate concentration, and > 2500 indicates high concentration.

Calculating a precise global HHI is challenging due to data limitations, particularly for smaller players comprising the "Other" category. The following calculations are based on the estimated 2024 market shares for the top players identified above, acknowledging that they represent a significant, but not complete, portion of the market. We estimate shares for SGRE (~5.8%), Nordex (~4.9%), and GE Vernova (~3.3%) based on their 2023 performance and leadership outside China, and

aggregate the remaining market share.

- **Overall Global HHI (2024, Top 8 OEMs covering ~70.5%):**
  - Calculation: $(15.9)2+(11.9)2+(10.3)2+(10.0)2+(8.4)2+(5.8)2+(4.9)2+(3.3)2 \approx 253+142+106+100+71+34+24+11=741$.
  - Analysis: Based on the top 8 players, the HHI suggests an **unconcentrated** global market. However, this low figure is heavily influenced by the sheer size of the Chinese market diluting global shares and the significant portion of the market attributed to smaller players or those outside the top 8. The underlying regional dynamics reveal a different picture.
- **Global Onshore HHI (2024, Estimated):**
  - Total Market: 109.9 GW.[1]
  - Analysis: The onshore market constitutes 90% of global installations and is heavily dominated by activity in China (>80 GW).[2] The leading global players (Goldwind, Envision, Windey, Mingyang) derive the vast majority of their installations from the Chinese onshore market. Vestas, GE Vernova, SGRE, and Nordex lead outside China. The HHI for global onshore is expected to be slightly lower than the overall HHI but still reflect the significant weight of the Chinese market, likely remaining in the **unconcentrated to low-moderate concentration** range when calculated globally based on available top-player data.
- **Global Offshore HHI (2024, Estimated):**
  - Total Market: 11.7 GW.[1] China installed 6.1 GW (52%), Rest of World 5.6 GW.
  - Key Players: SGRE installed 4 GW outside China, representing ~71% of the non-Chinese offshore market.[1] Mingyang led global offshore in 2023.[9] BNEF noted seven significant offshore players in China in 2024 with no single dominant one.[1]
  - Estimated Shares: SGRE (~34%), Vestas (~8.5%), Mingyang (~8.5%), Aggregate Other Chinese OEMs (~43% distributed among several players), GE Vernova (Haliade-X).
  - Calculation (Top 3 + 5 assumed others at ~8.6%): $(34)2+(8.5)2+(8.5)2+5\times(8.6)2 \approx 1156+72+72+370=1670$.
  - Analysis: The global offshore market appears **moderately concentrated** (HHI ≈ 1670). This is higher than the overall market, reflecting greater barriers to entry. However, this global figure averages a potentially less concentrated Chinese offshore market (multiple players) and a highly concentrated offshore market outside China (dominated by SGRE).

Table 1: Global Wind Turbine Installed Capacity Market Share & HHI (2024,

Estimated)

Manufacturer	Overall GW	Overall Share (%)	Onshore GW (Est.)	Onshore Share (%)	Offshore GW (Est.)	Offshore Share (%)
Goldwind (China)	19.3	15.9%	~18.8	~17.1%	~0.5	~4.3%
Envision (China)	14.5	11.9%	~14.2	~12.9%	~0.3	~2.6%
Windey (China)	12.5	10.3%	~12.3	~11.2%	~0.2	~1.7%
Mingyang (China)	12.2	10.0%	~10.2	~9.3%	~2.0	~17.1%
Vestas (Denmark)	10.2	8.4%	~9.2	~8.4%	~1.0	~8.5%
SGRE (Spain/Ger.)	7.0	5.8%	~3.0	~2.7%	~4.0	~34.2%
Nordex (Germany)	6.0	4.9%	~6.0	~5.5%	0.0	0.0%
GE Vernova (USA)	4.0	3.3%	~3.5	~3.2%	~0.5	~4.3%
Other	35.9	29.5%	~32.7	~29.8%	~3.2	~27.4%
Total Market	**121.6**	**100.0%**	**109.9**	**100.0%**	**11.7**	**100.0%**
HHI (Top 8 Basis)	**~741**		**~680**		**~1670**	
Concentration	**Low**		**Low**		**Moderate**	

Note: Onshore/Offshore GW splits are estimates based on global shares, known offshore leadership (SGRE, Mingyang), and domestic focus of Chinese OEMs. HHI calculated based on Top 8 shares only; actual HHI including all players would be higher but likely remain in the indicated concentration bands globally.

III. Continental Market Concentration Analysis (2024)

The global HHI figures provide a limited view due to the overwhelming influence of the Chinese market and the distinct competitive dynamics in different regions. A continental breakdown reveals a more accurate picture of market structure.

A. Asia (Focus on China)

- **Market Overview:** Asia, driven almost entirely by China, is the world's largest wind market by a significant margin. China installed over 80 GW in 2024, representing more than 60-70% of the global total.[1] This massive scale is propelled by ambitious national targets (e.g., 14th Five-Year Plan) and provincial mandates aiming for completion by the end of 2025.[1] India is another major Asian market, ranking fifth globally for total installations end-2024 [10] and adding 3.4 GW in 2024.[10]
- **Leading Players:** The Chinese market is dominated by domestic OEMs. Based on their global installations and high domestic focus (95%+), estimated 2024 shares within China's ~85 GW market are: Goldwind (~21.5%), Envision (~16.7%), Windey (~14.4%), and Mingyang (~14.1%). Other significant players include SANY, DEC, Shanghai Electric, and CSSC.[3] Western OEMs have historically struggled to gain significant share in China.[21]
- **HHI & Analysis:** Calculating HHI based on the estimated shares of the top 4 Chinese OEMs yields a value around 1150. Including other major domestic players like SANY and DEC would push this value higher, likely into the **moderately concentrated** range (1500-2500). Despite this concentration among the top firms, the Chinese market is characterized by intense price competition among numerous domestic players (14 active in 2023 [4]), which has driven down turbine prices but also eroded OEM profitability.[2] A price rebound was noted in Q4 2024 after manufacturers reportedly agreed to maintain healthier competition.[2] China also led offshore installations with 6.1 GW in 2024 [1], down from 7.6 GW in 2023 [9], with multiple domestic suppliers active.[1]

B. Europe

- **Market Overview:** Europe remains a critical wind market, driven by strong policy support like the EU's REPowerEU plan, the Green Deal Industrial Plan, and national

targets aiming to reduce reliance on fossil fuels and meet climate goals.[12] The EU added a record 15.3 GW in 2023 [9], and Europe overall installed 18.3 GW.[24] However, mirroring the trend outside China, European installations likely saw pressure in 2024, contributing to the overall decline in the non-Chinese market.[1] WindEurope forecasts an average of 22 GW per year needed across the EU until 2030 to meet targets, suggesting a potential gap.[23] Germany remains a key market.[10]

- **Leading Players:** The European market is the traditional stronghold of Western OEMs. Vestas is the clear leader outside China, installing over 10 GW globally in 2024.[2] Siemens Gamesa and Nordex followed Vestas in the non-Chinese market rankings.[2] Enercon (Germany) is another significant European player.[25] GE Vernova also has a presence. While Chinese OEMs are increasing their footprint outside China (commissioning 1.7 GW across 20 markets including EU states in 2023 [9]), their share in Europe remains small but growing, aided by lower prices.[9]
- **HHI & Analysis:** Estimating market shares for Europe in 2024 (assuming a ~20 GW market size) suggests Vestas (~30%), SGRE (~25%), and Nordex (~20%) as the top three. This yields an HHI of approximately 1925 based on these players alone. Including Enercon and GE Vernova would likely push the HHI well into the **highly concentrated** range (>2500). This reflects the consolidation among Western players and the challenges they face, including profitability issues and supply chain constraints [20], leading them to focus on core markets and commercial discipline.[2] Europe is also a leader in offshore wind, with SGRE being particularly strong.[1]

C. North America (Focus on USA)

- **Market Overview:** The US wind market experienced a significant slowdown in 2024, with installations hitting a decade low. BNEF reported 5.4 GW installed [1], while Wood Mackenzie reported 5.2 GW (3.9 GW onshore new build, 1.3 GW onshore repower, 0.1 GW offshore).[28] This follows 7.2 GW in 2023 [9] and 8.5 GW in 2022.[29] The slowdown was attributed to the lingering effects of policy uncertainty prior to the Inflation Reduction Act (IRA), supply chain constraints, higher interest rates, and project execution delays.[1] However, the IRA's incentives are expected to drive a rebound, with significant orders placed in 2023 supporting near-term forecasts [9], although recent policy uncertainty under a new administration has tempered longer-term outlooks.[28] The US offshore market is nascent but growing, with the first commercial-scale projects (South Fork, Vineyard Wind 1) beginning operations in 2023/2024 [7] and a substantial pipeline under development.[7]
- **Leading Players:** The US market, particularly onshore, is highly concentrated among Western OEMs. GE Vernova dominated US onshore installations in 2024

with a 56% market share, followed by Vestas (40%) and SGRE (4%).[28] This aligns with 2023 data where GE Vernova led with 58%, Vestas had 30%, Nordex 9%, and SGRE 4%.[13] Goldwind has established a presence through project development and strategic financing but holds a minimal market share.[34]

- **HHI & Analysis:** The US onshore market is **extremely highly concentrated**. Calculating HHI based on Wood Mackenzie's 2024 onshore shares (GE 56%, Vestas 40%, SGRE 4%) yields an HHI of approximately 4752 (562+402+42=3136+1600+16=4752). This indicates very limited competition among suppliers in the dominant onshore segment. The nascent offshore market is currently supplied primarily by GE Vernova (South Fork) and SGRE (Revolution Wind, Coastal Virginia) [7], suggesting high concentration there as well, though the market is still forming.

Table 2: Continental Wind Turbine Market Share & HHI (2024, Estimated)

Region	Segment	Key Players (Estimated Shares)	Approx. Market Size (GW)	HHI (Top Player Basis)	Concentration Level
Asia (China)	Overall	Goldwind (21.5%), Envision (16.7%), Windey (14.4%), Mingyang (14.1%)	~85	~1150 (Top 4)	Moderate
	Onshore	(Similar dominance by domestic OEMs)	~79	~1100 (Top 4)	Moderate
	Offshore	Multiple domestic players, no single dominant one [1]	6.1	Likely Moderate	Moderate

Europe	Overall	Vestas (~30%), SGRE (~25%), Nordex (~20%)	~20	~1925 (Top 3)	High
	Onshore	Vestas, Nordex, SGRE, Enercon	~17	Likely High	High
	Offshore	SGRE (dominant outside China), Vestas	~3	Very High	Very High
N. America (US)	Overall	GE Vernova (~50%), Vestas (~35%), SGRE/Nordex (~15%)	~5.4	~3850 (Top 3 Est.)	Very High
	Onshore	GE Vernova (56%), Vestas (40%), SGRE (4%)	~5.1 (New+Repower)	~4752 (Top 3)	Very High
	Offshore	GE Vernova, SGRE	0.1	Very High (Nascent)	Very High

Note: Shares and HHI are estimates based on available 2024 data and regional dominance patterns. Market sizes are approximate. HHI calculated based on specified top players only.

IV. Onshore vs. Offshore: A Comparative Look at Market Structure

Comparing the market concentration levels between the onshore and offshore wind segments reveals distinct structural differences driven by technology, economics, and

market maturity. Globally, the offshore market (estimated HHI ~1670 based on top players) appears more concentrated than the onshore market (estimated HHI ~680 based on top players). This trend generally holds within specific regions as well, particularly outside China.

Several factors contribute to the higher concentration typically observed in the offshore segment:

1. **Technology Complexity and Scale:** Offshore wind turbines are significantly larger and technologically more complex than their onshore counterparts.[7] Developing, manufacturing, and installing these massive machines (with ratings up to 15-20 MW [18]) requires substantial R&D investment, advanced manufacturing capabilities, and specialized know-how, limiting the pool of capable manufacturers.[5] The trend towards even larger turbines exacerbates this.[18]
2. **Higher Barriers to Entry:** Offshore wind projects involve significantly higher capital expenditures compared to onshore projects (average CAPEX $3609/kW vs $1420/kW in 2022 [20]). They require specialized, costly installation vessels, purpose-built port infrastructure for handling enormous components, and more complex grid connection solutions.[5] These factors create substantial financial and logistical barriers for new entrants.
3. **Market Maturity and Specialization:** While onshore wind is a relatively mature industry with established supply chains, the offshore sector, particularly deep-water floating wind, is still rapidly evolving.[20] This necessitates continuous innovation and favors companies with strong R&D capabilities and experience in harsh marine environments. Some OEMs specialize more heavily in one segment than the other.
4. **Dominant Players:** Historically, fewer OEMs have competed vigorously in the offshore space compared to onshore. Outside China, Siemens Gamesa has established a particularly strong position, supplying nearly three-quarters of the offshore market in 2024.[1] While Mingyang led globally in 2023 due to its strength in China [9], the market outside China remains dominated by Western firms like SGRE and, increasingly, GE Vernova with its Haliade-X platform.[7]

However, the global offshore HHI calculation might understate the concentration outside China. While BNEF reports multiple active players in China's 6.1 GW offshore market in 2024 [1], SGRE's ~71% share of the remaining 5.6 GW market outside China points to extremely high concentration in Europe and North America specifically. Therefore, while the global offshore market is moderately concentrated overall, the competitive landscape varies significantly between China and the rest of the world.

V. Competitive Landscape and Strategic Implications

A. Interpretation of HHI Results

The calculated HHI values provide a quantitative lens on the competitive intensity across different segments of the wind turbine market:

- **Global Overall (HHI ~741):** Appears unconcentrated based on top players, but this is misleading due to the dominance of the Chinese market and data limitations.
- **Global Onshore (HHI ~680):** Similar to the overall market, appears unconcentrated globally based on top players.
- **Global Offshore (HHI ~1670):** Moderately concentrated, reflecting higher barriers.
- **Asia (China) (HHI ~1150+):** Moderately concentrated, with several large domestic players competing fiercely.
- **Europe (HHI ~1925+):** Highly concentrated among a few Western OEMs.
- **North America (US Onshore) (HHI ~4752):** Extremely highly concentrated, bordering on a duopoly between GE Vernova and Vestas.

These varying concentration levels signal different competitive environments. The highly concentrated markets in Europe and North America suggest potentially less intense price competition (though profitability remains a challenge [4]) but higher strategic stakes for the few dominant players. The moderately concentrated Chinese market, despite having large leading firms, experiences fierce price wars.[2] The higher concentration in offshore markets implies significant advantages for incumbents with proven technology and execution capabilities.

B. Dynamics: Chinese OEM Dominance vs. Western OEM Strategies

The defining dynamic of the current global wind turbine market is the ascendancy of Chinese manufacturers and the strategic responses of established Western OEMs.

- **Chinese OEM Growth:** Companies like Goldwind, Envision, Mingyang, and Windey have leveraged China's massive, policy-driven domestic demand to achieve significant scale.[1] Their growth is underpinned by a mature domestic supply chain [4] and potentially government support.[20] While heavily reliant on their home market [1], they are increasingly targeting international markets, particularly in Asia, Latin America, the Middle East, and Africa.[9] Their primary competitive advantage internationally appears to be price, with reports suggesting their turbines are 20-32% cheaper than Western equivalents.[9]
- **Western OEM Adaptation:** Vestas, SGRE, GE Vernova, and Nordex face a

challenging environment outside the booming Chinese market. Installations in their core markets (Europe, North America) declined or stagnated in 2023/2024.[1] They have struggled with profitability due to supply chain disruptions, cost inflation, and specific quality issues (e.g., SGRE onshore platforms [44]). Their strategic responses, as noted by Wood Mackenzie and company reports, include [2]:

- **Commercial Discipline:** Prioritizing profitability over market share volume, leading to higher average selling prices compared to Chinese OEMs.[2]
- **Regional Focus:** Concentrating efforts on core, profitable markets, primarily in Europe and North America.
- **Restructuring & Simplification:** Streamlining operations, simplifying product portfolios, and divesting non-core activities.
- **Supply Chain Management:** Increasing outsourcing (potentially from Asia) while also investing in regionalized manufacturing (e.g., GE Vernova in US [46], Vestas in US [38], SGRE considering US facility [52]) and strengthening supplier collaboration on cost and sustainability.[45]

C. Implications for Stakeholders

The observed market concentration levels and competitive dynamics have significant implications:

- **Buyers (Developers):** Benefit from increased supplier choice and potentially lower prices due to Chinese competition, particularly in emerging markets.[9] However, in highly concentrated Western markets, negotiation leverage might be limited. Developers also face considerations around technology bankability, long-term service support, and potential geopolitical risks associated with supply chain concentration.[6] The dominance of a few players increases the impact of any single supplier's failure or policy changes affecting them.
- **Policymakers:** Face a balancing act between accelerating renewable deployment (potentially aided by lower-cost imports) and fostering domestic manufacturing, energy security, and supply chain resilience.[5] High concentration, particularly regional monopolies or oligopolies, raises concerns about fair competition and vulnerability to supply disruptions. Policies like the US IRA and EU's Green Deal Industrial Plan / Net Zero Industry Act aim to address this by incentivizing local production [5], but their effectiveness against established global supply chains remains to be seen. Trade investigations or restrictions are potential tools but could impact deployment costs and timelines.
- **Competitors (OEMs):** The intense competition necessitates clear strategic positioning. Western OEMs must leverage technological advantages, service

capabilities, established track records, and strong customer relationships while rigorously managing costs and supply chains.[45] Chinese OEMs need to build international track records, navigate geopolitical tensions, establish global service networks, and manage domestic price pressures. Strategic partnerships, M&A, and specialization (e.g., focusing on offshore or specific geographies) are likely strategies for survival and growth in this evolving landscape. The ability to manage complex global supply chains, including sourcing critical components like rare earth magnets (dominated by China [57]), steel [49], and blade materials [62], is paramount.[53]

VI. Conclusion and Outlook

The analysis of the global wind turbine market in 2024 reveals a highly dynamic and bifurcated landscape. While global installations reached record highs, driven primarily by China, the competitive structure differs vastly across regions and segments. The Herfindahl-Hirschman Index (HHI), calculated using available data for leading manufacturers, indicates a globally unconcentrated market overall, but this masks a moderately concentrated Chinese market and highly concentrated markets in Europe and North America, particularly for onshore wind. The offshore segment shows moderate concentration globally but is extremely concentrated outside of China.

Table 3: HHI Summary Comparison Matrix (2024, Estimated)

Region	Overall HHI (Concentration)	Onshore HHI (Concentration)	Offshore HHI (Concentration)
Global	~741 (Low)	~680 (Low)	~1670 (Moderate)
Asia (China)	~1150+ (Moderate)	~1100+ (Moderate)	Moderate
Europe	~1925+ (High)	High	Very High
N. America (US)	~3850+ (Very High)	~4752 (Very High)	Very High (Nascent)

Note: HHI based on top player shares; concentration levels are indicative.

The most significant trend is the rise of Chinese OEMs to global leadership positions in terms of annual installed capacity, challenging the long-standing dominance of Western manufacturers. This shift is primarily due to the immense scale of China's domestic market. Western OEMs, while maintaining leadership positions outside

China, are adapting through strategies focused on profitability, core markets, and supply chain resilience.

Looking ahead, the market structure remains in flux. Key factors influencing future concentration include:

- **Chinese International Expansion:** The success of Chinese OEMs in gaining significant market share outside China, driven by price competitiveness and strategic investments [9], could decrease concentration in Western markets but increase global concentration among fewer players.
- **Western Industrial Policy:** The effectiveness of policies in the US and Europe aimed at bolstering domestic supply chains and manufacturing [5] could limit Chinese import penetration and support Western incumbents, potentially maintaining or increasing regional concentration.
- **Technology and Cost:** The race towards larger, more efficient turbines [12] may favor OEMs with strong R&D and economies of scale, potentially leading to further consolidation. Continued cost pressures and supply chain challenges will also shape competitive viability.
- **Market Growth:** Sustained high growth, particularly outside China as forecast by GWEC [10] and driven by global decarbonization goals [11], could support a larger number of competitors, although regional dynamics will likely persist.

Continuous monitoring of market shares, OEM strategies, policy developments, and supply chain dynamics will be crucial for understanding the evolving structure of this critical industry in the global energy transition. The HHI serves as a valuable baseline metric against which these future shifts can be measured.

Works cited

1. Chinese Manufacturers Lead Global Wind Turbine Installations ..., accessed on April 23, 2025, https://about.bnef.com/blog/chinese-manufacturers-lead-global-wind-turbine-installations-bloombergnef-report-shows/
2. Wood Mackenzie: Chinese OEMs sweep the global wind podium for ..., accessed on April 23, 2025, https://www.woodmac.com/press-releases/2024-press-releases/chinese-oems-sweep-the-global-wind-podium-for-the-first-time/
3. Goldwind, Envision, MingYang lead wind turbine market in 2024: Wood Mackenzie, accessed on April 23, 2025, https://evwind.aeeolica.org/2025/03/15/goldwind-envision-mingyang-lead-wind-turbine-market-in-2024-wood-mackenzie/104897
4. China leads global wind turbine manufacturers' market share in 2023 | Wood

Mackenzie, accessed on April 23, 2025, https://www.woodmac.com/press-releases/2024-press-releases/global-wind-oem-marketshare/
5. Supply Chain Road Map for Offshore Wind Energy in the United States - NREL, accessed on April 23, 2025, https://www2.nrel.gov/wind/offshore-supply-chain-road-map
6. Wind Energy - Supply Chain Deep Dive Assessment US Department of Energy Response to Executive Order 14017, “America's Supply Chains”, accessed on April 23, 2025, https://www.energy.gov/sites/default/files/2022-02/Wind%20Energy%20Supply%20Chain%20Report%20-%20Final.pdf
7. www.nrel.gov, accessed on April 23, 2025, https://www.nrel.gov/docs/fy24osti/90525.pdf
8. Global Wind Turbine Installations Hit a Record 121.6 GW in 2024: Report - Mercom India, accessed on April 23, 2025, https://www.mercomindia.com/global-wind-turbine-installations-hit-a-record-121-6-gw-in-2024-report
9. China's Goldwind Retains Turbine Supplier Lead, as Global Wind ..., accessed on April 23, 2025, https://about.bnef.com/blog/chinas-goldwind-retains-turbine-supplier-lead-as-global-wind-additions-hit-new-high-according-to-bloombergnef/
10. Wind industry installs record capacity in 2024 despite policy instability, accessed on April 23, 2025, https://www.gwec.net/gwec-news/wind-industry-installs-record-capacity-in-2024-despite-policy-instability
11. GWEC | GLOBAL WIND REPORT 2024 - Saur Energy International, accessed on April 23, 2025, https://img.saurenergy.com/2024/05/gwr-2024_digital-version_final-1-compressed.pdf
12. Wind - IEA, accessed on April 23, 2025, https://www.iea.org/energy-system/renewables/wind
13. emp.lbl.gov, accessed on April 23, 2025, https://emp.lbl.gov/sites/default/files/2024-08/Land-Based%20Wind%20Market%20Report_2024%20Edition.pdf
14. Market and Industry Trends | Wind Power - REN21, accessed on April 23, 2025, https://www.ren21.net/gsr-2024/modules/energy_supply/02_market_and_industry_trends/09_windpower/
15. Land-Based Wind Market Report | Department of Energy, accessed on April 23, 2025, https://www.energy.gov/eere/wind/land-based-wind-market-report
16. Global wind energy capacity grows by 117GW in 2024 - Windtech International, accessed on April 23, 2025, https://www.windtech-international.com/industry-news/global-wind-energy-capacity-grows-by-117gw-in-2024
17. Goldwind, Envision and MingYang lead the wind turbine market in 2024 according to Wood Mackenzie's reporting. - 4C Offshore, accessed on April 23, 2025,

https://www.4coffshore.com/news/goldwind2c-envision-and-mingyang-lead-the-wind-turbine-market-in-2024-according-to-wood-mackenzie27s-reporting.-nid30883.html
18. Chinese wind turbine manufacturers dominate global market in 2024, accessed on April 23, 2025, https://www.windtech-international.com/industry-news/chinese-wind-turbine-manufacturers-dominate-global-market-in-2024
19. Wind turbine manufacturers: Goldwind, Envision, and Vestas lead the market - Rinnovabili, accessed on April 23, 2025, https://www.rinnovabili.net/business/energy/wind-turbine-manufacturers-goldwind-envision-and-vestas-lead-the-market/
20. Wind Market Share - Enerdata, accessed on April 23, 2025, https://www.enerdata.net/publications/executive-briefing/wind-market-share.html
21. China Emerges as a Major Exporter of Wind Turbine Nacelles - USITC, accessed on April 23, 2025, https://www.usitc.gov/publications/332/executive_briefings/ebot_wind_turbine_nacelles.pdf
22. Record highs for global wind turbine order intake in 2023 | Wood Mackenzie, accessed on April 23, 2025, https://www.woodmac.com/press-releases/2024-press-releases/record-highs-for-global-wind-turbine-order-intake-in-2023/
23. Winds of change: Europe strives to shield domestic wind turbine industry as Chinese rivals breeze in - Rabobank, accessed on April 23, 2025, https://www.rabobank.com/knowledge/d011459200-winds-of-change-europe-strives-to-shield-domestic-wind-turbine-industry-as-chinese-rivals-breeze-in
24. Wind Turbine Market Size, Growth Opportunity 2025-2034, accessed on April 23, 2025, https://www.gminsights.com/industry-analysis/wind-turbine-market
25. Top Global Wind Turbine Manufacturers by Capacity | Renewable Energy Leaders, accessed on April 23, 2025, https://www.globaldata.com/companies/top-companies-by-sector/power-utilities/global-wind-turbine-manufacturers-by-capacity/
26. New frontiers: order intake by Chinese wind turbine OEMs advanced beyond domestic dominance in H1 2024 | Wood Mackenzie, accessed on April 23, 2025, https://www.woodmac.com/news/opinion/new-frontiers-order-intake-by-chinese-wind-turbine-oems-advanced-beyond-domestic-dominance-in-h1-2024/
27. Wind Market Share analysis - Enerdata, accessed on April 23, 2025, https://www.enerdata.net/publications/executive-briefing/wind-turbines-manufacturers-market-share.pdf
28. US wind market installations hit a decade low | Wood Mackenzie, accessed on April 23, 2025, https://www.woodmac.com/press-releases/us-wind-market-installations-hit-a-decade-low/
29. Wind energy statistics 2023-24, accessed on April 23, 2025, https://i-windenergy.com/content/wind-energy-statistics-2023-24

30. Goldwind and Vestas in Photo Finish for Top Spot as Global Wind Power Additions Fall, accessed on April 23, 2025, https://about.bnef.com/blog/goldwind-and-vestas-in-photo-finish-for-top-spot-as-global-wind-power-additions-fall/
31. Energy Transition Factbook 2024 - Bloomberg Professional Services, accessed on April 23, 2025, https://assets.bbhub.io/professional/sites/24/Clean-Energy-Ministerial-Factbook-2024.pdf
32. Wind Market Reports: 2024 Edition | Department of Energy, accessed on April 23, 2025, https://www.energy.gov/eere/wind/wind-market-reports-2024-edition
33. Offshore Wind Energy Market Assessment | Wind Research - NREL, accessed on April 23, 2025, https://www2.nrel.gov/wind/offshore-market-assessment
34. Goldwind - Wikipedia, accessed on April 23, 2025, https://en.wikipedia.org/wiki/Goldwind
35. Recharge News: China's Goldwind poised for North America breakthrough, accessed on April 23, 2025, https://www.goldwindamericas.com/news/recharge-news-chinas-goldwind-poised-north-america-breakthrough
36. 1H 2024 Offshore Wind Market Outlook: Course Correct - BloombergNEF, accessed on April 23, 2025, https://about.bnef.com/blog/1h-2024-offshore-wind-market-outlook-course-correct/
37. CRRC Installs 'World's Largest' Floating Offshore Wind Turbine in China - OffshoreWIND.biz, accessed on April 23, 2025, https://www.offshorewind.biz/2025/01/20/crrc-installs-worlds-largest-floating-offshore-wind-turbine-in-china/
38. Vestas - Wikipedia, accessed on April 23, 2025, https://en.wikipedia.org/wiki/Vestas
39. Overcoming Turbulence in the Offshore Wind Sector - Energy Transitions Commission, accessed on April 23, 2025, https://www.energy-transitions.org/wp-content/uploads/2024/05/ETC-Offshore-Wind-Insights-Briefing.pdf
40. Potential International Trade Implications of Local Content Requirements for Wind Turbines in China - Center for Resource Solutions, accessed on April 23, 2025, https://resource-solutions.org/wp-content/uploads/2015/08/China.wind_.policy.and_.intl_.trade_.law_.Oct_.07.pdf
41. Goldwind lands in Brazil's wind energy and opens the first wind turbine factory outside China | REVE News of the wind sector in Spain and in the world, accessed on April 23, 2025, https://evwind.aeeolica.org/2024/08/29/goldwind-lands-in-brazils-wind-energy-and-opens-the-first-wind-turbine-factory-outside-china/100527
42. China's Mingyang to set up Italian factory and supply 18.8MW turbines for floating project, accessed on April 23, 2025, https://www.rechargenews.com/wind/chinas-mingyang-to-set-up-italian-factory-and-supply-18-8mw-turbines-for-floating-project/2-1-1690134

43. China tightens grip over Middle East turbine market with new factory deal - Recharge News, accessed on April 23, 2025, https://www.rechargenews.com/wind/china-tightens-grip-over-middle-east-turbine-market-with-new-factory-deal/2-1-1807651
44. Siemens Gamesa takes immediate action to stabilize the business and accelerate long-term value creation, accessed on April 23, 2025, https://www.siemensgamesa.com/global/en/home/press-releases/080222-siemens-gamesa-press-release-results-q3-2022.html
45. How Vestas is Navigating Supply Chain Uncertainty, accessed on April 23, 2025, https://supplychaindigital.com/sustainability/how-vestas-is-navigating-supply-chain-uncertainty
46. GE Vernova to invest $600 million in U.S. manufacturing sites - DC Velocity, accessed on April 23, 2025, https://www.dcvelocity.com/logistics/manufacturing/ge-vernova-to-invest-600-million-in-u-s-manufacturing-sites
47. GE Vernova to invest nearly $600M in US factories - Utility Dive, accessed on April 23, 2025, https://www.utilitydive.com/news/ge-vernova-invest-nearly-600-million-us-factories/739564/
48. GE Vernova invests in US wind manufacturing expansion - Windtech International, accessed on April 23, 2025, https://www.windtech-international.com/company-news/ge-vernova-invests-in-us-wind-manufacturing-expansion
49. Vestas North American Manufacturing Operations | Pueblo Colorado, accessed on April 23, 2025, https://choosecolorado.com/success-stories/vestas/
50. Wind turbine manufacturing and service | Vestas US, accessed on April 23, 2025, https://us.vestas.com/en-us
51. us.vestas.com, accessed on April 23, 2025, https://us.vestas.com/en-us/manufacturing#:~:text=Vestas%20has%20two%20North%20American,a%20thriving%20energy%20supply%20chain.
52. Siemens Gamesa intends to establish an offshore wind turbine nacelle facility in New York, accessed on April 23, 2025, https://www.siemensgamesa.com/global/en/home/press-releases/021323-siemens-gamesa-press-release-new-york-offshore-nacelles-facility.html
53. Supplier Sustainability - Vestas, accessed on April 23, 2025, https://www.vestas.com/en/sustainability/supplier-sustainability
54. Suppliers - Siemens Gamesa, accessed on April 23, 2025, https://www.siemensgamesa.com/global/en/home/sustainability/suppliers.html
55. Suppliers - Vestas, accessed on April 23, 2025, https://www.vestas.com/en/about/our-partners/Suppliers
56. Wind Supplier Information - GE Vernova, accessed on April 23, 2025, https://www.gevernova.com/wind-power/about/suppliers
57. China has a monopoly on rare earth metals - Polytechnique Insights, accessed on April 23, 2025, https://www.polytechnique-insights.com/en/columns/geopolitics/china-has-a-mo

nopoly-on-rare-earths/
58. The Consequences of China's New Rare Earths Export Restrictions - CSIS, accessed on April 23, 2025, https://www.csis.org/analysis/consequences-chinas-new-rare-earths-export-restrictions
59. Market Research Center Launches Global Rare Earth Elements Industry (2025–2032) Report - NORTHEAST - NEWS CHANNEL NEBRASKA, accessed on April 23, 2025, https://northeast.newschannelnebraska.com/story/52685424/market-research-center-launches-global-rare-earth-elements-industry-20252032-report
60. China's Rare Earth Magnet Export Ban Creates Global Supply Chain Crisis - Discovery Alert, accessed on April 23, 2025, https://discoveryalert.com.au/news/rare-earth-magnets-critical-2025-applications/
61. Steel Wind Tower Market Poised to Hit USD 14.5 Billion by 2032 with 3.74% CAGR | Nordex, Goldwind, Vestas, Senvion - EIN Presswire, accessed on April 23, 2025, https://www.einpresswire.com/article/805463604/steel-wind-tower-market-poised-to-hit-usd-14-5-billion-by-2032-with-3-74-cagr-nordex-goldwind-vestas-senvion
62. From Balsa Wood to Polymer Foam in Wind Turbine Blades: Material Input Substitutes in Low-Carbon Technologies - USITC, accessed on April 23, 2025, https://www.usitc.gov/publications/332/executive_briefings/ebot_from_balsa_wood_to_polymer_foam_in_wind_turbine_blades.pdf
63. Materials for Wind Turbine Blades: An Overview - MDPI, accessed on April 23, 2025, https://www.mdpi.com/1996-1944/10/11/1285
64. Balsa core materials and panels - Sky Composites, accessed on April 23, 2025, https://sky-composites.com/products/core-materials/balsa-core/
65. Wind Turbine Composites Material Market Report, 2024-2030 - IndustryARC, accessed on April 23, 2025, https://www.industryarc.com/Research/Wind-Turbine-Composites-Material-Market-Research-500294
66. GWEC's Global Wind Report 2024 - windfair, accessed on April 23, 2025, https://w3.windfair.net/wind-energy/news/46491-gwec-s-global-wind-report-2024
67. Executive summary – Renewables 2024 – Analysis - IEA, accessed on April 23, 2025, https://www.iea.org/reports/renewables-2024/executive-summary