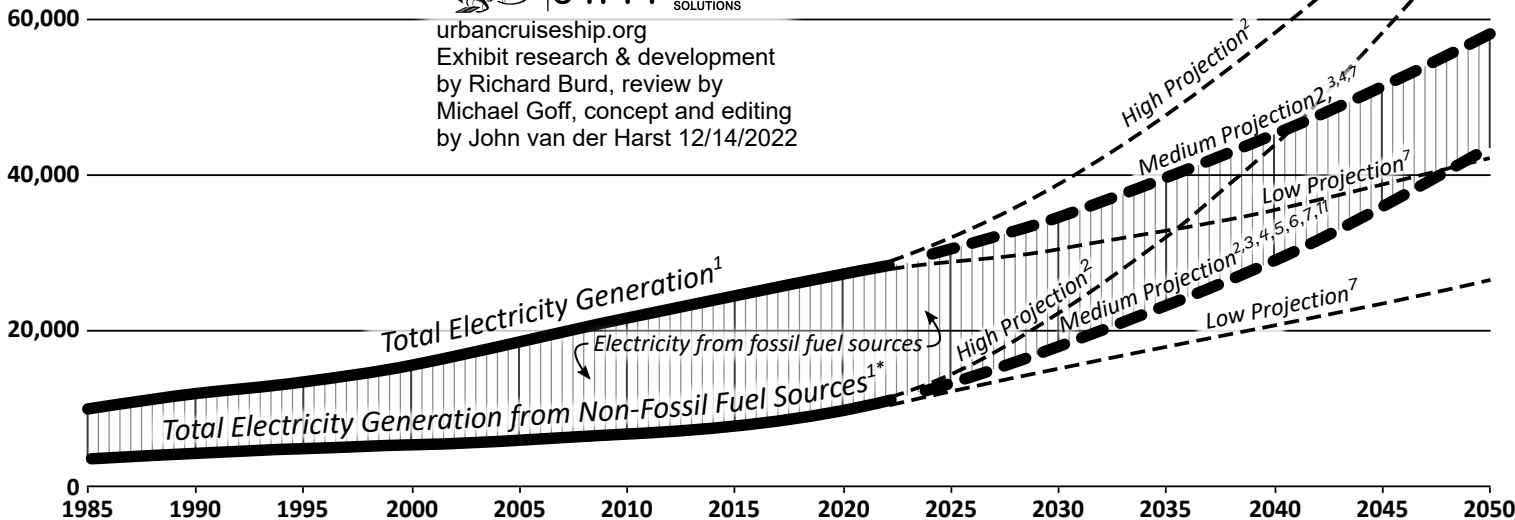


ELECTRICITY PRODUCTION FORECAST

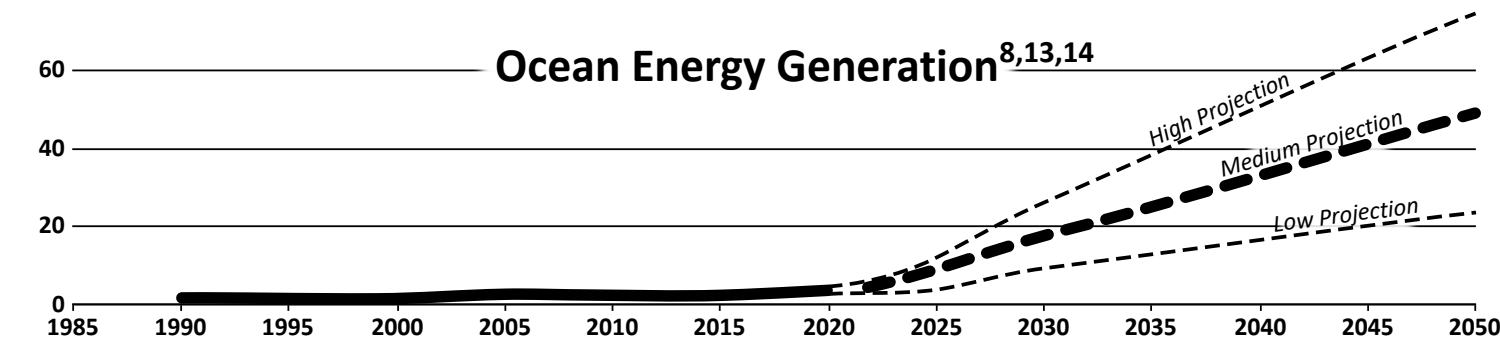
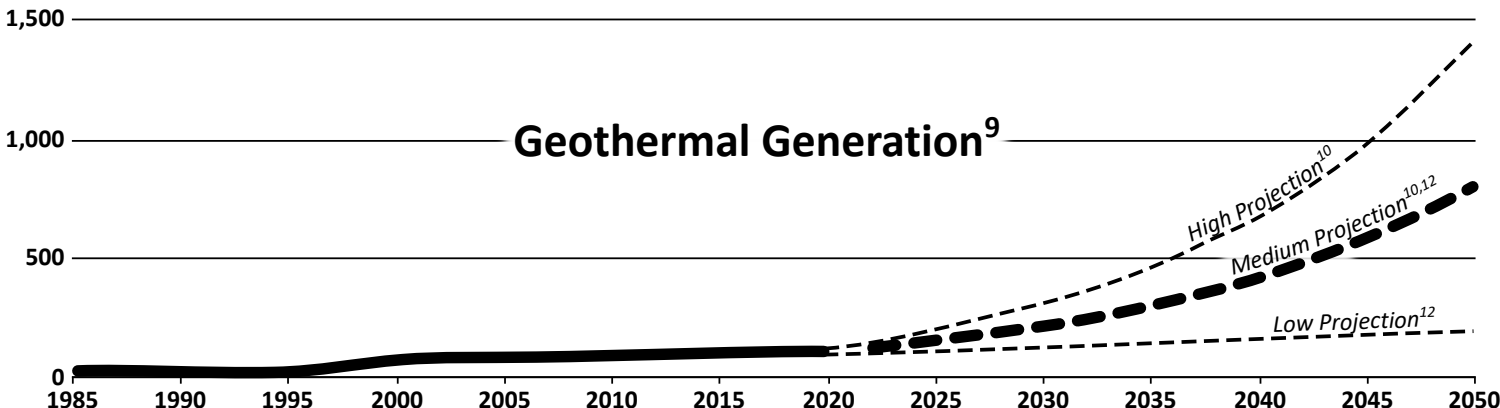
Total Generation of Electricity & Generation From Non-fossil Fuel Sources

Terawatt hour (TWh) of electricity produced per year, globally



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 Exhibit research & development
 by Richard Burd, review by
 Michael Goff, concept and editing
 by John van der Harst 12/14/2022

* This includes the following energy sources: geothermal, wave, solar, wind, hydro, and nuclear. Other green energy sources (e.g. biomass, biofuels, etc.) contributed such a small amount to the overall power grid so as to not warrant inclusion in this exhibit



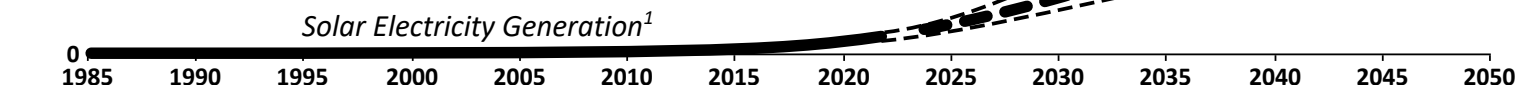
- 1.) BP Statistical Review of World Energy - all data, BP Overview Documents/bp-stats-review-2022-all-data.xlsx. Accessed on August 17, 2022. This is the primary source for all historical data outside geothermal and wave (ocean) energy.
- 2.) McKinsey Energy Insights Global Energy Perspective 2022; McKinsey Power Model, p.12 of 28. Accessed on August 17, 2022. This source gave the highest projected estimates for energy sources except nuclear and geothermal.
- 3.) IEA (2021), World Energy Outlook 2021, IEA, Paris. Figure 3.12. Accessed on August 17, 2022. The data shown in the Announced Pledges Scenario (APS) were consulted for 2030 and an extrapolation was done between it and the next source; the middle trajectory shown here is an average of all trajectories derived from the consulted sources
- 4.) BP Energy Outlook 2022 Edition. Accessed on August 17, 2022. The data shown in the New Momentum scenario were consulted for 2050 and an extrapolation was done between it and the previous source to form an estimated trajectory.
- 5.) IEA (2021), World Energy Outlook 2021, IEA, Paris. Table A.17: Solar PV Generation. Accessed on August 18, 2022 This data provided the middle-most trajectory for forecasted solar energy generation
- 6.) IEA (2021), World Energy Outlook 2021, IEA, Paris. Table A.18: Wind Generation. Accessed on August 18, 2022 This data provided the middle-most trajectory for forecasted wind energy generation
- 7.) EIA, Nalley, Stephen (Acting Administrator) & LaRose, Angelina (Assistant Administrator) International Energy Outlook 2021 (IEO2021), p.14: World net electricity generation by source. Accessed on August 17, 2022. This source provided the lowest forecasted trajectory for future electricity sources except solar where it was the middle estimate. Values are for 2020, 2030, 2040, and 2050, with intermittent years being interpolated by our UCS model. This source provides no input on geothermal or wave (ocean) energy
- 8.) IEA (2021), Ocean Power, IEA, Paris. Accessed on August 18, 2022. This source provides the historical data on ocean (wave) energy and is used to extrapolate a future projection
- 9.) IEA (2021), Geothermal Power, IEA, Paris. Accessed on August 17, 2022. This source is used for historical data on geothermal power generation
- 10.) IEA (2011), Technology Roadmap - Geothermal Heat and Power, IEA, Paris. Accessed on August 17, 2022. This source is used for the high future forecast of geothermal power generation it assumes 75% renewable energy by 2050 which is what you would get if you added up all the medium projections (for other energy sources) in this handout and coupled with this source for geothermal energy; for all other energy sources, the 'business-as-usual' or 'most-likely-scenario' (in a study) is used and they are then averaged to produce all of the other "Medium Projections" in this handout.
- 11.) IEA (2021), World Energy Outlook 2021, IEA, Paris. Table A.19: Nuclear Generation. Accessed on August 18, 2022 This data provided the middle-most trajectory for forecasted nuclear energy generation
- 12.) Augustine et al. (2019). GeoVision Analysis Supporting Task Force Report: Electric Sector Potential to Penetration. (Interactive Graph) NREL/TP-6A20-71833. Golden, CO: National Renewable Energy Laboratory
- 13.) IRENA (2020). Innovation outlook: Ocean energy technologies, International Renewable Energy Agency, Abu Dhabi. This source provides a high (10 GW) and low (534.7 MW in development + 2.83 GW) forecast estimates for 2030; we then extrapolate the respective trajectories to 2050 after applying conversions to TWh/yr (GW * 8760 hr/yr * 30% capacity factor we apply based on the source below)
- 14.) The Future Potential of Wave Power in the United States, U.S. Department of Energy, August 2012. (see footnote 13 above)

Terawatt hour (TWh) of electricity produced per year, globally

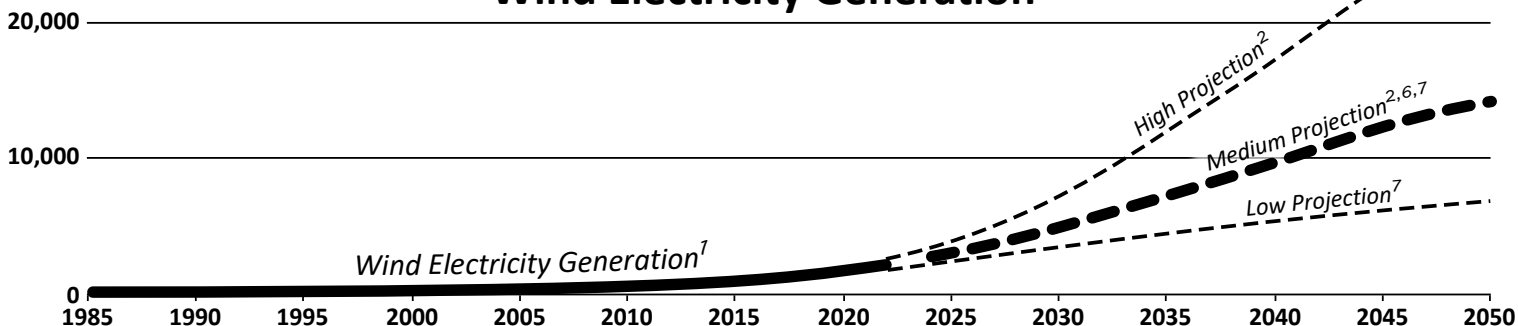
Solar Electricity Generation



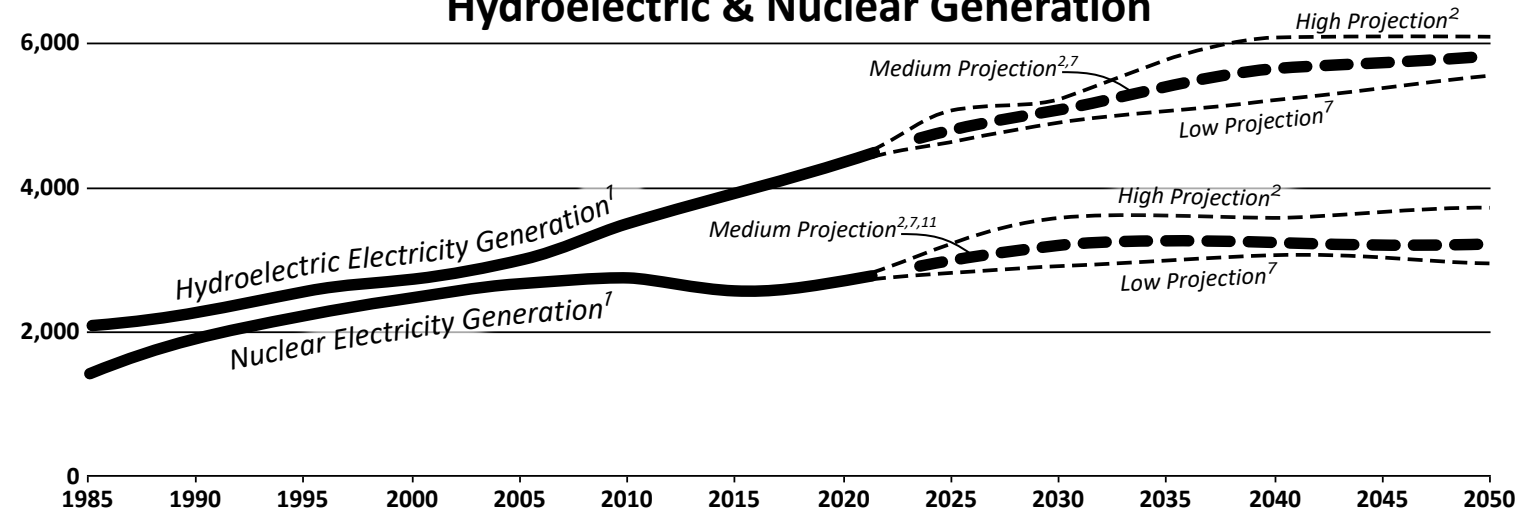
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Wind Electricity Generation



Hydroelectric & Nuclear Generation



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