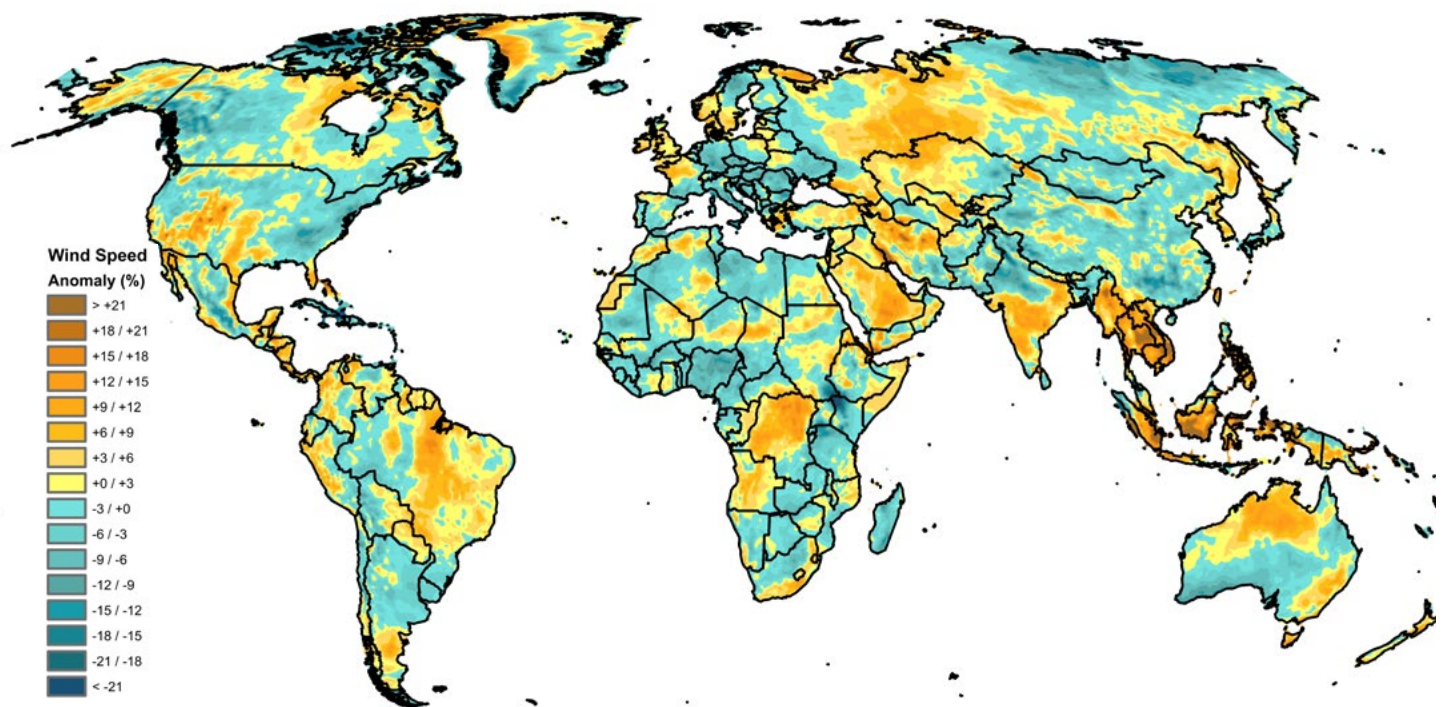


Wind Trends Bulletin

WIND SPEED PERFORMANCE

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GLOBAL

Q3 2019

In the third quarter of 2019, winds were above normal relative to the long-term, third-quarter norm (1988-2014) across much of the southern interior of the United States, Central America, British Isles, southern India, and Southeast Asia. Winds were below normal across the Northeast and Midwest United States, much of continental Europe, northern India, and China.

North American wind speeds rose above the quarterly norm for the first time since early 2018, driven by near-normal to well above-normal conditions across the United States. Higher than normal wind speeds persisted across much of the southern interior throughout the quarter. In September, above-normal wind speeds expanded to include much of the western and central U.S., as well as the upper Midwest.



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Strongly above-normal winds (21%+) were realized in September across Kansas, the southern Rockies, and southern Texas. Below-normal winds persisted across much of the Northeast, the Rust Belt region, and Hawaii. Wind speeds across Canada dipped below the long-term norm. Although near-normal to slightly above-normal conditions persisted across key areas of the Canadian Prairies during the beginning of the quarter, well below-normal wind speeds were ushered in by September; the reverse was true for the Canadian Maritimes. Wind speeds across Mexico, as a whole, have remained below normal since late 2018. Above-normal wind speeds persisted throughout the quarter in the eastern and northeastern states of Tamaulipas and Veracruz (18-21% above normal in August), while speeds fell below normal across Oaxaca and the Mexican Plateau. Above-normal wind speeds overspread much of Central America.

Near-normal wind speeds remained for another quarter across South America. Above-normal conditions persisted in the north across portions of Ecuador, Venezuela, and Colombia. Strongly above-normal winds (21%+) across Argentina in September counteracted strong deficits in July (-6% to -12%) and enabled the country to round out the quarter above the norm in key areas. Wind speeds across Chile were also highly variable, although a strong start to the quarter was mitigated by waning speeds in September. Wind speeds persisted at near normal to slightly above normal for much Brazil, although monthly wind speed departures were less volatile than in recent quarters. Uruguay and southern Brazil finished the quarter below the norm (-3% to -9%), despite strongly above-normal conditions in August (12% to 15%).

Below-normal wind speeds overspread much of Europe, although some key areas remained above the norm. Strong deficits established across localized areas of Central Europe (as low as -12%), while even stronger deficits were felt to the south in central Italy (-18% below normal). Wind speed departures across Greece rose well above normal during the latter half of the quarter, allowing for an above-normal end to the quarter. This was also true to the north and west over southern Scandinavia, the British Isles, and northern France. The wind speed surplus across the Iberian Peninsula in the second quarter waned, with third quarter wind speeds dipping to near normal or slightly below normal.

Wind speeds rose above the norm for Africa and the Middle East, a change from the second quarter when much of the region experienced below-normal winds. Wind speeds increased throughout the area, particularly across the Arabian Peninsula, Morocco and West Sahara, and South Africa. Wind speed deficits strengthened across East Africa.

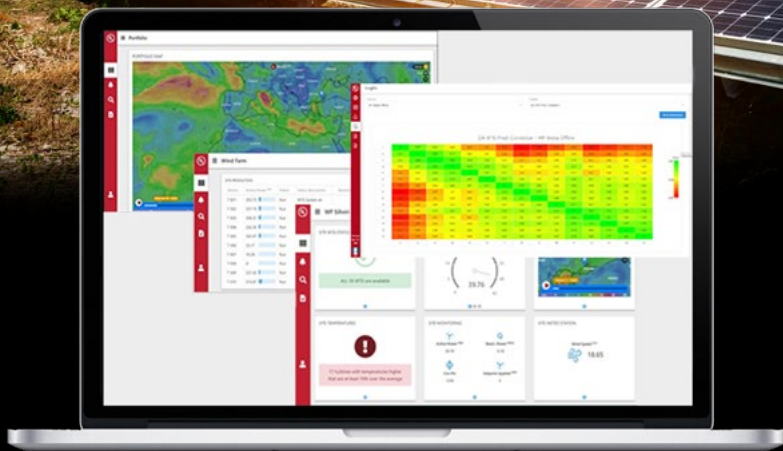
Key wind power producing areas across Asia transitioned to near-normal or above-normal conditions, apart from China. Wind speeds across much of eastern China have held steadily below the norm for almost all of 2019, while the wind speed surplus over the northeast during the first half of the year has waned. Wind speeds across Southeast Asia rose well above the long-term norm, with localized areas of wind speeds 21%+ above normal across Thailand, Vietnam, and the Philippines. A strong contrast of wind speed anomalies established across India during the latter half of the quarter: a deficit of -6 to -21% below the norm in the north and wind speed surplus of 9% to 12% in the south.

Wind speeds moderated to near normal over Oceania, although anomalies varied across the region. A strong wind speed deficit established in July across southwest Australia (-15% to -18%), contrasted the strongly above-normal conditions across Tasmania (21%+). Winds fell below the norm throughout much of Southern Australia by the end of the quarter. Wind speeds rose above the long-term norm across New Zealand in the third quarter.



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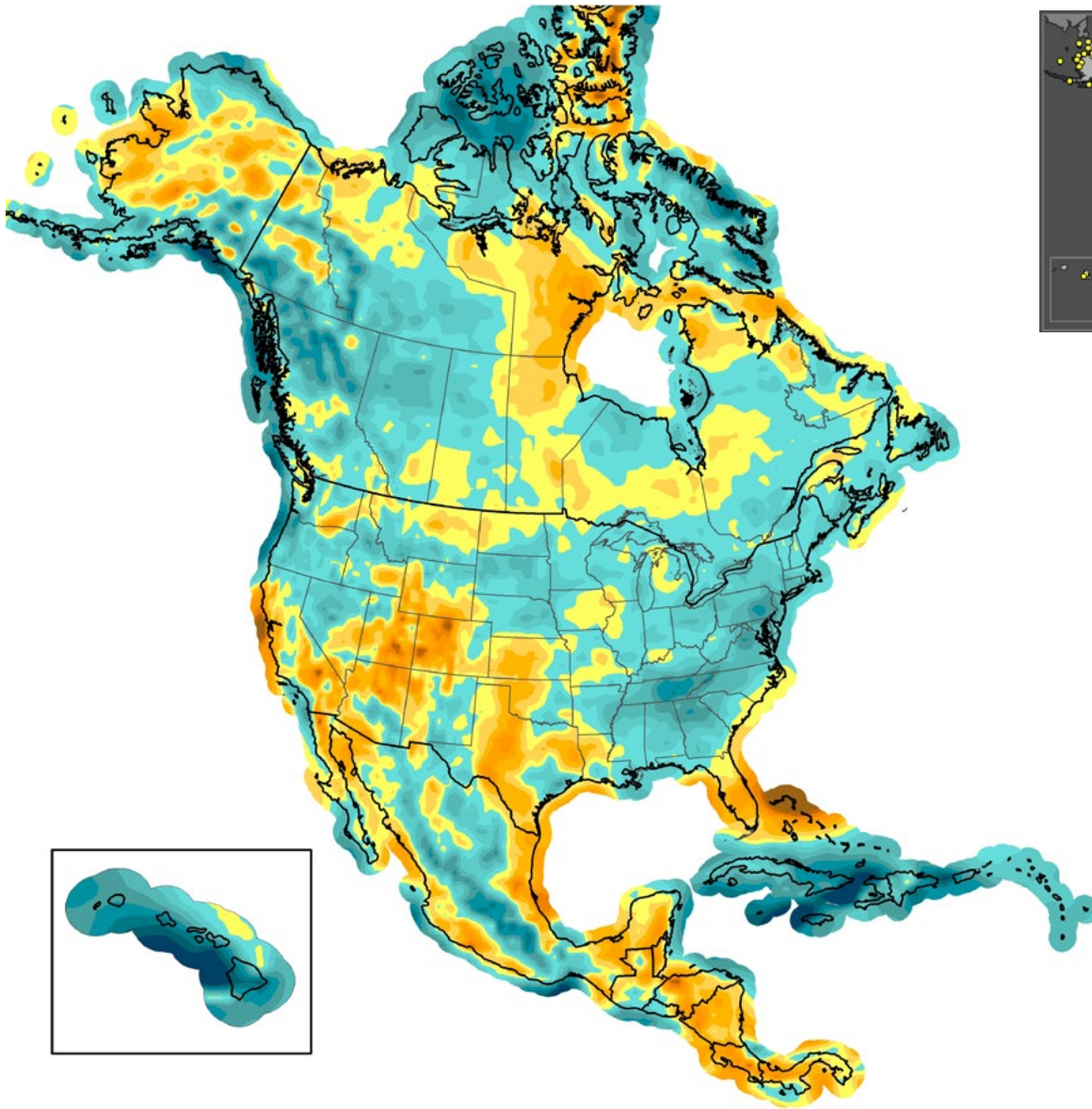
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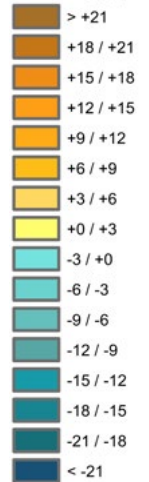
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Wind plant locations source:
www.thewindpower.net

Wind Speed Anomaly (%)



NORTH AMERICA

Q3 2019

Areas with below-average winds:

- Northeast US
- Midwest US
- Hawaii
- Central Mexico & Oaxaca
- The Caribbean

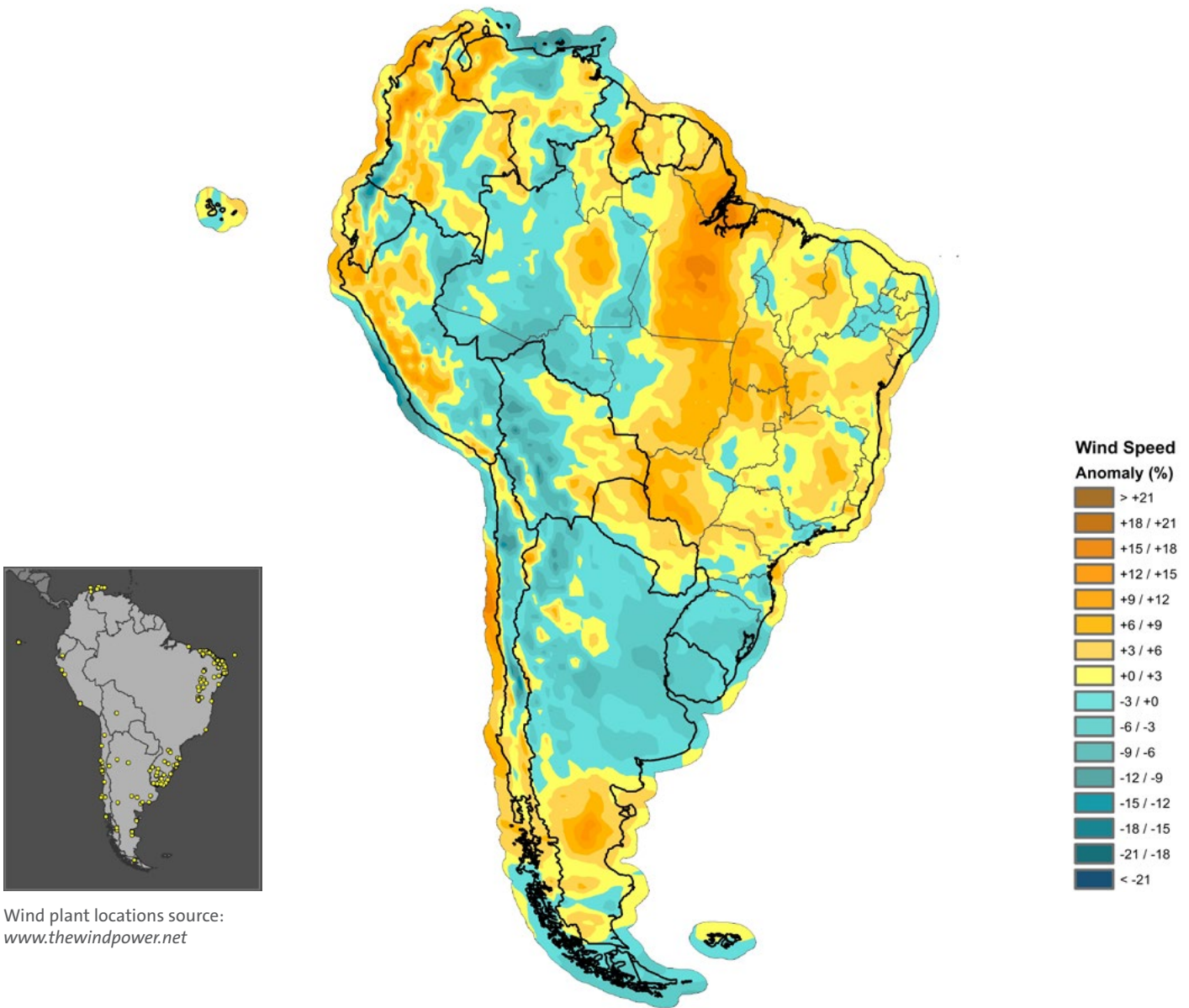
Areas with above-average winds:

- Central America
- California
- Southern Plains
- The Southern Rockies



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SOUTH AMERICA

Q3 2019

Areas with below-average winds:

- Southern Brazil
- Uruguay
- Western Bolivia

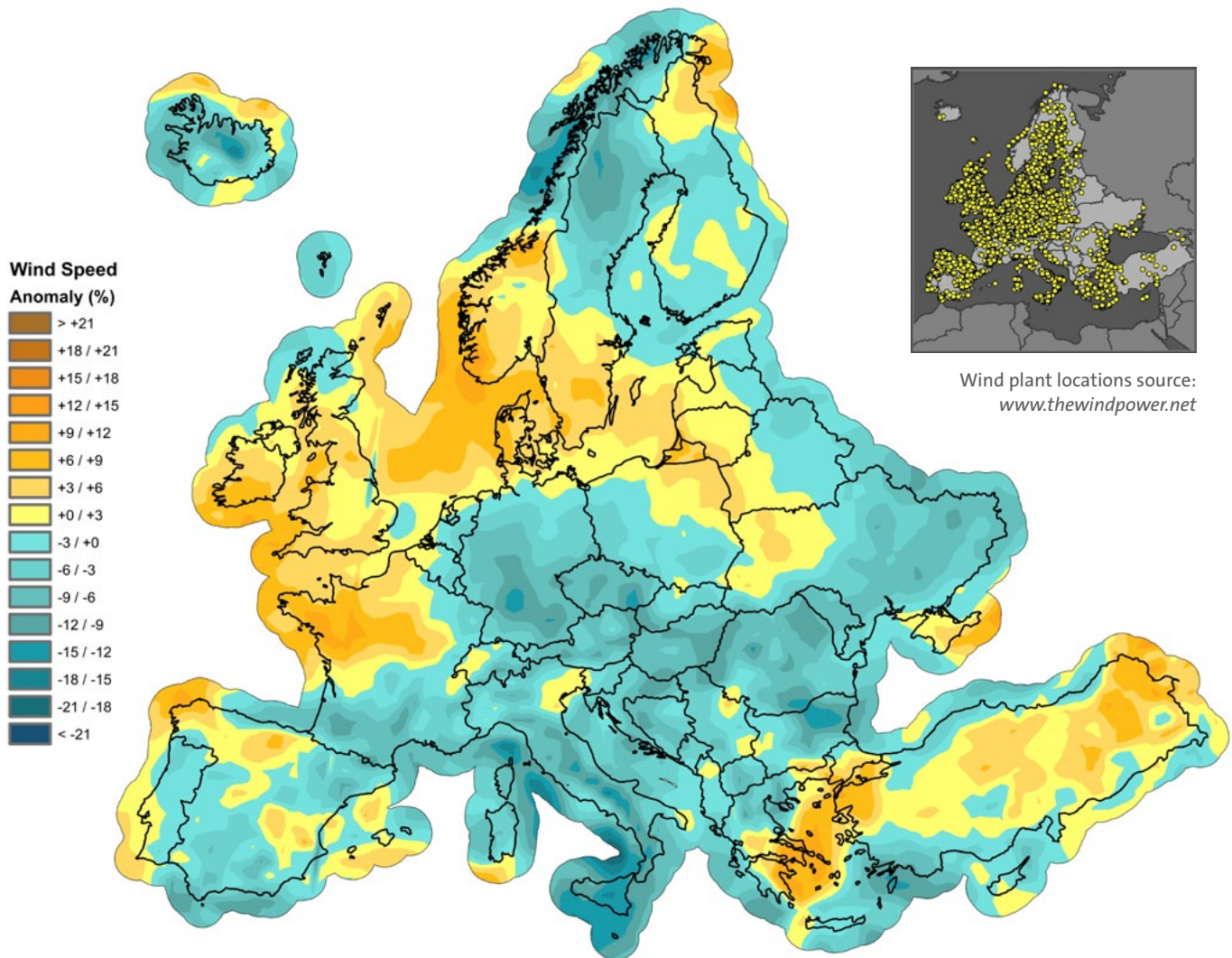
Areas with above-average winds:

- Southern Chile & Argentina
- Venezuela
- Colombia
- Ecuador



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EUROPE

Q3 2019

Areas with below-average winds:

- Germany
- Italy
- Austria
- The Balkan Peninsula
- Slovakia

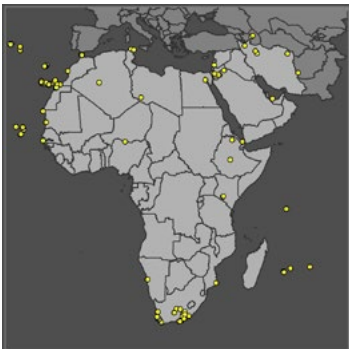
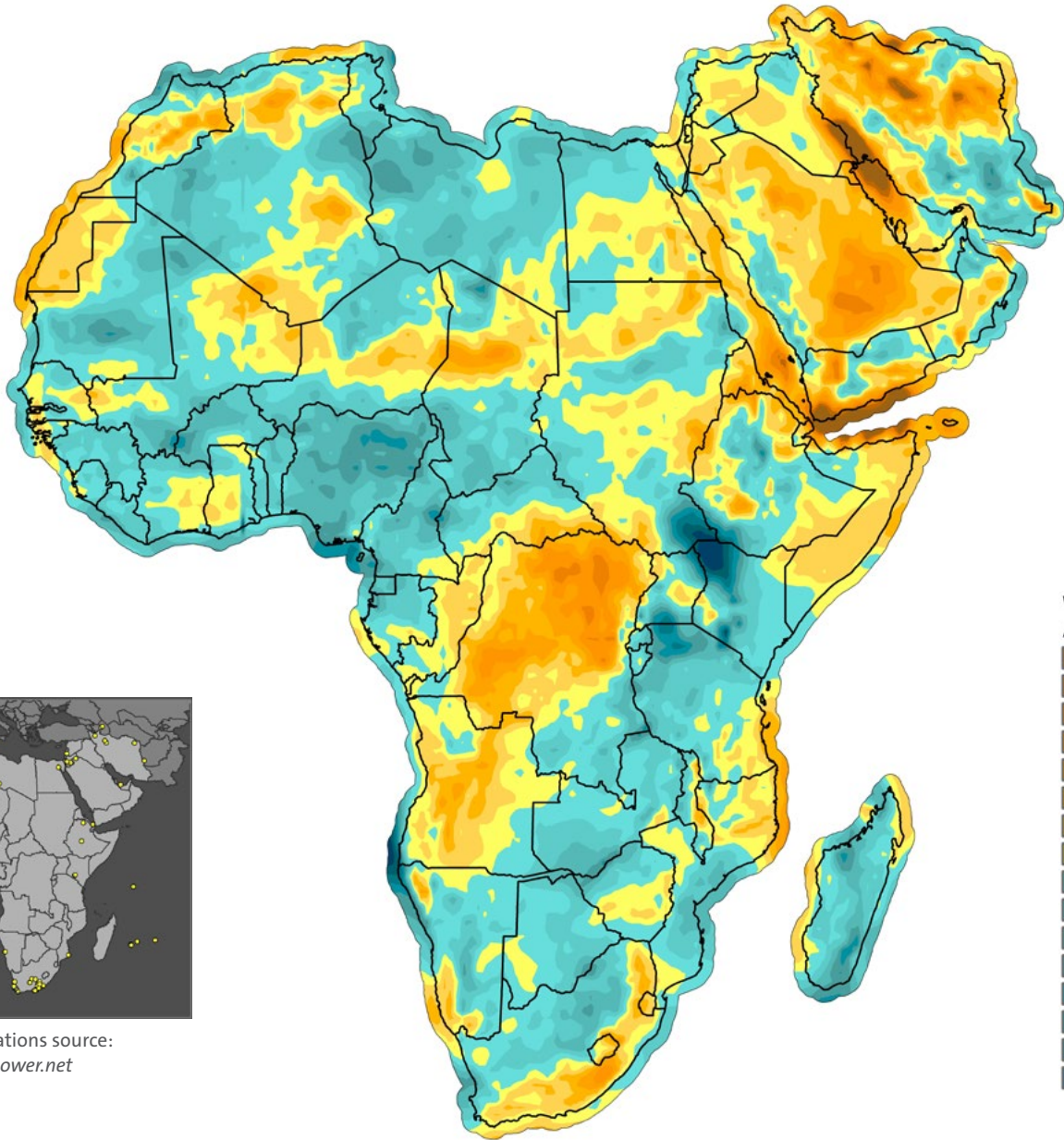
Areas with above-average winds:

- The British Isles
- Denmark
- Southern Scandinavia
- Northern France
- Turkey



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Wind plant locations source:
www.thewindpower.net

AFRICA / MIDDLE EAST

Q3 2019

Areas with below-average winds:

- Egypt
- Tunisia
- Kenya
- Nigeria
- Indian Ocean Islands

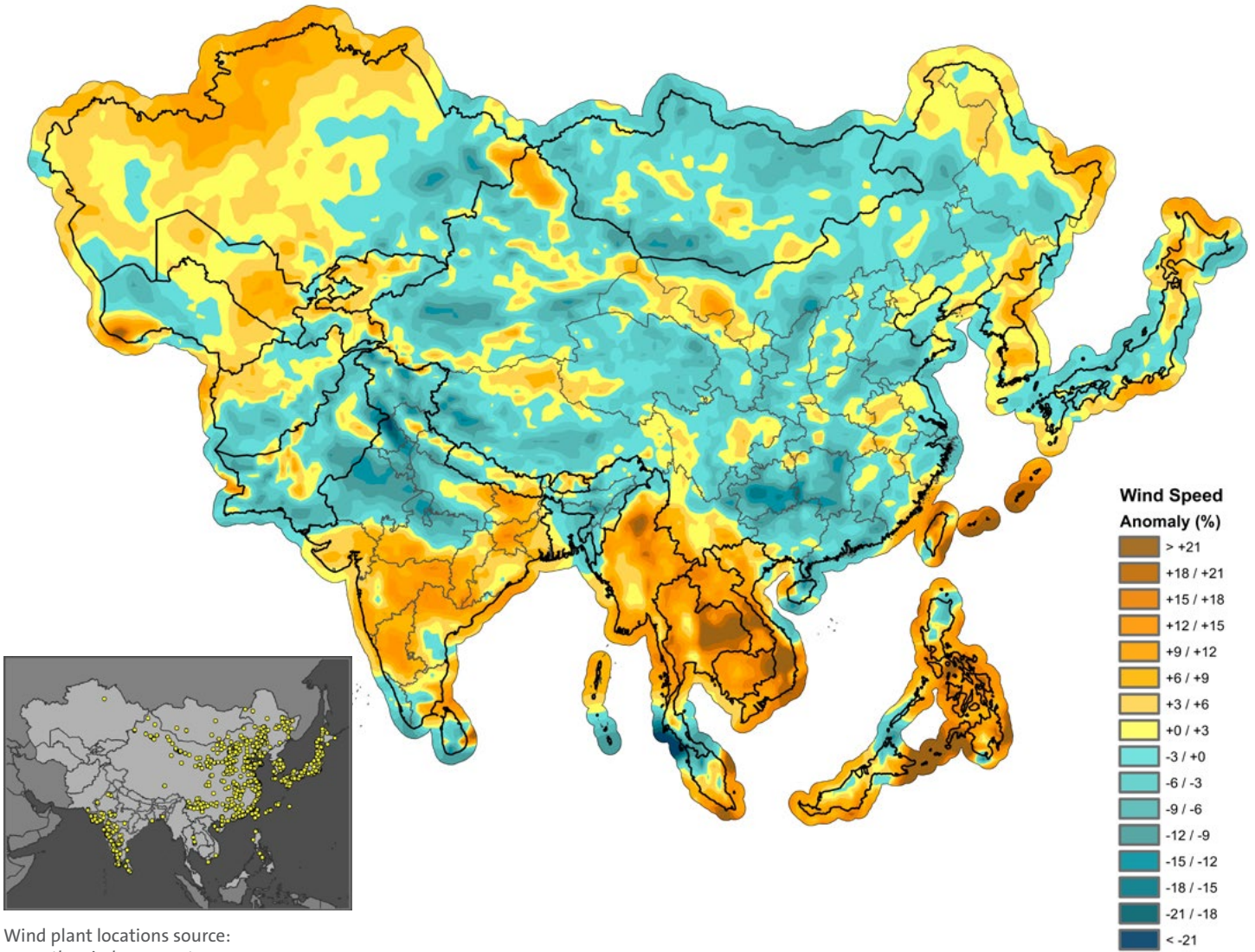
Areas with above-average winds:

- Western Sahara
- Morocco
- Iran
- Jordan
- Arabian Peninsula
- Eritrea



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ASIA

Q3 2019

Areas with below-average winds:

- China
- Northern India
- Pakistan
- Mongolia

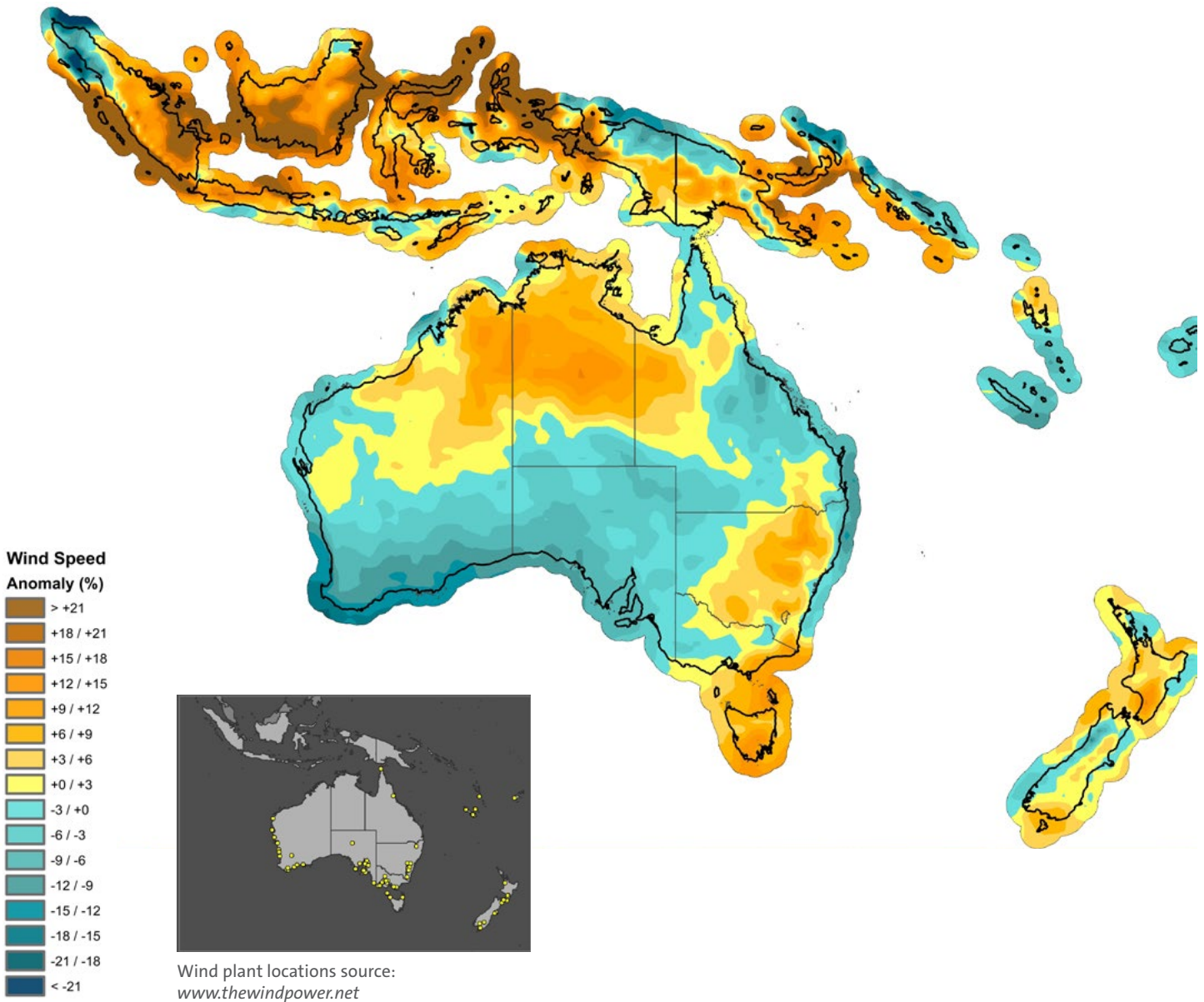
Areas with above-average winds:

- Thailand
- Vietnam
- Philippines
- Western & Central India



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WIND SPEED PERFORMANCE



INDONESIA, AUSTRALIA AND OCEANIA

Q3 2019

Areas with below-average winds:

- Southwest & Central Australia
- New Caledonia
- Southern Vanuatu
- Fiji

Areas with above-average winds:

- New Zealand
- Tasmania
- New South Wales, Australia



Wind Trends Bulletin

2019 Wind Index

This index represents the average wind anomaly (expressed as a percent deviation in mean speed from the 1988-2014 baseline for the corresponding calendar period) for each region and country shown, weighted by the location and megawatt capacity of wind projects in production by the end of 2018. The wind project locations and rated capacities are from The Wind Power database (TheWindPower.net). Note that not all operating projects are in the database, and coverage in certain countries such as China is weak. However, UL believes the findings are reasonably representative of wind conditions for the industry as a whole and for the key wind-producing countries.

Regions/Leading Wind Producing Countries	Jan	Feb	Mar	Q1	Apr	May	Jun	Q2	Jul	Aug	Sep	Q3	Oct	Nov	Dec	Q4	ANNUAL
North America	-1.1	3.1	-4.9	-1.3	-1.0	-5.2	-4.0	-3.4	1.0	-1.3	6.3	2.0	5.3				
Canada	3.0	8.1	0.7	3.9	9.6	-5.2	0.8	2.0	-2.0	-2.5	-1.1	-1.8	-3.4				
USA	-1.6	3.2	-6.0	-1.8	-2.4	-5.1	-4.8	-4.1	1.5	-0.8	7.7	2.8	7.6				
Mexico	-2.5	-13.5	0.5	-4.9	1.4	-3.8	-3.5	-2.1	-5.9	-13.6	-1.2	-7.2	-18.6				
South America	8.8	-9.2	-3.9	-0.9	-6.5	2.1	4.9	0.6	-1.0	3.8	-1.6	0.4	2.2				
Brazil	11.1	-10.7	-6.6	-1.5	-7.8	1.9	4.7	0.1	-2.1	3.1	0.1	0.4	2.2				
Argentina	-0.7	5.9	1.2	2.0	1.7	-4.7	2.9	0.0	-4.0	4.2	12.4	4.1	3.8				
Europe	0.1	-4.8	11.0	1.9	0.6	2.1	-0.1	0.8	-3.6	-2.6	3.4	-0.9	-4.6				
Denmark	-2.9	-3.2	13.5	2.2	-4.6	15.8	-1.8	3.1	7.5	-3.2	11.6	5.4	-11.3				
France	-7.7	-14.0	18.1	-1.7	-5.7	-1.6	-0.1	-2.6	-2.5	-2.7	11.2	2.1	6.9				
Germany	1.9	-7.6	19.7	4.6	3.8	1.1	-2.8	0.8	-4.8	-8.0	3.4	-3.1	0.0				
Great Britain	-16.2	-7.5	9.8	-5.3	-2.1	-14.3	4.1	-4.4	-6.0	12.4	1.0	2.5	-2.0				
Ireland	-22.1	12.9	4.7	-2.8	12.9	-14.3	3.5	-1.2	-7.2	17.2	4.5	4.9	0.0				
Italy	17.3	16.4	6.4	13.2	-4.3	11.9	-7.2	0.2	-2.9	-17.3	-10.8	-10.2	-16.8				
Portugal	5.3	-7.3	-2.1	-0.9	5.8	15.8	1.4	7.6	-6.2	-2.8	5.3	-1.5	-6.0				
Spain	7.0	-12.1	-1.3	-1.9	1.5	9.8	3.3	4.7	0.9	-5.1	5.3	0.3	-7.3				
Africa / Middle East	5.7	-3.8	1.2	1.3	-1.5	0.7	-2.1	-0.9	5.7	-2.6	0.2	1.1	2.7				
South Africa	-5.5	-3.4	-1.0	1.6	-0.7	-2.8	3.0	0.0	17.4	-10.0	-1.9	1.8	4.7				
Egypt	8.0	-15.1	-3.7	-7.8	2.9	2.3	-11.1	-2.4	-1.2	-14.3	9.0	-1.8	-0.4				
Asia	-4.5	-2.8	-3.1	-3.5	-4.6	4.3	-1.8	-0.8	-3.0	4.4	-2.7	-0.6	-0.9				
China	-4.9	-4.0	-3.7	-4.2	-5.1	7.2	-1.3	0.2	-4.1	4.7	-3.8	-1.2	1.0				
India	-4.1	5.7	0.3	0.3	-1.5	-9.0	-5.4	-5.5	1.5	2.5	2.2	1.8	-12.5				
Ind, Aus, Oceania	-2.5	1.7	-1.4	-0.9	3.9	13.0	-6.7	3.1	5.8	2.0	-5.3	0.8	-3.1				
Australia	-4.5	0.9	0.3	-1.3	5.4	13.3	-6.0	3.8	6.6	-0.3	-7.1	-0.3	-3.8				
World	-0.6	-1.7	2.2	-0.2	-0.9	0.4	-1.1	-0.5	-1.4	-0.4	2.1	0.9	-1.7				

[Click HERE](#) to download index values for even more wind producing countries!

