Supplementary table 1: Estimate of ‘Electricity-powered Unregulated’ (category C) groundwater pumping capacity

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Country | Area equipped for groundwater irrigation (m ha)[[1]](#footnote-1) | # of electric tubewells (million) | Average HP/ connection | Total pumping capacity in HP  (million HP) |
| India (excluding West Bengal and Gujarat)[[2]](#footnote-2) | 39.4[[3]](#footnote-3) | 24.1[[4]](#footnote-4) | 7.2[[5]](#footnote-5) | 174.4[[6]](#footnote-6) |
| Pakistan (Baluchistan and Khyber Pakhtunwa)[[7]](#footnote-7) | 0.72[[8]](#footnote-8) | 0.18 | 45[[9]](#footnote-9) | 8.1 |
| Iran[[10]](#footnote-10) | 5.2 | 1.1 | 40 | 44 |
| Saudi Arabia[[11]](#footnote-11) | 1.7 | 0.1 | 150 | 15 |
| Mexico | 2.5 | 0.3[[12]](#footnote-12) | 120 | 36 |
| Morocco, Tunisia, Algeria[[13]](#footnote-13) | 1.4 | 0.45 | 100 | 45 |
| Total for ‘Electricity-powered Unregulated’ groundwater economy |  |  |  | 322.5 |

1. Siebert et al (2010), Supplement S1 and S2. For Baluchistan and Khayber Pakhtunwa in Pakistan, estimates of groundwater irrigated area by Siebert et al. (2010), Supplement S2 are for 1995 and too high (44.77 million hectare); therefore, we have used Pakistan Agriculture Census data. [↑](#footnote-ref-1)
2. West Bengal has metered all electrified tubewells; Gujarat has 1.4 million metered and 0.48 million unmetered connections under a stringent power rationing regime. Therefore, we have excluded these two states. [↑](#footnote-ref-2)
3. This may be a serious underestimate since India’s 6th Minor Irrigation Census for 2017-18 (p:29) counted the gross area irrigated by groundwater wells at 69.6 million hectares and irrigation potential created at 80.45 ha. <https://micensus.gov.in/sites/default/files/reports/integratedReportII%28A%29.pdf>

   visited on February 12, 2023. [↑](#footnote-ref-3)
4. according to Central Electricity Authority of India, total agricultural grid power connections in 2022 were 26.6 million and their connected load was 196.9 m HP. <https://cea.nic.in/wp-content/uploads/general/2022/GR_2022_FINAL.pdf> From these, we have deducted the numbers for Gujarat and West Bengal. [↑](#footnote-ref-4)
5. The average capacity of electric irrigation pumps is 7.15 HP in the Report of the 6th Minor Irrigation Census 2017-18. New Delhi: in Government of India (GOI) (2023) Ministry of Water Resources. <https://micensus.gov.in/sites/default/files/reports/integratedReportII%28A%29.pdf>

   visited on February 12, 2023 [↑](#footnote-ref-5)
6. India’s 6th Minor Irrigation Census yields a significantly lower estimate at 151.6 m HP (16.6 m electrified wells with average capacity of 9.1 HP). However, we believe the Central Electricity Authority of India is more accurate in total agricultural grid power connections <https://cea.nic.in/wp-content/uploads/general/2022/GR_2022_FINAL.pdf> [↑](#footnote-ref-6)
7. # Lytton L, Ali A, Garthwaite B, Punthakey JF and Saeed B (2021) Groundwater in Pakistan’s Indus Basin Present and Future Prospects, Washington: The World Bank

   [↑](#footnote-ref-7)
8. 0.52 m ha in Baluchistan and 0.2 m ha in Khyber Pakhtunwa

   Government of Pakistan (2022) Agricultural Statistics of Pakistan 2019-20. Pakistan Bureau of Statistics, Statistics Division, Islamabad. Government of Pakistan (GoP) <https://www.pbs.gov.pk/content/agriculture-statistics> , visited on February 12, 2023 [↑](#footnote-ref-8)
9. # Rana AW, Davies S, Moeen MS and Shikoh SH (2020) Solarization of electric tube-wells for agriculture in Balochistan, Economic and environmental viability, DOI:10.2499/p15738coll2.134030

   [↑](#footnote-ref-9)
10. Nabavi E (2018) Failed Policies, Falling Aquifers: Unpacking Groundwater Over-abstraction in Iran. *Water Alternatives* 11(3), 699-724. [↑](#footnote-ref-10)
11. FAO (2009) Groundwater Management in Saudi Arabia: Draft Synthesis Report. Rome: FAO [↑](#footnote-ref-11)
12. Number of pumps and average size from pers. Comm. Christopher Scott, email dated February 6, 2023. [↑](#footnote-ref-12)
13. Data on number and size of irrigation pumps in Morocco, Algeria and Tunisia from Kuper et al., 2016.

    Kuper M, Faysse N, Hammani A, Hartani T, Marlet S, Hamamouche MF and Ameur F (2016) Liberation or Anarchy? The Janus Nature of Groundwater Use on North Africa’s New Irrigation Frontiers. In Integrated Groundwater Management, (ed. Jakeman AJ), pp 583-615. Springer, Cham. <https://doi.org/10.1007/978-3-319-23576-9_23> [↑](#footnote-ref-13)