



Guam Territory Energy Profile

Guam Quick Facts

- Guam, with no conventional energy resources, relies on petroleum products shipped in by tanker and wind and solar resources that are used to generate electricity.
- Electricity use is increasing on Guam, and the island's sole power utility exceeded 50,000 customers for the first time in 2016.
- The U.S. military accounts for one-fifth of the Guam Power Authority's electricity sales.
- Guam's first commercial solar farm, the 25.6-megawatt Dandan facility, was completed in October 2015, and the U.S. Navy agreed in mid-2017 to lease sites where 40 megawatts of additional solar power will be installed.
- Guam allows net metering, and an increasing number of customers are installing solar photovoltaic panels. As of early 2016, nearly 9 megawatts of distributed solar power was connected to Guam's grid.

Last Updated: September 21, 2017

Data

Last Update: October 19, 2017 | Next Update: November 16, 2017

Economy

Population and Industry	Guam	United States	Period
Population	0.2 million	321.4 million	2015
Gross Domestic Product	NA	\$ 18,037 billion	2015

Prices

Electricity	Guam	United States	Period
Residential	NA	13.12 cents/kWh	Jun-17
Commercial	NA	11.00 cents/kWh	Jun-17
Industrial	NA	7.33 cents/kWh	Jun-17

Reserves & Supply

Reserves & Supply

Reserves	Guam	United States	Period
Crude Oil	0 billion barrels	35 billion barrels	2016
Natural Gas	0 trillion cu ft	308 trillion cu ft	2016
Recoverable Coal	0 million short tons	258,619 million short tons	2014
Production	Guam	United States	Period
Total Energy	0 trillion Btu	82,019 trillion Btu	2014
Crude Oil	0 thousand barrels/day	8,875 thousand barrels/day	2016
Natural Gas - Marketed	0 billion cu ft	29,475 billion cu ft	2014
Coal	0 thousand short tons	1,000,049 thousand short tons	2014
Capacity	Guam	United States	Period
Crude Oil Refinery Capacity (as of Jan. 1)	0 barrels/calendar day	18,317,036 barrels/calendar day	2016
Total Electricity Installed Capacity	1 million kW	1,075 million kW	2014
Total Utility-Scale Net Electricity Generation	Guam	United States	Period
Total Net Electricity Generation	2 billion kWh	4,103 billion kWh	2014
Petroleum, Natural Gas, and Coal Net Electricity Generation	2 billion kWh	2,751 billion kWh	2014
Total Electricity Generation from Renewable Sources	0 billion kWh	562 billion kWh	2014
» Hydroelectric	0 billion kWh	259 billion kWh	2014
» Other Renewables	0 billion kWh	302 billion kWh	2014
Production Facilities	Guam		
Major Coal Mines	None		
Petroleum Refineries	None		
Major Non-Nuclear Electricity Generating Plants	Cabras 1 - 4 (Guam Power Authority) ; Dededo: CT 1 & 12/ Diesel 1 - 4 (Guam Power Authority) ; Macheche (Guam Power Authority) ; Marbo (Guam Power Authority) ; Piti 7 - 9 (Guam Power Authority) ; Pulantat (Guam Power Authority) ; Talofoto (Guam Power Authority) ; Tanguisson 1 & 2 (Guam Power Authority) ; Tenjo 1 - 6 (Guam Power Authority) ; Yigo (Guam Power Authority)		
Nuclear Power Plants	None		

Imports & Exports

Total Imports	Guam	United States	Period
Natural Gas Imports	0 billion cu ft	2,695 billion cu ft	2014
Coal Imports	0 thousand short tons	11,350 thousand short tons	2014
Total Exports	Guam	United States	Period
Natural Gas Exports	0 billion cu ft	1,514 billion cu ft	2014
Coal Exports	0 thousand short tons	97,257 thousand short tons	2014

Distribution & Marketing

Distribution Centers	Guam
Oil Seaports/Oil Import Sites	Apra Harbor (Piti)
Natural Gas Market Centers	None
Major Pipelines	None

Consumption

per Capita	Guam	United States	Period
Total Energy	199 million Btu/person	313 million Btu/person	2011
by Source	Guam	United States	Period
Total Energy	27 trillion Btu	98,301 trillion Btu	2014
Total Petroleum Products	15.0 thousand barrels/day	19,531.0 thousand barrels/day	2015
» Motor Gasoline	0.8 thousand barrels/day	8,843.0 thousand barrels/day	2013
» Distillate Fuel	3.0 thousand barrels/day	3,827.0 thousand barrels/day	2013
» Liquefied Petroleum Gases	0.0 thousand barrels/day	2,448.0 thousand barrels/day	2013
» Jet Fuel	2.7 thousand barrels/day	1,434.0 thousand barrels/day	2013
» Kerosene	*	5 thousand barrels/day	2013
» Residual Fuel	5 thousand barrels/day	319 thousand barrels/day	2013
» Other Petroleum Products	2 thousand barrels/day	2,037 thousand barrels/day	2013
Natural Gas	0 billion cu ft	26,593 billion cu ft	2014
Coal	0 thousand short tons	917,731 thousand short tons	2014

Carbon Dioxide Emissions

by Source	Guam	United States	Period
Total Fossil Fuels	2 million metric tons	5,422 million metric tons	2014
Petroleum	2 million metric tons	2,252 million metric tons	2014
Natural Gas	0 million metric tons	1,451 million metric tons	2014
Coal	--	1,719 million metric tons	2014

Analysis

Last Updated: September 21, 2017

Overview

Guam, the largest island in Micronesia, is located in the Pacific Ocean about three-fourths of the way from Hawaii to the Philippines. Guam has no fossil energy resources¹ and meets nearly all of its energy needs, including electricity, with petroleum products^{2,3} shipped in by tanker.⁴ However, Guam has wind and solar energy resources used for electricity generation.⁵ Surrounded by coral reef, Guam sits on the edge of the Mariana Trench and its Challenger Deep, which at nearly 7 miles below the surface of the ocean is the deepest known place on earth. Guam, like the neighboring Mariana Islands, is the top of an undersea mountain, part of a volcanic subsea range stretching northwest toward Japan. At 30 miles long and 4 to 12 miles wide, Guam has nearly three-and-a-half times the land area of Washington, DC.^{6,7,8} Guam has a tropical marine climate that is warm and humid with little seasonal temperature variation. The dry season runs from December to June, and the rainy season runs from July to November. The wet season can bring destructive typhoons.^{9,10}

Guam's population is estimated to be about 162,000,¹¹ plus more than 12,000 military personnel and their families.¹² Tourism and the U.S. military are the two biggest contributors to Guam's economy.¹³ U.S. military plans to move some personnel from Okinawa, Japan, to Joint Region Marianas on Guam could bring a substantial influx of people to the island.^{14,15} The military already accounts for more than one-fifth of Guam's energy consumption.¹⁶ Per capita energy consumption on Guam is about two-thirds the average in the 50 states,^{17,18} and the island's energy intensity—the amount of energy consumed per dollar of gross domestic product—is typically slightly higher than the average for the states.^{19,20}

Petroleum

Guam has no petroleum production²¹ or refineries.²² All petroleum products are shipped in through its only port, located at Apra. Most petroleum products are imported from Japan.²³ About half of all petroleum consumed is residual fuel oil, used to generate electricity. Motor gasoline and jet fuel each make up about one-fifth of total consumption. Diesel fuel and propane make up the balance of petroleum consumed.²⁴ Guam's petroleum consumption per capita varies by year, but recently it has averaged nearly twice the consumption per capita in the 50 states.^{25,26} In 2012, the Guam government set a goal of cutting petroleum

To meet its energy needs, Guam imports petroleum products and uses its wind and solar resources to generate electricity.

Guam has set a goal of cutting petroleum consumption by 20% from the

consumption 20% from 2010 levels by 2020.²⁷ Since nearly one-third of petroleum use on-island (that is, not including aviation or shipping) in 2010 was in ground transportation, the government is aiming to increase the efficiency of vehicles on the island, improve traffic flows, reduce vehicle miles traveled, and increase use of biodiesel.²⁸

2010 level by 2020.

Natural gas

Guam does not produce²⁹ or consume natural gas.³⁰ As part of its long-term integrated resource plan, the Guam Power Authority (GPA) seeks to replace or convert some older generators to burn liquefied natural gas (LNG) instead of petroleum.^{31,32} In addition to diversifying GPA's energy sources, the plant conversions would enable the utility to comply with environmental requirements.³³ GPA's regulator, the Guam Public Utilities Commission (PUC), has questioned the cost of infrastructure, such as storage, pipelines, and tanker terminals, that would be needed to supply LNG to GPA generating plants.³⁴

Coal

Guam does not produce³⁵ or consume coal.³⁶

Electricity

Electricity is provided by GPA, a public corporation overseen by the elected Consolidated Commission on Utilities (CCU) and regulated by the Guam PUC. GPA owns and manages the island's power grid, which is made up of more than 800 miles of transmission lines and distribution primary lines.³⁷ GPA's electricity is generated mainly from residual fuel oil and diesel fuel.³⁸ Some hotels also have their own generators to produce power and hot water.³⁹

In the 1990s, GPA faced the need for major reinvestment in its baseload electricity generating facilities and began contracting with independent power providers (IPPs) to upgrade and operate the island's baseload power generators. GPA's baseload generating facilities are now managed by IPPs under long-term contracts.⁴⁰

An August 2015 explosion and fire at GPA's main Cabras power plant knocked out two of the station's four generating units.⁴¹ GPA lost about one-seventh of its nominal generating capacity, leaving the island with periodic power rationing and localized power outages. GPA asked large hotels, shopping malls, and military facilities to use their own generators when possible,^{42,43} and the power utility leased high-efficiency diesel generators to stabilize its electricity supply.^{44,45} GPA received approval from regulators to build a new power plant to replace all four of the Cabras generating units. The new power plant is expected to begin operating in 2022.⁴⁶

In 2016, the number of Guam Power Authority's customers exceeded 50,000 for the first time.

Two of the four generating units at Guam's main power plant were destroyed by an explosion and fire in 2015.

In recent years, Guam's electricity costs, including fuel surcharges, have run two to three times higher than in the 50 states, although costs are still less than on many Pacific islands.^{47,48,49} Even with low world oil prices, GPA's most recent surcharge for fuel costs was about 12 cents per kilowatt-hour.⁵⁰ The high cost of petroleum products for power generation spurred electricity conservation among Guam consumers that resulted in a downward trend in electricity consumption for several years.^{51,52} However,

power use has picked up and GPA's customers surpassed 50,000 for the first time during 2016.⁵³ The commercial sector, which includes hotels and restaurants serving tourists, is the largest electricity consuming sector and accounts for more than one-third of all electricity use.⁵⁴ That sector includes hotels and restaurants serving tourists. The residential sector accounts for close to one-third of electricity use, and the U.S. military accounts for one-fifth.⁵⁵ Faced with the volatile cost of importing petroleum fuels, GPA funds energy efficiency management programs and installs smart meters to improve system operations.^{56,57,58} Guam also offers net metering, and an increasing number of customers are installing their own distributed generation.^{59,60}

Renewable energy

A major goal of Guam's economic development strategy is to substitute sustainable local energy resources for imported petroleum.^{61,62} Guam aims to reduce fossil fuel consumption in all sectors by 20% from the 2010 level by 2020.⁶³ Multiple opportunities for energy efficiency and renewable energy applications are being implemented.⁶⁴ In 2008, Guam's legislature enacted a renewable portfolio goal of having renewable sources provide 8% of net electricity sales by 2020 and 25% of sales by 2035. Under the goal, any new baseload electrical generating plant must obtain 10% of its total generating capacity from alternative energy sources. Solar photovoltaic (PV), wind, biomass, wave energy, and ocean thermal energy are all recognized as acceptable renewable sources.⁶⁵ GPA's updated integrated resource plan calls for the power utility to continue to pursue about 120 megawatts of power generation from renewable resources.⁶⁶ Since 2000, Guam's building code has required new homes to be configured so that solar hot water heating can be installed.⁶⁷ In addition, the two military bases on Guam have added solar PV arrays and solar water heaters to their living quarters.^{68,69}

Until recently, little renewable energy was available on the island beyond a few solar PV units used for cell phone towers and remote weather stations, solar thermal units used for water heating, and a few small wind generators (less than 5 kilowatts capacity) operated by commercial and residential users.^{70,71} GPA released its Phase 1 renewables solicitation in 2011 and concluded contracts for 35 megawatts of solar and wind power.⁷² In 2015, Guam's first commercial solar PV facility, NRG Energy's 26-megawatt Dandan solar farm, began operating.⁷³ The facility can generate enough electricity to serve 10,000 homes.⁷⁴ The U.S. Navy agreed in mid-2017 to lease several sites to GPA for solar facilities that will support 40 megawatts of generation.⁷⁵ Also in mid-2017, the CCU cleared the way for 120 megawatts in renewable electricity projects, which are expected to come online in three years. Those power projects will enable GPA to meet by 2021

Guam's renewable portfolio standard to have 25% of its electricity supplies comes from renewables by 2035.⁷⁶ In order to maintain grid stability as it relies on more renewable electricity supplies, GPA is adding battery storage systems.⁷⁷

Guam has substantial wind potential but also unique siting issues. The island is seismically active and is in the Pacific's Typhoon Alley, so wind turbines must be engineered to resist both earthquakes and typhoon-force winds. Wind turbine siting must also consider impacts on military facilities, endangered species, and other local environmental concerns. Another challenge is maintaining stability of the island's small electric grid given the variability of wind power.⁷⁸ However, wind power remains part of Guam's long-term energy plan.^{79,80} In early 2016, GPA inaugurated a wind pilot project, a single 275-kilowatt turbine at the Cotal region of Yona⁸¹ that can generate enough power for 25 homes.⁸²

Guam has limited known geothermal resources, but geothermal energy is considered a potential future resource.⁸³ During GPA's Phase 2 renewables bidding in late 2016, one company proposed providing up to 10 megawatts of geothermal power.⁸⁴

Wind turbines requires special engineering to cope with Guam's earthquake and typhoons.

Two ocean-based technologies being investigated are Ocean Thermal Energy Conversion (creating electricity from the temperature differences between ocean layers) and Sea Water Air Conditioning (using cold ocean water for chillers). Both technologies would involve pipes to access cold water deep in the ocean, and applications may be limited by pipe impacts on the fragile coral reef surrounding Guam.^{65,66}

Endnotes

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Other Resources

Energy-Related Regions and Organizations

- [Petroleum Administration for Defense District \(PADD\): 7](#)

Other Websites

- [Guam Energy Office](#)
- [Guam Public Utilities Commission](#)
- [Guam Power Authority](#)
- [Guam Consolidated Commission on Utilities](#)
- [Guam Energy Office, Weatherization Works on Guam](#)
- [Guam Environmental Protection Agency](#)
- [Guam Bureau of Statistics and Plans](#)
- [Guam Economic Development Authority](#)
- [Guam Bureau of Labor Statistics](#)
- [Alternative Fuels and Advanced Vehicle Data Center, Federal and State Incentives and Laws](#)
- [U. S. Department of the Interior, Office of Insular Affairs, Guam](#)
- [NC Clean Technology Center, Database of State Incentives for Renewables and Efficiency \(DSIRE\)](#)
- [National Association of Regulatory Utility Commissioners \(NARUC\)](#)
- [National Association of State Energy Officials \(NASEO\)](#)

- National Conference of State Legislatures (NCSL), Energy
- National Renewable Energy Laboratory (NREL)-Geospatial Data Science
- U.S. Geological Survey (USGS), Publications
- U.S. Bureau of Ocean Energy Management
- United States Department of Health and Human Services, Administration for Children and Families, Office of Community Services, Low Income Home Energy Assistance Program

Email suggestions for additional Guam website resources to: states@eia.gov.



Grey Base National Geographic, Esri, DeLorme, NAVTEQ, UNEP-WCMC, USGS,



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|-----------------------------|----------------------------------|-------------------------------|
| ■ Mask | ⚡ Natural Gas Power Plant | ⚙ Wind Power Plant |
| ▲ Surface Coal Mine | ☢ Nuclear Power Plant | ⚙ Wood Power Plant |
| ▼ Underground Coal Mine | ● Other Power Plant | 🏭 Petroleum Refinery |
| 🌱 Biomass Power Plant | ⚙ Other Fossil Gases Power Plant | 🛡 Strategic Petroleum Reserve |
| ⚙ Coal Power Plant | ⚙ Petroleum Power Plant | 🛳 Petroleum Port |
| ⊕ Geothermal Power Plant | ⚙ Pumped Storage Power Plant | 🚢 LNG Import/Export Terminal |
| ⚙ Hydroelectric Power Plant | ☀ Solar Power Plant | |

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