Renewables Global Status Report 2025 – Geothermal Power and Heat – Endnotes

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3 Heat output in 2024 is based on sources for the four largest markets (China, Türkiye, Iceland and Japan) noted elsewhere in this section, and a nominal 1% annual growth rate since 2019 for the rest of the world. Historical growth rate of 1% from J.W. Lund and A.N. Toth, "Direct Utilization of Geothermal Energy 2020 Worldwide Review", 2020, https://www.worldgeothermal.org/pdf/IGAstandard/WGC/2020//01018.pdf. Policy in China from Zhao, F. and Xiang, Ye, "The Goal of China's Geothermal Energy Industry in 2025s", Proceedings of the World Geothermal Congress 2023, Beijing, China, 17-21 April 2023, https://worldgeothermal.org.

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5 The 2024 edition of the REN21 Renewables Global Status Report brought news of geothermal technology advances and declining costs as reported by the US Department of Energy in early 2024. It noted that “The US government is actively pursuing ‘next-generation’ technology advancement and cost reduction for enhanced geothermal systems (EGS) and closed-loop geothermal systems” with the aim of expanding the geographical range for geothermal energy generation. Further, it was reported that “Advancements during 2021-2023 have reduced US estimated EGS project costs 50%, supporting the objective to achieve levelised costs of electricity of USD 45 per megawatt-hour by 2035 and to install 90 GW of new geothermal power capacity by 2050.” As of May 2025, the Department has removed the sources of this information as cited last year and no updates on the topic appear to be available. See, for example: broken links to the National Renewable Energy Laboratory’s “Enhanced Geothermal Shot” analysis at US Department of Energy, “Enhanced Geothermal Systems (EGS) Pilot Demonstrations”, https://www.energy.gov/eere/geothermal/enhanced-geothermal-systems-egs-pilot-demonstrations, accessed May 2025; and the broken link to the Department’s “Pathways to Commercial Liftoff: Next-Generation Geothermal Power Webinar” at https://www.energy.gov/technologytransitions/events/does-pathways-commercial-liftoff-next-generation-geothermal-power. Original link to a 2024 report cited in 2024: US Department of Energy, Geothermal Technology Office, “Pathways to Commercial Liftoff: Next-Generation Geothermal Power”, March 2024, https://liftoff.energy.gov/next-generation-geothermal-power.

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8 See, also endnote 5. Allen S. Braddock, Joseph E. Donovan, and Kris J. Eimicke, "Congress Phases Out Energy Tax Credits", National Law Review, 7 July 2025, https://natlawreview.com/article/congress-phases-out-energy-tax-credits; Clara Hudson, "Republicans Push for Surge in Geothermal Energy on Federal Land", 13 May 2025, https://www.wsj.com/articles/republicans-push-for-surge-in-geothermal-energy-on-federal-land-79f27914.

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Note: In some instances, the effective geothermal generating capacity (achievable or running capacity) may be lower than indicated values, due to gradual degradation of the steam-generating capability of geothermal fields or to insufficient drilling of make-up wells to restore steam flow over time. If a geothermal power plant extracts heat and steam from the reservoir at a rate that exceeds the rate of replenishment across all its boreholes, additional wells may be drilled over time to tap additional steam flow, provided that the geothermal field overall can support additional steam flow. For example, the effective net generation capacity in the United States was 2.7 GW at the end of 2024, as

resource depletion in particular has limited the effective output far below the stated gross nameplate capacity of 4.0 GW. This resource-limited capability of a geothermal plant defines its dependable running capacity, as opposed to the total nameplate capacity of its generator(s). For the United States, most of the difference between nameplate and running capacity (around 800 MW) results from plant de-rating at the Geysers geothermal field in California, which is not able to produce enough steam, due to productivity decline, to operate at nameplate capacity. Net summer capacity from US Energy Information Administration (EIA), "Electric Power Monthly", February 2024, Table 6.2.B, https://www.eia.gov/electricity/monthly; nameplate capacity from US EIA, "Form EIA-860M (Preliminary Monthly Electric Generator Inventory)", December 2024, https://www.eia.gov/electricity/data/eia860m; US Department of Energy, Office of Scientific and Technical Information, "GeoVision: Harnessing the Heat Beneath Our Feet", June 2019, https://www.energy.gov/eere/geothermal/downloads/geovision-harnessing-heat-beneath-our-feet. In general, a power plant's net capacity equals gross capacity less the plant's own power requirements and any seasonal de-rating. In the case of geothermal plants, net capacity also would reflect the effective power capability of the plant as determined by the current steam production of the geothermal field.

11 Estimates are based on the following sources: power capacity data for Indonesia, Japan, New Zealand, the Philippines, Türkiye and the United States from sources noted elsewhere in this section; Iceland: Orkustofnun, "Raforkuvinnsla" [Electricity Generation], viewed May 2025, https://orkustofnun.is/raforkueftirlit/raforkuvinnsla; Germany: Federal Environment Agency (Umwelt Bundesamt), "Erneuerbare Energien in Deutschland Daten zur Entwicklung im Jahr 2024" [Renewable Energies in Germany, Data on Developments in the Year 2024], March 2025, https://www.umweltbundesamt.de/publikationen/erneuerbare-energien-in-deutschland-2024; Kenya: Energy and Petroleum Regulatory Authority, "Biannual Energy and Petroleum Statistics Report Financial Year 2023-2024", https://www.epra.go.ke/annual-reports; Mexico: Luis C.A. Gutiérrez-Negrín, "2023 Mexico country report", International Energy Agency Geothermal, November 2024, https://www.iea-gia.org/our-members/mexico; capacity data for other countries from International Renewable Energy Agency, "Renewable Capacity Statistics 2025", 2025, https://www.irena.org/Publications/2025/Mar/Renewable-capacity-statistics-2025.

12 REN21, "Renewables Global Status Report", 2020-2024 editions, https://www.ren21.net/reports/global-status-report.

13 Estimates are based on the following sources: power capacity data for Indonesia, Japan, New Zealand, the Philippines, Türkiye and the United States from sources noted elsewhere in this section; Iceland: Orkustofnun, "Raforkuvinnsla" [Electricity Generation], viewed May 2025, https://orkustofnun.is/raforkueftirlit/raforkuvinnsla; Germany: Federal Environment Agency (Umwelt Bundesamt), "Erneuerbare Energien in Deutschland Daten zur Entwicklung im Jahr 2024" [Renewable Energies in Germany, Data on Developments in the Year 2024], March 2025, https://www.umweltbundesamt.de/publikationen/erneuerbare-energien-in-deutschland-2024; Kenya: Energy and Petroleum Regulatory Authority, "Biannual Energy and Petroleum Statistics Report Financial Year 2023-2024", https://www.epra.go.ke/annual-reports; Mexico: Luis C.A. Gutiérrez-Negrín, "2023 Mexico country report", International Energy Agency Geothermal, November 2024, https://www.iea-gia.org/our-members/mexico; capacity data for other countries from International Renewable Energy Agency, "Renewable Capacity Statistics 2025", 2025, https://www.irena.org/Publications/2025/Mar/Renewable-capacity-statistics-2025; estimated electricity generation in 2024 based on International Energy Agency, "Renewable Energy Progress Tracker", 9 October 2024, https://www.iea.org/data-and-statistics/data-tools/renewables-data-explorer. Heat output in 2024 is based on sources for the four largest markets (China, Türkiye, Iceland and Japan) noted elsewhere in this section, and a nominal 1% annual growth rate since 2019 for the rest of the world. Historical growth rate of 1% from J.W. Lund and A.N. Toth, "Direct Utilization of Geothermal Energy 2020 Worldwide Review", 2020, https://www.worldgeothermal.org/pdf/IGAstandard/WGC/2020//01018.pdf. Figure G1 based on year-end 2023 capacity data and capacity additions in 2024 from the sources listed above, and from sources noted elsewhere in this section. For the purpose of this figure, year-end 2023 capacity is assumed to be equal to year-end 2024 capacity less new capacity installed (or expanded) during 2024.

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29 The Ministry of Energy and Mineral Resources noted the completion of three units in 2024 but counted only one as entering commercial operation. These were noted as Sorik Marapi Unit 5 (41.25 MW noted but 33 MW realized per owner – see note below), Salak binary unit (15 MW), and Blawan Ijen (35 MW). Only the first unit was counted towards total capacity at year-end 2024 of 2,638.8 MW. See: Republic of Indonesia, Ministry of Energy and Mineral Resources, “Laporan Kinerja Ditjen EBTKE Tahun 2024” [Performance Report 2024 of the Directorate General of New, Renewable Energy and Energy Conservation], 49, 63, 82-85, https://www.esdm.go.id/assets/media/content/content-laporan-kinerja-ditjen-ebtke-tahun-2024.pdf. Three new generating units were constructed in 2024 but only one entered service – the 33 MW Unit 5 at the Sorik Marapi complex on North Sumatra, running a total of 200 MW as of year’s end, from Sorik Marapi Geothermal Power, “Commitment to increase clean electricity supply Sorik Marapi geothermal power plant successfully ran unit rated capacity test of Unit-5 33 megawatt”, press release, 18 December 2024, https://ksorka-sorikmarapi.com/page/pressrelease/11-2024-pressrelease-.html; Republic of Indonesia, Ministry of Energy and Mineral Resources, “Laporan Kinerja Ditjen EBTKE Tahun 2024” [Performance Report 2024 of the Directorate General of New, Renewable Energy and Energy Conservation], 49, 63, 82-85, https://www.esdm.go.id/assets/media/content/content-laporan-kinerja-ditjen-ebtke-tahun-2024.pdf. The other two units, which did not complete testing until early 2025, were the 35 MW Blawan Ijen (first geothermal plant in East Java province), and a 15 MW binary-cycle unit at the Salak complex in the Province of West Java, based on the following sources: Ormat Technologies, “Ormat Commences Commercial Operation of 35 MW Ijen Geothermal Facility in Indonesia, Delivering Low Carbon Geothermal Power”, press release, 10 February 2025, https://investor.ormat.com/news-events/news/news-details/2025/Ormat-Commences-Commercial-Operation-of-35-MW-Ijen-Geothermal-Facility-in-Indonesia-Delivering-Low-Carbon-Geothermal-Power/default.aspx; Inti Karya Persada Tehnik, “Penandatanganan Kontrak

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