Portland, Maine

Located in the Northernmost state on the East Coast, Portland is the largest city in Maine. It is home to a midsized community of approximately 68,854 people (State Demographics, 2026). The population has grown by 0.92% throughout the past ten years (MapSof, 2026). The median age is 16% lower than the state median of 44.8 years at 37.8 years. The diversity in Portland is ranked 38/100 because the population is 77.5% White (non-hispanic), 9.1% African American, and 3.9% Asian. However, the overall diversity in Portland is higher than the state average with higher African American and Asian populations (State Demographics, 2026).

The employment rate in the city is 73.5%, and the median income for households is $79,540. The poverty rate is 4% higher than the state average at 11.2%. There are a total of 35,048 families/living arrangements who reside in a total of 39,175 housing units (US Census Bureau, 2024). The homeownership rate is 46.9%, which is 37% lower than the state average. The median value of a home in Portland is estimated around $489,600 which is significantly more costly compared to the state median of $296,600. Home affordability is proven to be a concern for many residents due to the home-value-to-income ratio of 6.2 (State Demographics, 2026).

As for the geography, Portland is a coastal city as it borders the Atlantic Ocean and the Gulf of Maine. It is built upon two hilly peninsulas that overlook many islands and Casco Bay (Britannica Authors, 2026). The city contains two main topographic features, the White Mountains in the Northwest and an elevated peninsula in downtown Portland. It has an area of approximately 21.2 square miles, and is 34 feet above sea level. Portland experiences heavy amounts of annual participation with an average of 44.3 inches rain and 71.3 inches snow respectively (City data, 2026). This is likely because it has a latitude and longitude of 43.6574, -70.185305 (Ookie et al., n.d.).

Overall Portland is also very cold, especially during the winter months where the city's heating needs contribute to Maine having the highest per capita energy use in New England (United States Energy Information Administration, 2025). In addition to snow and cold temperatures, Portland has had other extreme weather events like floods. In January of 2024, city water levels reached 14.57 feet, the highest since the historic Blizzard of 1978. This flooding was caused by the synergistic effect of a 3.4-foot storm surge and southerly winds (Sommers, 2026). Figures 1-2 below are maps of the city that are provided for reference.



Figure 1: Streetview Map of Portland

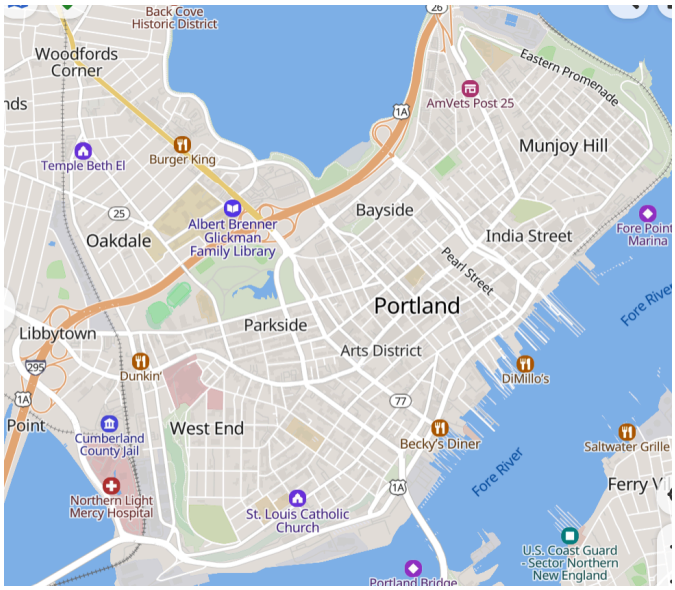


Figure 2: Map of Portland Waterways

Portland also is in possession of many vast natural resources including lush wooded areas. 90% of the state of Maine itself is covered by forests. This is the largest portion of forest cover for any state in the US (United States Energy Information Administration, 2025). As can be seen in Figure 1 above, Portland contains many parks including Harbor view, Lincoln, Compass, Congress Square, Peppermint, Back Cove, Fort Allen, and Belmeade Park. It also contains Mayor Baxter Woods, the Fore River Sanctuary, and the Presumpscot River Preserve. It is important to recognize that these natural areas are home to many species, including animals such as the endangered Northern Long Eared Bat, the endangered Tricolored Bat, the endangered Roseate tern, and the notable threatened Monarch Butterfly. However, thankfully there are currently no critical habitats in Portland (US Fish and Wildlife, n.d.).

The aquatic resources in Portland are also numerous, featuring the Fore River, Casco Bay, and Back Cove (refer to Figure 2 above). Back Cove is located at the North Western tip of Portland adjacent to the corresponding Back Cove Historic district. The waterways of Portland are also host to a vast range of Fish species including the Acadian Redfish, the American Plaice, the Atlantic Butterfish, the Atlantic Cod, the Atlantic Herring, the Atlantic Mackerel, the

Atlantic Sea Scallop, the Atlantic Wolffish, the Bluefish, the Haddock, the skate, the Monkfish, the Ocean Pout, the Pollock, the Red Hake, the Silver Hake, the Smooth Skate, the Spiny Dogfish, the Thorny Skate, the White Hake, the Windowpane Flounder, the Winter Flounder, the Winter Skate, and the Yellowtail Flounder (NOAA, n.d.). With Portland's Port being the second largest in New England, it is a busy transportation and commercial center. Consequently, the main industries of the city are shipping, commercial fishing, and shipbuilding (Britannica Authors, 2026).

Due to the state of Maine and the city of Portland's extensive natural resources, it has substantial potential for renewable energy resources (United States Energy Information Administration, 2025). The many rivers, winds, and forests provide a great opportunity to expand renewable energy supply and storage projects in the city. Currently, there are plans for the U.S. Department of Energy's Grid Deployment Office to support the creation of a 111-mile transmission line connecting ISO-NE to renewable generation in northern Main, entitled the Aroostook Renewable Project. Additionally, this year there are plans for a 145-mile transmission line that will bring 1,200 megawatts of hydropower from Canada to New England. As for fossil fuels, there are no oil refineries, crude oil reserves, or production in the entire state of Maine. However, there is one intrastate petroleum product pipeline that runs between Portland and Bangor (United States Energy Information Administration, 2025).

On a state level, Maine's electricity grid is approximately 55% renewable (United States Energy Information Administration, 2025). In the 90s, Maine's energy supply consisted of 40% nuclear power, until 1997 when the sole nuclear plant ceased operations. The renewable energy mix has now shifted towards hydropower, wind, biomass, and solar energy. In fact, 82% of the state's renewable generation was powered by hydroelectric dams, wind turbines, biomass and solar energy. In 2024, hydroelectric power comprised 32% of the state's total with 51 hydroelectric power plants with approximately 726 megawatts of capacity in 2025. Unfortunately, hydroelectric dams can interfere with natural river flows and fish migrations, so some dams have to be removed for conservation. The notable remainder of the renewable energy mix consists of 27% wind energy and 10% biomass in 2024 (United States Energy Information Administration, 2025). Overall, Maine's optimal location and bountiful resources promise great potential for Portland's renewable energy future.

Outside of renewable energy, the energy mix primarily consists of petroleum and natural gas. Petroleum comprised over 50% of the state's total generation in 2023, and natural gas comprised roughly 41% of the state's total generation in 2024. There is such a high reliance on petroleum products for home heating, particularly in the very frigid winter months (United States Energy Information Administration, 2025). There are two main voltage lines that go through Portland, one is in the very bottom near South Portland and it runs from east to west and the other goes through the tip of northern Portland going Northeast. The black lines in Figure 3 below represent the two high voltage lines in Portland, and these are significant because they could be in close proximity to renewable energy development locations.

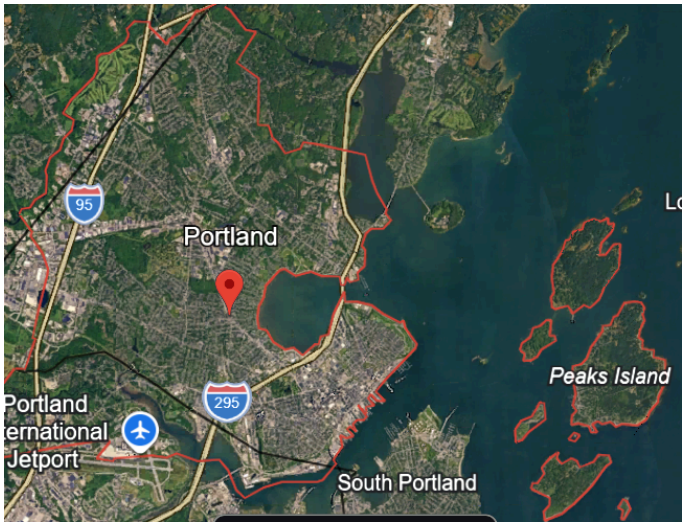


Figure 3: Map of Portland Voltage Lines

Portland's residential cost per kWh is $0.29 per kWh of electricity, which is 41% higher than the national average of $0.21/kWh (Energysage, 2026). The price is likely higher than the national average because Maine has no reserves of coal, natural gas, or crude oil. This means that Portland only produces about 25% of the energy it consumes (United States Energy Information Administration, 2025). Portland is part of the ISO new england grid region which has a medium carbon intensity of 298 gCO2eq/kWh as indicated by the yellow color in Figure 4 below. The energy mix for the region is 48% carbon free and 27% renewable composed mostly of gas, nuclear, some hydro, solar with low actual capacity, wind, and a little biomass (Electricity Maps, 2026).

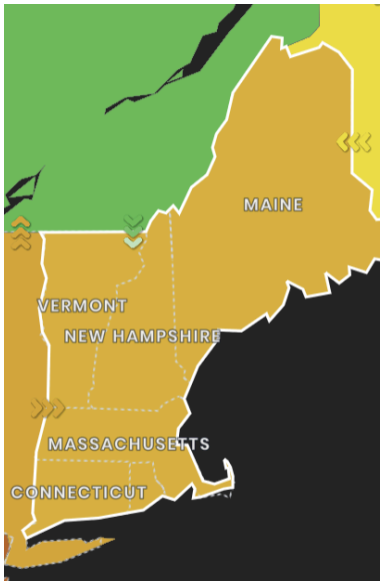


Figure 4: Carbon Intensity of ISO Region

The city of Portland itself has great suitability for different types of renewable energy development. Firstly, solar power can be beneficial for the city due to its presence of large inland water bodies including the Capisic Pond, Stroudwater river, Fore River, and Sebago Lake (City

of Portland, n.d.) and its medium solar irradiance (National Laboratory of the Rockies, n.d.). However, due to Portland's largely metropolitan presence there is not a sufficient amount of open space for a larger solar farm. Wind is another renewable source with potential in Portland due to the city's high wind speeds (National Laboratory of the Rockies, n.d.) and its coastal location. Additionally, wind power would be ideal for Portland because it will not interfere with bird populations (ABC Birds, n.d.).

As for tidal power, Figure 5 below shows that the speed of the ocean currents and the density of the power of the ocean currents, indicated by dark blue, are low at 0-0.1 and 0-100 respectively. However, the presence of ocean currents means that tidal power is viable. Biomass was the last promising resource for Portland as 27,000 acres of corn were planted in the state of Maine in 2026 (USDA, 2018). Portland had a total residual biomass of 145756.44 with 80710 forest residuals but 0 crop residuals (Tippett, 2026). This does suggest that there is room for potential growth in the development of biofuel resources. Overall, Portland seems viable for expansion of solar, wind, tidal, and biomass power. Refer to Figures 6 and 7 below for maps of Maine's renewable sources.



Figure 5: Portland Tidal Speed Map



Figure 6: Map of Maine's Renewable Resources

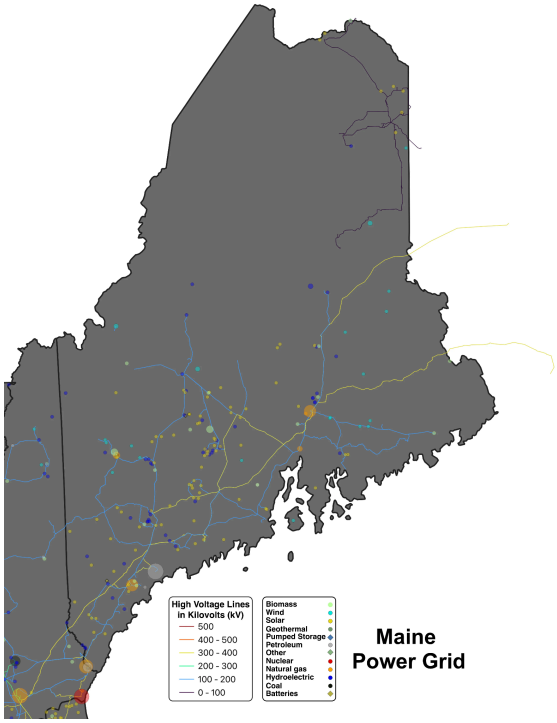


Figure 7: Maine's Renewable Power Grid

Portland also has plentiful opportunities for storage development. Firstly, chemical batteries and thermal cryogenic storage are sufficient options for any location. Portland in particular has some potential for a pumped hydro facility due to the elevation change at Portland High Point at 189.9 ft in the northwestern section of the city limits (Jackson, 2026).

Unfortunately, there are no abandoned salt mines for compressed air storage in Portland Maine, so compressed gas storage would not be ideal. Buoyancy storage would be ideal for Portland, however, because of the presence of deep water at Sebago Lake at 300 ft (Portland Water District, 2026) and Portland Harbor at 45 feet deep (US Army Corps of Engineers, n.d.). Lastly, Portland would be compatible with hydrogen storage because of the multiple freshwater sources to electrolyze water and store energy as compressed hydrogen gas including the Stroudwater river, the Fore River, the Capisic Pond, and the Sebago Lake right outside of Portland (City of Portland, n.d.). Overall, Portland has vast opportunities for development in renewable storage and supply due to its natural resources, geography, location, and demographics.

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