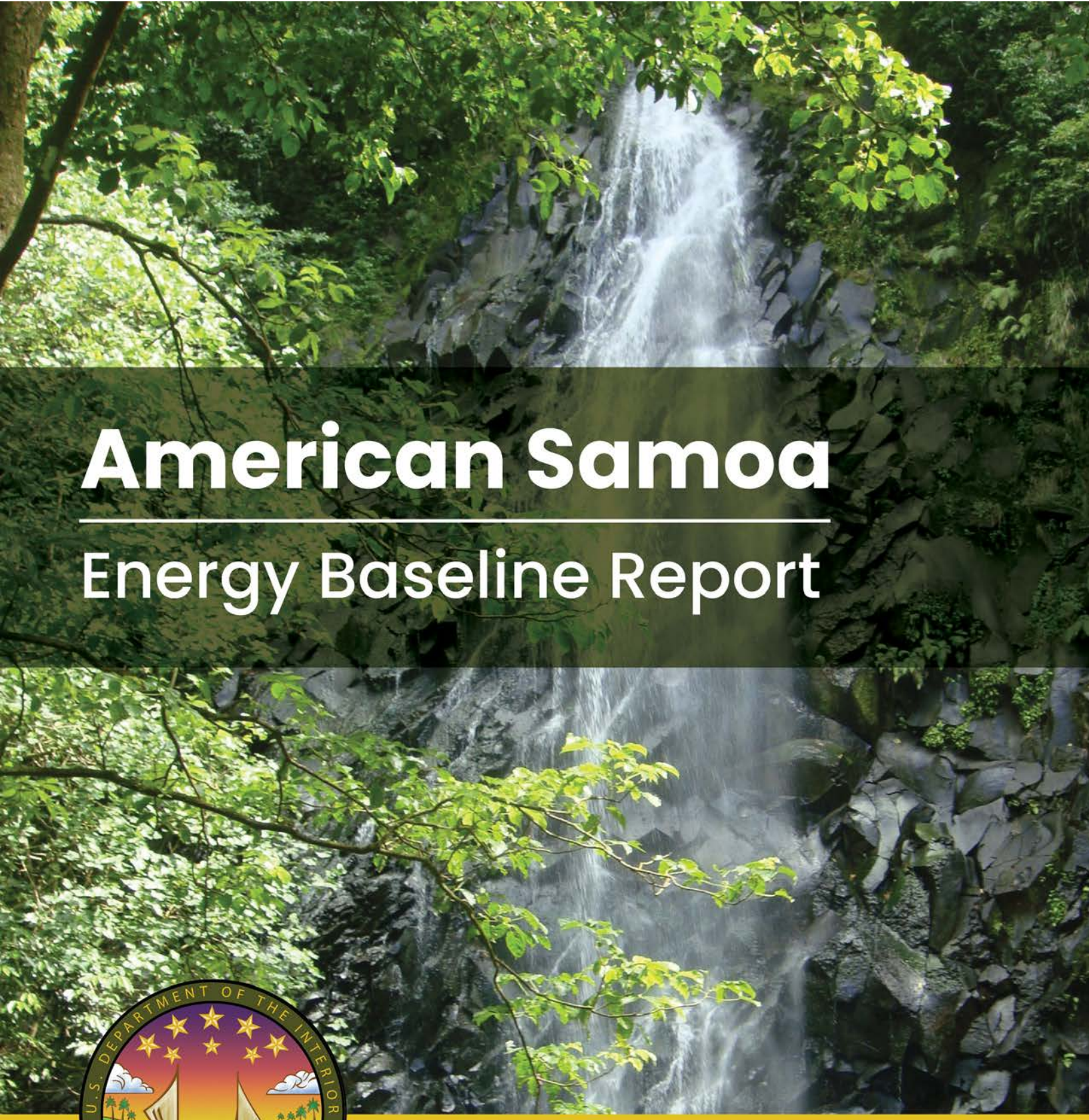

American Samoa

Energy Baseline Report

National Renewable Energy Laboratory
15013 Denver West Parkway, Golden, CO 80401
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2023-2024 Energy Baseline Report: American Samoa

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National Renewable Energy Laboratory

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List of Acronyms

ASCA	American Samoa Code Annotated
ASG	American Samoa Government
ASPA	American Samoa Power Authority
ASREC	American Samoa Renewable Energy Committee
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EV	electric vehicle
FY	fiscal year
GDP	gross domestic product
GRO	Governor's Resilience Office
ODAPM	Office of Disaster Assistance and Petroleum Management
OIA	Office of Insular Affairs
PV	photovoltaic

Executive Summary

The U.S. Department of the Interior's Office of Insular Affairs (OIA) has partnered with the National Renewable Energy Laboratory to publish a series of energy baseline reports for the U.S. territories of American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and the U.S. Virgin Islands. OIA helps coordinate federal policy for these territories, with the aim of supporting the development of efficient and effective government while also honoring unique history and culture.[1] The 2023-2024 energy baseline report series provides a high-level overview of each territory's energy and transportation sectors, energy policy frameworks, and climate- and energy-related challenges.

This report provides recent energy baseline data for the territory of American Samoa. Located roughly between Hawaii and New Zealand, American Samoa is the only U.S. territory in the southern hemisphere and faces similar climate and energy resilience challenges as other Pacific islands: geographical remoteness, dependence on imported fossil fuels, and increased vulnerability to natural hazards like earthquakes, cyclones, and tsunamis (Bundhoo, Shah, and Surroop 2018). The geographic remoteness of Pacific islands causes their inhabitants to pay some of the highest electricity prices in the world. For example, in 2022, the average electricity price for residential customers in American Samoa was approximately 44.97 cents/kilowatt hours (kWh)—almost three times the U.S. average of 15.04 cents/kWh (EIA 2023c).

American Samoa's energy sector relies almost entirely on imported fossil fuels, although renewables represent a small but growing power system contribution. The territory possesses substantial solar energy resources, as well as wind and biomass resource potential. Planned renewable power projects include utility-scale solar photovoltaic (PV), wind, and battery storage systems. The American Samoa Power Authority (ASPA) is the territory's public utility and provides electricity, water, wastewater, and solid waste services to over 12,000 customers.

The energy policy landscape in American Samoa constitutes a blend of multilateral agreements, strategic plans, rules, regulations, and dedicated offices. In 2016, the American Samoa Renewable Energy Committee (ASREC) adopted a goal to meet 50% of the territory's energy needs from renewable resources by 2025 and 100% by 2040 (EIA 2023a). ASREC is a non-regulatory advisory group comprising local volunteers and supported by federal agencies (ASREC 2011). American Samoa has not formally adopted renewable portfolio standards. The territory's various energy frameworks work to support ASREC's goal through a focus on areas like energy efficiency and conservation, the exploration and development of renewable power resources, and the reduction of petroleum use by land-based vehicles.

Key climate- and energy-related challenges for American Samoa include:

- **Utility infrastructure:** Major challenges for utility infrastructure include a dependence on imported fossil fuels and high fuel costs, destructive natural hazards (particularly earthquakes, cyclones, and tsunamis), heavy rain, and waste management capacity.

[1] For more information, see https://www.doi.gov/oia/who-we-are.

- **Renewable energy infrastructure:** Barriers to building more renewable energy infrastructure include a lack of certain renewable energy resources, grid stability, public perception, and constraints associated with American Samoa's communal land ownership system. Other challenges cited by ASPA include a lack of land to build new projects and a high concentration of sea spray, which can degrade renewable energy systems.
- **Renewable energy adoption:** Obstacles to renewable energy adoption more broadly include lack of technician training for operations and maintenance of inverters and electric vehicles (EVs), as well as grid integration challenges. ASPA wants to increase renewable energy and reduce the use of imported petroleum for electricity generation, but large penetrations of inverter-based resources on island electric grids represent a unique challenge that must be carefully handled.

American Samoa has demonstrated its commitment to addressing these resilience challenges, including through the adoption of ambitious renewable energy goals. After not meeting for several years due to the COVID-19 pandemic, ASREC has now reconvened and will share goals, progress, and lessons learned to facilitate peer-to-peer learning and provide a solid foundation for further clean energy advancements in American Samoa. Goals and visions overlap between ASREC and American Samoa governmental entities, which can now work together to revisit pre-COVID objectives and missions in the energy sector.

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1 Introduction

The purpose of this report is to provide updated energy infrastructure baseline data for American Samoa. These data offer a high-level overview of American Samoa's energy sector and existing energy policy frameworks. Compiling energy sector data can help inform future programming and priorities around items like energy security and resilience, especially in the face of a rapidly expanding threat landscape for critical energy infrastructure.

American Samoa became a territory of the United States in 1900, and the U.S. Department of the Interior assumed administration responsibility in 1951. In 1967, American Samoa adopted a constitution meant to help protect traditional Samoan land tenure rules, language, and culture (CIA 2023). Land ownership is unique in American Samoa, with five categories of ownership: (1) freehold, (2) government-owned, (3) church-owned, (4) individually owned, and (5) communal/native-owned. Communal land ownership is the traditional land tenure system and under the direct authority of Samoan chiefs known as "matais" (American Samoa Governor's Office and American Samoa Territorial Hazard Mitigation Council 2020). Residents of American Samoa are U.S. nationals, rather than U.S. citizens.

American Samoa is part of the Samoan Islands chain in the South Pacific Ocean, located roughly between Hawaii and New Zealand but closer to New Zealand (Figure 1). The territory consists of five volcanic islands (Tutuila, Aunu'u, Ta'u, Ofu, and Olosega) and two coral atolls (Rose Atoll and Swains Island). With a total land area of 224 sq km (approximately 139 mi), American Samoa is slightly larger than Washington, D.C. The estimated population for 2023 is 44,620. The larger of the two primary islands that make up the territory is Tutuila, where the capital and principal port city Pago Pago is located. Pago Pago has one of the best natural deep-water harbors in the South Pacific Ocean, sheltered from rough seas by its shape and protected from high winds by peripheral mountains (CIA 2023).

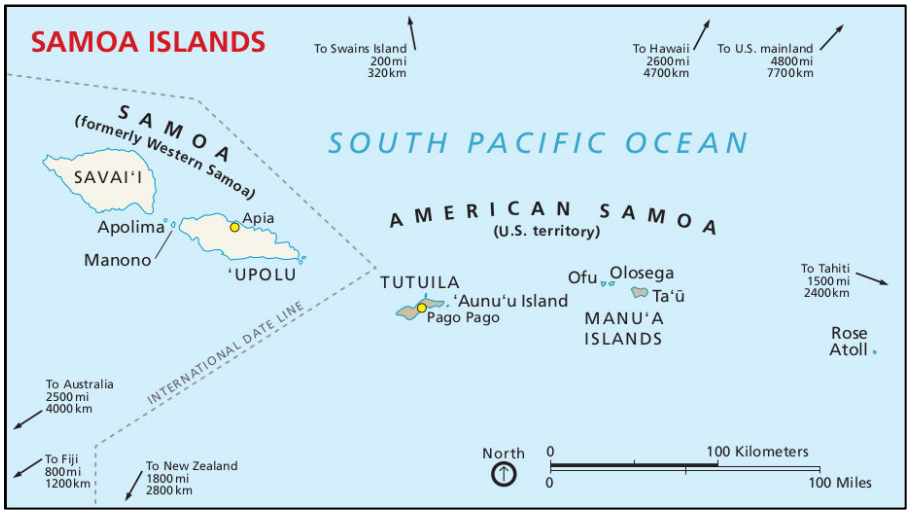


Figure 1. Map of the Samoa Islands

Image from U.S. National Park Service, modified by Matt Holly (Wikimedia Commons)

American Samoa is the only U.S. territory in the southern hemisphere and experiences a tropical marine climate with little seasonal variation in temperatures. The territory receives between 125 and 300 inches of precipitation per year, typically during the rainy season that extends from November to April. Cyclones are common from December to March, and American Samoa is also subject to earthquakes (CIA 2023; EIA 2023a).

As outlined in Table 1, American Samoa's estimated gross domestic product (GDP) as of 2022 is $871 million (BEA 2023a). Real GDP in the territory increased 1.8% from 2021, primarily due to increases in government spending and exports. Government spending increased 5%, reflecting growth in territorial government spending due in part to federal grant revenues (including COVID-19 support payments). Exports of goods and services increased 3%, mainly because of an increase in exports of canned tuna and related products (BEA 2023b). Tuna fishing is the largest industry in American Samoa, followed by government, livestock, and agriculture. The COVID-19 pandemic slowed economic growth, but a 2018 trans-pacific fiber optic cable has helped to increase overall internet access and economic development (EIA 2023a).

Table 1. GDP of the U.S. Territories (Millions, U.S. Dollars)[2]

Territory	GDP
Puerto Rico (2021)	111,067
Guam (2021)	6,123
U.S. Virgin Islands (2021)	4,444
American Samoa (2022)	871
Commonwealth of the Northern Mariana Islands (2020)	858

Data from BEA (2023a)

In 2021, American Samoa spent approximately 90% of its GDP on imported goods. That same year, the ratio of imported goods to GDP for the United States (excluding the territories) was 12.2% (Montes, Fanning, and Hamano 2023). American Samoa's imports decreased 12.5% in 2022, resulting in a positive contribution to the territory's GDP. This substantial decrease in imports primarily reflects a decrease in goods imported for domestic consumption (BEA 2023b).

The geographic remoteness of Pacific islands causes their inhabitants to pay some of the highest electricity prices in the world. American Samoa depends on petroleum imports for almost all its energy needs, so electricity prices in the territory are closely linked to world petroleum prices. For example, American Samoa's average electricity price exceeded 31 cents/kWh in 2021—more than twice the U.S. average. Per-capita consumption in the territory that same year, however, was about 70% less than the U.S. average (EIA 2023a). As of 2020, electricity access reached 60% of American Samoa's urban population and 45% of its rural population (DOE 2020).

[2] GDP estimates represent preliminary U.S. Bureau of Economic Analysis data and are the most recent available for each territory as of January 2024.

The remainder of this baseline report is organized into three sections. The first section provides an overview of American Samoa's energy sector, the second section outlines the current climate and energy policy landscape in the territory, and the third section summarizes the climate- and energy-specific challenges facing American Samoa. Where appropriate, appendices have been included to provide additional data.

2 Energy Sector Overview

American Samoa's energy sector relies almost entirely on imported fossil fuels, although renewables represent a small but growing power system contribution. The territory possesses substantial solar energy resources, as well as wind and biomass resource potential. This section provides a high-level profile of American Samoa's energy generation and consumption before going into more detail on the territory's power and transportation sectors, with an emphasis on utility infrastructure and planned renewable energy projects.

American Samoa has no known indigenous coal, natural gas, or petroleum resources and relies almost entirely on imported fossil fuels and petroleum products. Imported petroleum (primarily diesel fuel) is received at the Port of Pago Pago, where fuel is unloaded and stored at a terminal and tank farm adjacent to the main harbor (EIA 2023a). Imported fuels provide most of the energy (approximately 89%) for American Samoa's power generation, transportation, and water treatment needs. Table 2 outlines some of the key organizations that support American Samoa's power sector, with additional detail provided in subsequent sections.

Table 2. Key Energy Sector Organizations

Organization	Brief Description	Website/Contact Information
American Samoa Power Authority (ASPA)	Public utility providing electricity, water, wastewater, and solid waste services	https://www.aspower.com/
American Samoa Department of Commerce (ASDOC)	Land use permitting agency for American Samoa; holds an important role in renewable energy development (ASDOC representative, personal communication, August 9, 2023)	https://www.doc.as.gov/
American Samoa Department of Homeland Security	Conducts operational meetings with key players from each American Samoa Government (ASG) department and civilian agency to help identify and mitigate any or all challenges during planning and response activities (American Samoa Governor's Office and American Samoa Territorial Hazard Mitigation Council 2020)	https://www.americansamoa.gov/dhs
American Samoa Department of Port Administration	Manages and operates the airports and seaports of American Samoa	https://portadministration.as.gov
American Samoa Department of Public Works	Works to continuously improve public infrastructure, maintenance, and operations, as well as engineering services to provide a safe and suitable environment for the people of American Samoa	https://asgpublicworks.as/
American Samoa Renewable Energy Committee (ASREC)	Established in 2010 to coordinate American Samoa's renewable energy efforts with federal experts (EIA 2023a)	https://www.aspower.com/ASRenewable.html
American Samoa Shipyard Services Authority	Provides critical services to ASPA tanks and port infrastructure (American Samoa	Phone: 684-644-4123

Organization	Brief Description	Website/Contact Information
	Shipyard Services Authority representative, personal communication, August 9, 2023)	
Governor's Resilience Office (GRO)	Established by executive order in December 2021, the GRO's main functions are to engage in physical visitations to groups and places affected by climate change, conduct risk and needs assessments, and prepare/submit reports and recommendations to the American Samoa Resilience Commission (American Samoa Governor's Office 2023a)	---
Office of Disaster Assistance and Petroleum Management (ODAPM)	Ensures the adequate and cost-effective supply of petroleum products for American Samoa; assists with applications for and implementation of federally funded grant programs	https://odapm.as.gov/
Pacific Energy South West Pacific Ltd.	Manages the tank farm at American Samoa's terminal; fuel supplier and distributor for the territory	---
Sunrise Oil	Fuel supplier and distributor for the territory	---
Territorial Energy Office	Connects government, private sector, and communities to financial and technical resources in the areas of energy efficiency and advanced energy technologies; responsible for administering U.S. Department of Energy funding allocated to American Samoa	https://www.americansamoa.gov/territorial-energy-office

Data from respective websites except where otherwise noted

Snapshot: Electricity Generation

Between 2017 and 2022, American Samoa's annual electricity net generation has been approximately 0.2 billion kWh (EIA 2023b; ASPA 2023). Imported fossil fuels constitute most of this generation, with small but growing contributions from renewables. In 2021, solar power accounted for about 11% of American Samoa's electricity generating capacity and 3% of its electricity generation.[3] The territory possesses substantial solar energy resources, as well as wind and biomass resource potential (EIA 2023a; ASREC and ASPA 2015; ASPA 2019).

Snapshot: Electricity and Primary Energy Consumption

Between 2017 and 2022, American Samoa's annual electricity net consumption has also been approximately 0.2 billion kWh (EIA 2023b; ASPA 2023). Annual primary energy consumption

[3] According to the EIA (2023), electricity generation capacity is the maximum electric output an electricity generator can produce under specific conditions. Nameplate generator capacity is determined by the generator's manufacturer and indicates the maximum output of electricity a generator can produce without exceeding design thermal limits. Many generators do not operate at their full capacity all the time. Electricity generation is the amount of electricity a generator produces during a specific period. For example, a generator with 1 MW capacity that operates at that capacity consistently for 1 hour will produce 1 MWh of electricity.

between 2017 and 2021 has approximated 0.005 quad Btus, with almost all consumption from petroleum and other liquid fuels. As Table 3 demonstrates, recent consumption of refined petroleum products in American Samoa has ranged from approximately 98,500–108,400 thousand gallons/day. Distillate fuel oil constitutes most of American Samoa's consumption, followed by motor gasoline and jet fuel. Diesel is used for electricity generation and marine transport. Motor gasoline is used by American Samoa's more than 12,000 vehicles, and jet fuel is used at Pago Pago International Airport (EIA 2023a; EIA 2023b).

Table 3. Refined Petroleum Products Consumption in American Samoa, 2018–2021 (Thousand Gallons/Day)

Fuel	2018	2019	2020	2021
Motor Gasoline	13,188	13,188	12,529	14,507[st]
Jet Fuel	7,669	7,669	7,286	8,436[st]
Distillate Fuel Oil	77,515	77,515	73,639	85,267[st]
Residual Fuel Oil	69	69	64	74
Other Petroleum Liquids	76	76	72	83
Total Consumption	98,517	98,517	93,590	108,367

Data from EIA (2023b)

[st] = EIA forecasts

Table 4 shows an approximate breakdown of on-island fuel use by fuel type and specific entities. For example, estimated total fuel use in American Samoa for 2023 was approximately 34.3 million gallons, and ASPA generator diesel usage for the same year was approximately 11.3 million gallons. This means ASPA generator diesel usage represented almost one-third of estimated on-island fuel use for 2023.

Table 4. American Samoa Fuel Use, 2021–2023 (Gallons)

Fuel	2021	2022	2023 (est.)
Unleaded Petrol	6,524,733	5,968,334	6,334,215
Jet	861,617	1,398,894	2,320,510
Land Transport Diesel [1]	1,600,000	2,000,000	3,200,000
Marine Diesel [2]	7,052,042	5,609,480	9,511,474
ASPA Generator Diesel Use (est.)	11,690,000	11,133,000	11,302,000
Star Kist Generator Diesel Use (est.)	1,600,000	1,600,000	1,600,000
Totals	29,328,392	27,709,708	34,268,199

Data from Pacific Energy (Pacific Energy representative, personal communication, December 18, 2023) and ASPA (ASPA representative, personal communication, May 16, 2024)

[1] Land use up due to construction.
[2] Marine diesel up as purse seines fishing boats offloading in American Samoa.

A fuel surcharge is applied to electricity rates to reflect global demand. Fuel surcharges have ranged from a low of 16 cents/kWh in 2020 to a high of 44 cents/kWh in September 2022 (EIA 2023a; ASPA 2022). Increases in the 2022 fuel surcharge rate (due to a rise in global fuel prices) led to an increase in average electricity prices from 33 cents/kWh in September 2021 to almost 54 cents/kWh in 2022 (ASPA 2021; ASPA 2022). As of January 2024, the fuel surcharge has decreased to approximately 31 cents/kWh (ASPA 2024).

2.1 Power Sector

ASPA manages the island's power system, while the Office of Disaster Assistance and Petroleum Management (ODAPM) works to ensure adequate and affordable petroleum supply and compliance with quality, safety, and security standards. Established by Title 12 American Samoa Code Annotated (ASCA) in 1981, ASPA is a public utility providing electricity, water, wastewater, and solid waste services to over 12,000 customers (ASPA 2023). The electric power demand of ASPA's electricity, potable water, solid waste removal, and wastewater treatment services represents a significant portion of the electricity ASPA generates (EIA 2023a). ASPA is governed by a five-member board of directors and administered by an executive director. Title 15 ASCA in 1982 vested all powers in the board (including rates and rate-setting). Members are nominated by the governor and confirmed by the legislature (American Samoa Legislature [Fono] 1982).

In 2010, the Governor of American Samoa issued Executive Order No. 004, which established ASREC to deliver a long-term strategic energy plan focused on decreasing fossil fuel dependence and encouraging the adoption of renewable and clean technologies. ASREC is a non-regulatory advisory group comprising local volunteers and supported by federal agencies (ASREC 2011). In 2016, ASREC set goals to meet 50% of American Samoa's energy needs with renewable resources by 2025 and to reach 100% by 2040 (EIA 2023a). Otherwise, the territory has not formally adopted renewable portfolio standards.

Within ODAPM, Executive Order No. 006 established the Office of Petroleum Management in September 2014. The Office of Petroleum Management—in conjunction with the American Samoa Petroleum Cooperative—is responsible for the development, operation, and maintenance of ASG fuel facilities and infrastructure, including the ASG fuel dock, Gataivai tank farm, and Pago Pago International Airport fuel tank farm. The ASG's terminal operator is Pacific Energy South West Pacific. The American Samoa Petroleum Cooperative Board of Directors is made up of the chairman (a representative of the terminal operator), a governor appointee, a representative for major users (appointed by the chairman and the governor appointee), and one additional member appointed for each of American Samoa's two fuel suppliers (ODAPM 2024).

Pacific Energy South West Pacific Ltd. and Sunrise Oil are American Samoa's fuel suppliers, and both operate facilities in American Samoa. There are three tankers running in the region that belong to Pacific Energy and Sunrise Oil. Fuel for American Samoa comes from Singapore with Busan, South Korea as an alternate provider if needed. In the case of fuel disruption, Pacific Energy prioritizes serving ASPA to ensure power and water treatment services are not interrupted (Pacific Energy representative, personal communication, August 9, 2023).

Regarding power outages, ASPA calculated its System Average Interruption Duration Index value (including major event days) as 90.20 and its System Average Interruption Frequency

Index value (including major event days) as 2.24. ASPA conducted these calculations for 2022 using 12,472 customers (ASPA 2023). System Average Interruption Duration Index metrics indicate the total duration of the average customer interruption, while System Average Interruption Frequency Index metrics indicate how often the average customer experiences an interruption (IEEE 2012). For context, the System Average Interruption Duration Index value (with major event days) for the entire U.S. distribution system in 2022 was 333, and the System Average Interruption Frequency Index (with major event days) was 1.40 (EIA 2023c). Typical outage causes in American Samoa include normal wear and tear and hardware aging (ASPA representative, personal communication, August 28, 2023).

2.1.1 Utility Infrastructure: Overview

ASPA engages in: (1) generation from company-owned plants; (2) distribution using company-owned electric wires; (3) retail power marketing; and (4) bundled services (electricity plus water, wastewater, and solid waste) (ASPA 2023). Total electricity generation capacity was 50 MW for 2021, and total installed diesel generation capacity was 50 MW for 2022—with an expected drop to 46 MW for 2023 and 2024 (EIA 2023a; ASPA representative, personal communication, November 13, 2023). The expected drop in diesel generation capacity is due to ASPA replacing older, less-efficient generators with new units. A diesel generator at ASPA's Satala power plant was also damaged by a fire in August 2023, and ASPA is currently working with insurance to address the claim. ASPA owns and maintains all power system distribution lines. There is one high-voltage transmission line, a 34.5-kV sub-transmission tie line between the Tafuna and Satala power plants on Tutuila (ASPA 2019).

ASPA maintains 15 mobile standby generators of up to 125kW for its water wells and 20 fixed standby generators of up to 800kW at various critical facilities belonging to ASG and ASPA. The Lyndon B. Johnson Tropical Medical Center recently received two new standby 800-kW diesel generators. Other fixed standby generators are at strategic locations throughout the territory. ASPA is also investing in four new GE generators as redundant measures to back up its new renewable energy capacity (which is expected to total 30 MW) and is undergrounding 70% of the new transmission and distribution infrastructure for greater energy system resilience (ASPA representative, personal communication, August 10, 2023 and June 17, 2024).

Key challenges for utility infrastructure include a dependence on imported fossil fuels and high fuel costs, destructive natural hazards (particularly earthquakes, cyclones, and tsunamis), heavy rain, and waste management capacity. Natural hazards have real and severe human and energy impacts in American Samoa—in 2009, an 8.1 magnitude earthquake resulted in a tsunami that killed 34 people and "severely impacted electricity generating capacity in the territory" (EIA 2023a). The destruction included a power plant, cutting generating capacity in half (EIA 2023a). Barriers to building more renewable energy infrastructure include a lack of certain renewable energy resources, grid stability, public perception, constraints associated with American Samoa's communal land ownership system, and trends toward more intense tropical cyclones (Elsner 2020). Other challenges cited by ASPA include lack of land to build new projects and a high concentration of sea spray (ASPA representative, personal communication, August 28, 2023).

2.1.2 Electricity Production and Consumption

Generation

As of 2021, ASPA's total electricity generation capacity of 50 MW is approximately 89% fossil fuels. ASPA owns and operates two diesel generating plants on Tutuila with a combined capacity of 45 MW (EIA 2023a). Five MW of grid-connected solar photovoltaic (PV) capacity represents the other 11% of American Samoa's electricity generating capacity. For 2022, ASPA reported net generation of 176,356 MWh. Of this generation, 151,587 MWh were sold to customers, 5,042 MWh were consumed by ASPA, and there were total energy losses of 19,727 MWh (ASPA 2023).

Of the 5 MW of ASPA's grid-connected solar PV capacity, 4.1 MW is utility scale and 900 kW is distributed across rooftops. American Samoa's smaller islands are moving toward a combination of solar, batteries, and diesel generators. For example, since 2016, Ta'u has had a hybrid solar and energy storage system that supplies 100% of the island's electricity. The 1.4-MW solar array has over 5,000 panels coupled with a 6-MWh battery storage system. Ofu and Olosega also received 80% of their electricity from a 350-kW solar-plus-storage system between 2017 and 2019, when a fire at the solar power plant in Ofu forced the islands back onto diesel power (EIA 2023a). ASPA is currently working on bid specifications to increase the capacity of the PV array in Ofu to 500 kW and to replace the 1-MWh battery storage system (ASPA representative, personal communication, May 16, 2024).

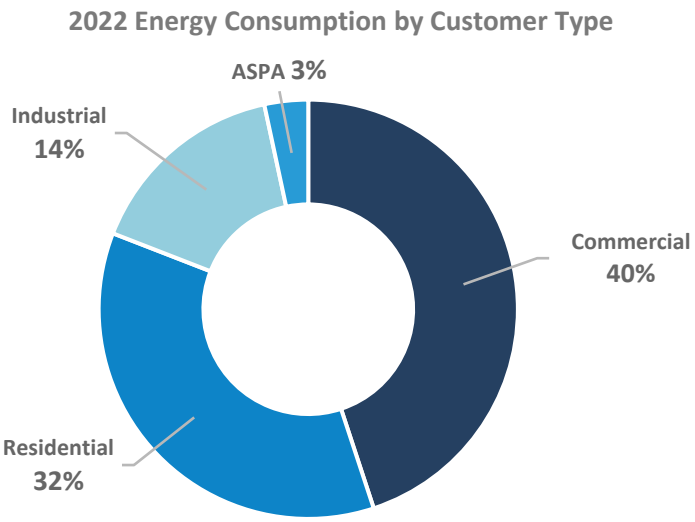
Distribution

The electrical distribution system on Tutuila operates at 13.2 kV, 60 hz. ASPA services two tie line substations, approximately 170 miles of 13.2-kV lines, and 2,000 miles of low-voltage lines (Busche et al. 2011; ASPA 2019). Some power lines are buried, but most are above ground due to cost constraints (EIA 2023a). Line losses occur at a rate of approximately 10.8% (ASPA representative, personal communication, February 17, 2024). ASPA has 12 distribution circuits (ASPA 2023).

Consumption, Sales, and Customers

In 2022, ASPA serviced almost 12,500 customers. ASPA's sales breakdown in terms of MWh is approximately 47% commercial, 37% residential, and 16% industrial (ASPA 2023). The number of residential and commercial customers has risen slightly from 2012 to 2022 (by a combined 2.4% over the 10-year period), while the industrial sector has generally remained at four customers. The change in total electricity sales (in MWh) over the same time period is commensurate with ASPA's increase in customers (EIA 2023c). See Appendix A, Tables A-1 through A-4 for more detailed information on ASPA sales and customers.

In 2022, the summer peak electric system demand was 26.9 MW (up from 24.5 the previous year) and the winter peak was 25.9 MW (slightly up from 25.5 the previous year) (ASPA 2023). The electric power demand of the public services ASPA provides represents a significant portion of the electricity ASPA generates (EIA 2023a). For 2022, an approximate breakdown of energy consumption showed commercial customers using the most energy (40%), followed by residential customers (32%), industrial customers (14%), and ASPA (3%). Losses in 2022 represent the other 11% (ASPA 2023).



Rates

Electricity prices in American Samoa are subject to global commodities market fluctuations and fuel surcharges. The average price of electricity to ASPA end-use customers in cents/kWh decreased from 2012 to 2021 before spiking in 2022 due to an increase in global fuel prices (EIA 2023c). As Table 5 demonstrates, average electricity prices in American Samoa in 2022 were approximately three times the U.S. average for residential customers, almost four times the U.S. average for commercial customers, and slightly more than five times the U.S. average for industrial customers.

Table 5. Average U.S. and American Samoa Electricity Prices (2022)

Customer Type	U.S. Average, 2022 (Cents/kWh)	American Samoa Average, 2022 (Cents/kWh)
Residential	15.04	44.97
Commercial	12.41	44.97
Industrial	8.32	43.79

Data from EIA (2023c)

ASPA rates are down slightly as of January 2024—approximately $0.41/kWh for residential and commercial customers and $0.38/kWh for industrial customers. ASPA's total energy rates include a renewable energy flat rate charged at $0.002/kWh across all service types (ASPA 2024). Fuel surcharges—charged at $0.31/kWh as of January 2024 across all service types—fluctuate monthly based on costs to ASPA.[4] Fuel surcharges are the greatest cost contributor to overall ASPA retail rates. In January 2024, for example, the fuel surcharge represented approximately 75% of the total residential electricity price.

[4] For more information, see https://www.aspower.com/rates.html.

System rate charges per kWh do not include demand rates and service charges per meter (which are flat monthly rates by service type). ASPA charges demand rates on a kW basis to Government Large General Service, Large General Net Meter Service, and Industrial blocks up to 1 million kW. Streetlight services have tiered system rates based on wattage and illumination type (ASPA 2024). See Appendix A, Table A-5 for more details on ASPA's billing rates.

Renewable Power Systems

In the last decade, American Samoa has worked on several plans to help advance renewable power systems in the territory. For example, ASREC's 2015 Renewable Energy Strategic Plan identified a two-pronged approach to American Samoa's energy future focused on: (1) waste-to-energy, wind, and PV; and (2) geothermal (ASREC and ASPA 2015). The 2016 American Samoa Energy Action Plan identifies some geothermal resources, but none of these are viable for commercial electricity generation. The 2016 plan instead emphasizes the development of wind and solar power (Ness, Haase, and Conrad 2016).

American Samoa is exploring opportunities for both offshore and onshore wind power generation. In 2022, federal legislation opened offshore waters around the U.S. territories (including American Samoa) to wind power development. The U.S. Department of the Interior will call for information and nominations for offshore wind leases within the exclusive economic zones of territorial waters by September 30, 2025 (EIA 2023a).

American Samoa has also proposed developing wind power on Tutuila through a power purchase agreement (Ness, Haase, and Conrad 2016). Potential barriers to onshore wind energy development in American Samoa include tropical cyclones, public perception and acceptance, grid stability, and communal land ownership structures (EIA 2023a). Other challenges for renewable energy adoption more broadly include lack of technician training for inverter operations and maintenance, as well as grid integration challenges (ASPA representative, personal communication, February 17, 2024).

Solar PV represents the best-available short-term option for significantly expanding the percentage of electricity generated from renewable resources. Project lead times are much shorter than for wind power systems, and the success of previous solar installations in American Samoa has set a positive precedent for further development. Incorporating energy storage into PV installations substantially increases their value, allowing solar-generated electricity to be consumed during evening peak hours and producing various ancillary services for the grid (Ness, Haase, and Conrad 2016).

2.1.3 Customer-Sited Distributed Energy Resources

American Samoa adopted net-metering laws in 2008, which allow small renewable energy generators (installed primarily for on-site use) to receive surplus generation credits (EIA 2023a). In 2022, ASPA had net-metering installed capacity of 0.049 MW for residential and 0.937 MW for commercial (ASPA 2023). As of January 2024, ASPA system rate billing costs per kWh for net-meter customers are $0.41/kWh for residential service, $0.42/kWh for Small General Service, and $0.40/kWh for Large General Service (the same system rate per kWh as for ASPA's typical Residential, Small General Service, and Large General Service customers) (ASPA 2024).

2.1.4 Planned Power System Projects

The ASG and ASPA are currently working to advance several planned power system projects, primarily based on renewable energy. American Samoa expects a 20-MW solar PV and battery energy storage project to come online via a power purchase agreement in 2024. Plans are also underway for a 42-MW wind generation and battery energy storage power purchase agreement, a 1-MW waste-to-energy gasification plant, a waste oil-to-diesel fuel distillation plant, and a solar-plus-storage project on Aunu'u that will include the installation of 430 kW of solar PV panels and 1,500 kWh of battery storage (American Samoa Governor's Office 2023a).

The biggest projects on the horizon are the 42-MW wind farm and the 20-MW solar PV project. Together, ASPA estimates these projects could satisfy up to 80% of Tutuila's power needs. ASPA is using an independent power producer/power purchase agreement model for both projects, with construction expected to start in 2024 (ASPA representative, personal communication, August 10, 2023). ASPA also has a priority action to increase efficiency by working to optimize grid operations, reduce transmission losses, and facilitate demand response programs via a new wind and solar national control center (American Samoa Environmental Protection Agency 2024).

Approximately 80 tons of municipal solid waste per day would provide the feedstock for the proposed waste-to-energy gasification plant. A 2009 waste stream study characterized and quantified the waste stream on the islands and demonstrated the feasibility of the gasification project at Tutuila's Futiga landfill. The project is primarily meant to help address landfill capacity issues, as waste management is particularly challenging for islands like American Samoa. The plant would also generate approximately 1 MW of power, of which ASPA would be the sole off-taker (ASPA 2019). ASPA issued a request for development proposals in 2019, and acceptance testing began in spring 2024.

2.2 Transportation Sector

The American Samoa Shipyard Services Authority is a key player in American Samoa's energy sector. Shipyard facilities support local shipping and fishing fleets and provide critical services to ASPA tanks and port infrastructure. The shipyard was closed before February 2021, when Governor Lemanu P.S. Mauga appointed a new shipyard board and CEO to revive operations. Since its reopening, the American Samoa Shipyard Services Authority has focused on needed repairs and upgrades, as well as growing its workforce. More recently, the Authority submitted a grant proposal to fund the expansion of electrical and water infrastructure across the entire shipyard (American Samoa Shipyard Services Authority representative, personal communication, August 2023; American Samoa Governor's Office 2023a).

American Samoa's Department of Port Administration manages six seaports and three airports throughout the territory (American Samoa Governor's Office 2023a). The Department of Port Administration is currently pursuing seaport improvement projects across the territory and is in the contracting phase for a reconstruction of the entire Aunu'u wharf. The territory's main airport terminal on Tutuila is also undergoing a complete renovation—the goal is to emphasize the airport's role as a central community congregation point, turning the airport into a resilience center and eventually using rooftop and parking canopy solar PV to provide reliable power in the

case of a natural disaster or prolonged disruption to the power grid (Department of Port Administration representative, personal communication, August 10, 2023).

2.2.1 Transportation Fuels

From January to September 2022, the Office of Petroleum Management imported 19,823,626 metric tons of fuel. Table 6 provides a breakdown of these imports by fuel type.

Table 6. Office of Petroleum Management Fuel Imports, January–September 2022

Fuel Type	Imports (Metric Tons)
Diesel	15,163,143
Motor Gasoline	3,904,243
Jet Fuel	755,011
Kerosene	1,229
Total	**19,823,626**

Data from American Samoa Governor's Office (2023a)

Table 7 provides an overview of American Samoa's maximum allowable transportation fuel prices as of January 15, 2024. While American Samoa has some of the lowest fees, taxes, and rents in both the U.S. and among Pacific Islands countries and territories, it has the highest markups on local retail prices. Average gas station markups as of January 2024 are 60 cents/gallon on motor gasoline and $1.00/gallon on diesel. The maximum allowable price plus the markup equals the local retail price. ODAPM sets the maximum allowable price, which changes monthly based on oil prices (ODAPM 2024).

Table 7. Maximum Allowable Fuel Prices as of January 15, 2024 (U.S. Dollars/Gallon)

	Road Diesel	ULSD Road	B/Gen Diesel	ULSD B/Gen	Clean Fuel Vehicle Diesel	Other/ Marine Diesel	Mogas	Jet	Kerosene
Maximum Allowable Price	3.71	3.82	3.41	3.50	3.12	3.25	3.45	3.56	3.58
Previous Maximum Allowable Price (Dec. 2023)	3.86	3.99	3.55	3.69	3.27	3.40	3.53	3.63	3.66
Decrease From Previous Maximum Allowable Price	0.15	0.17	0.14	0.19	0.15	0.15	0.08	0.07	0.08

Data from ODAPM (2024)

ULSD = Ultra Low Sulfur Diesel
B/Gen = Boiler/Generator

2.2.2 Road Transportation

As of Fiscal Year (FY) 2022, there were approximately 12,100 registered road vehicles in American Samoa. This represents an estimated growth of 47% in registered motor vehicles over the last decade—the total for FY2012 was approximately 8,200 (Appendix B, Table B-1). The large increase in registered road vehicles is mostly the result of wealth accumulation, as cited in the local newspaper.[5] Registered vehicles grew by 14% from FY2019 to FY2020 alone, although the number of vehicles dropped by almost 70 between FY2021 and FY2022. Bus registration dropped in FY2022, while registration for rental cars, taxis, and cargo vehicles increased. Nearly 84% of the vehicles registered in FY2022 are privately owned, while 600 ASG-owned vehicles represent 5% of the total (ASDOC 2023).

The territory's average vehicle fuel efficiency as of 2012 is 13–15 mpg (Ness, Haase, and Conrad 2016). According to the 2015 Household Income and Expenditure Survey of American Samoa, a household's annual average spending in 2015 on motor fuel was $1,542 (ASDOC 2023). Given the high cost of imported fuel, ASREC cited reducing petroleum use by land-based vehicles as one of its four main petroleum reduction strategies in the 2016 American Samoa Energy Action Plan (Ness, Haase, and Conrad 2016).

2.2.3 Marine Transportation

From FY2012–2022, incoming vessel traffic at Pago Pago Harbor decreased by over 50% and outgoing vessel traffic by approximately 44% (Appendix B, Table B-2). However, both incoming and outgoing vessels increased from FY2021 to FY2022. Fishing boats constituted over half of incoming vessels in FY2022, followed by freighters at 26%. 21 tankers arrived bringing fuel, and no cruise ships visited American Samoa for the second year in a row (ASDOC 2023).

2.2.4 Air Transportation

In FY2022, there were almost 3,000 aircraft operations at Pago Pago International Airport. This number represents a significant increase from previous years, when the COVID-19 pandemic contributed to an over 80% drop in aircraft operations between FY2019 and FY2020 (Appendix B, Table B-3). Air traffic operations began to open up in FY2021 and incoming flights doubled in FY2022, bringing in over 30,000 passengers. Around half of these arriving passengers came from the Pago–Honolulu route (ASDOC 2023).

2.2.5 ASG Goal: Decarbonizing Transportation

American Samoa's 2016 Energy Action Plan set a target to reduce petroleum use by land-based vehicles through the adoption of electric and hybrid electric vehicles (EVs). Specifically, the Energy Action Plan endeavored to: (1) develop a strategy and implement a pilot project by 2019; (2) calculate the updated average fuel efficiency of vehicles in American Samoa; (3) enable residents to qualify for EV credits; and (4) help the ASG obtain 30 EVs by December 31, 2018 (Ness, Haase, and Conrad 2016). The COVID-19 pandemic and a lack of certified and qualified

[5] For more information, see https://www.samoanews.com/local-news/territorys-vehicle-registration-count-surpasses-10000.

mechanics to service both vehicles and charging stations have delayed these efforts (Territorial Energy Office representative, personal communication, February 14, 2024).

Other challenges to the greater adoption of renewable transportation in American Samoa include a lack of EV charging stations and the need for funding for infrastructure, operations, and maintenance capacity development (Young and Asalele 2022). The limited range needed for travel in the island context of American Samoa presents both a challenge and an opportunity: a challenge in acquiring smaller EVs with smaller batteries, and an opportunity in leveraging the advantage of limited on-island range. Although residents of American Samoa can and do use standard-sized EVs, standard-sized battery capacity can be more costly and less efficient due to the relatively small size of the territory.

The present administration's goal is to begin the transition to EV and hybrid vehicles with the government fleet. First, however, the ASG must focus on prerequisites related to workforce development, such as training mechanics and technicians to work on alternative vehicles. There are also issues on the demand side given the high costs of EVs to American Samoans after additional charges related to shipping and customs duties (Territorial Energy Office representative, personal communication, February 14, 2024).

In recent years, the U.S. Environmental Protection Agency (EPA) has granted ASPA Diesel Emissions Reduction Act funding to replace diesel trucks with battery-electric trucks and to install EV charging stations. In 2019, ASPA received more than $118,000 to replace four diesel trucks and install three EV charging stations (Electrification Coalition 2021). In 2020, the EPA's West Coast Collaborative provided a $121,883 grant to ASPA under the Diesel Emissions Reduction Act to purchase one battery-electric truck and install EV charging stations (West Coast Collaborative 2020). American Samoa is committed to leveraging these and other federal funding opportunities to advance its energy goals and priorities moving forward.

3 Climate and Energy Policies, Goals, and Progress

American Samoa's energy policy landscape constitutes a blend of multilateral agreements, strategic plans, rules, regulations, and dedicated offices. In 2016, ASREC adopted a goal to meet 50% of American Samoa's energy needs from renewable resources by 2025 and 100% by 2040 (EIA 2023a). The territory's energy frameworks work to support this goal through a focus on areas like energy efficiency and conservation, the exploration and development of renewable power resources, and the reduction of petroleum use by land-based vehicles. Other territorial climate and energy priorities include resilience, environmental justice, and energy justice.

The multilateral agreements and strategic plans outlined in Figure 2 capture some of American Samoa's policy commitments toward clean energy and sustainable development. The timeline in Figure 2 is meant to provide an illustrative (rather than exhaustive) list of the climate- and energy-related frameworks, strategies, and multilateral agreements in which American Samoa has participated and which continue to shape the territory's clean energy goals.

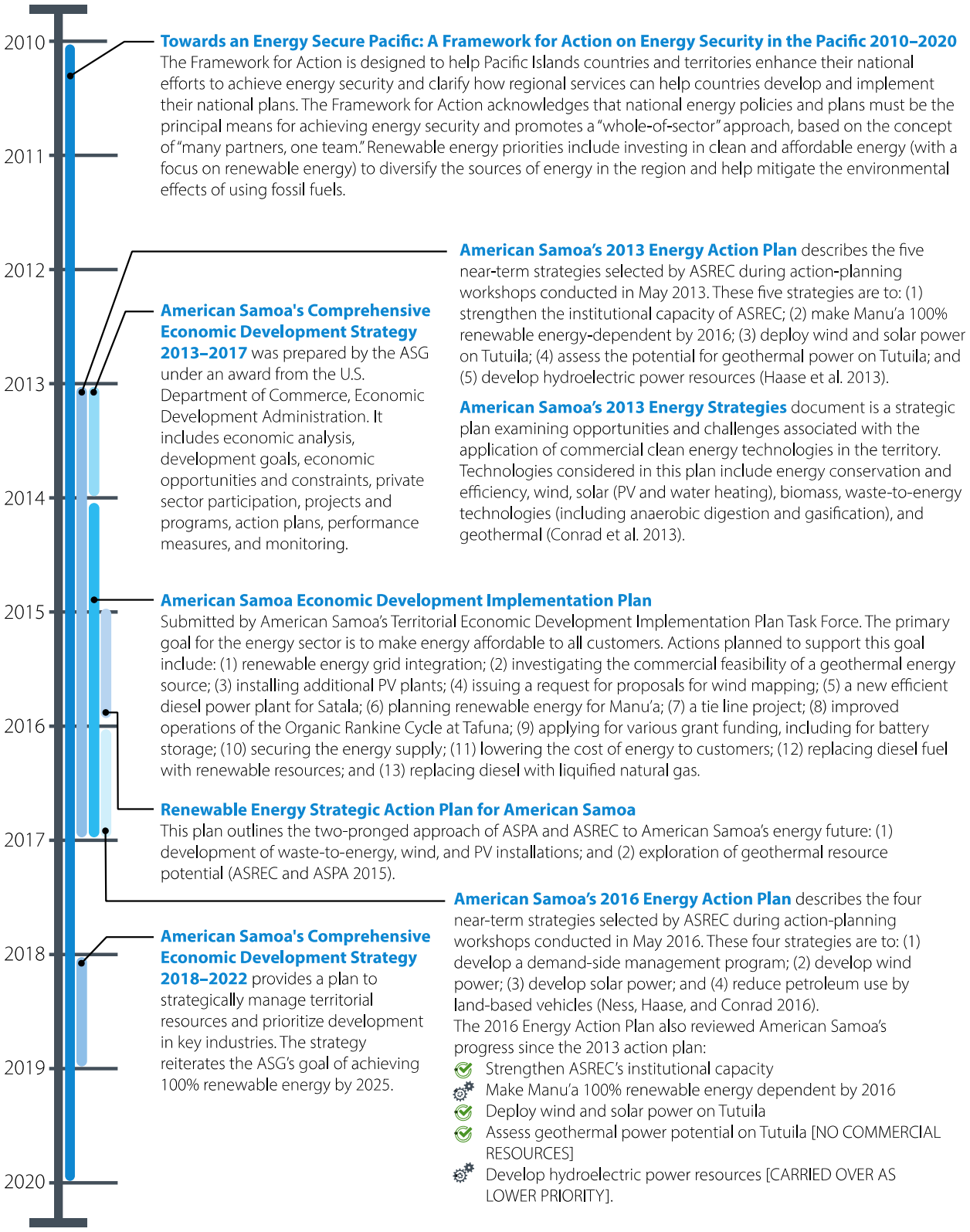


Figure 2. Timeline of American Samoa Climate and Energy Frameworks, 2010–2020

American Samoa has also instituted a number of rules, regulations, and informal goals to help codify its climate and energy objectives. These include (but are not limited to) the following (Asia Pacific Energy Portal 2023, except where otherwise noted):

- **1972**: Chapter 1 of Title 24 ASCA establishes American Samoa's Environmental Quality Commission. The Environmental Quality Commission enforces environmental quality controls and establishes emissions and pollution discharge requirements applicable to the territory's energy sector.

- **1979**: The U.S. "Emergency Energy Conservation Act of 1979" requires the submission of an emergency energy conservation plan by each state or territory (Public Law 96-102, as amended). American Samoa adopted its Emergency Energy Conservation Plan in 1982 (see Chapter 5, Annex A of ASCA 12 for plan details).

- **1981**: Title 12 ASCA establishes ASPA, creating an institutional structure for the generation, transmission, distribution, and sale of electric power within American Samoa.

- **1982**: Title 15 ASCA updates and clarifies ASPA's powers and duties.

- **2007:**
    - Executive Order No. 010A-2007 (Climate Change) establishes government initiatives to address climate change and its negative effects in the territory.
    - Chapter 5 of Title 26 ASCA prioritizes energy efficiency and cites the need to both develop alternate energy sources and implement energy conservation practices. 26.0501 ASCA adopts a building code based on lighting, equipment, and thermal efficiency standards developed by the American Society of Heating, Refrigeration, Air Conditioning Engineers, Inc.

- **2008:**
    - General Memorandum No. 41-2008 (Implementation of Executive Order 010A-2007) designates the ASG departments and agencies responsible for implementing Executive Order 010A-2007. Implementation requirements include ENERGY STAR® approval for ASG appliances and electronic purchases, the replacement of incandescent light bulbs in ASG facilities with compact fluorescent bulbs, and minimum fuel efficiency ratings for new passenger and light-duty vehicles purchased by the ASG (as well as requirements for incremental increases in ASG hybrid vehicle purchase rates).
    - American Samoa adopts net-metering laws to allow small renewable energy generators (installed primarily for on-site use) to receive surplus generation credits (EIA 2023a).

- **2009:** General Memorandum No. 85-2009 (Hybrid Vehicle Purchasing Policy) aims "to standardize the official American Samoa government (ASG) procedure for the procurement of vehicles" by setting new energy efficiency transport standards.

- **2010:** Executive Order No. 004-2010 empowers ASREC to develop energy strategies to: (1) explore wind, solar PV, and geothermal potential in Tutuila; and (2) consider the feasibility of supplying the Manu'a islands' grid completely with renewables (NREL 2015).

- **2012:** Executive Order No. 003-2012 (Climate Change Mitigation Rules) includes the following: (1) prohibition of older motor vehicle imports; (2) requirements for government vehicle purchasing for hybrids and super cars; (3) requirements for ENERGY STAR appliances; (4) prohibition of phosphates in detergents; (5) prohibition of incandescent lightbulbs; and (6) creation of an ASG recycling program to help mitigate greenhouse gas emissions.

- **2016:** ASREC adopts a goal to meet 50% of American Samoa's energy needs from renewable resources by 2025 and 100% by 2040 (EIA 2023a).

- **2021:** Executive Order No. 019-2021 leads to the establishment of the American Samoa Resilience Commission and the GRO (American Samoa Governor's Office 2023a). More information on these entities and their roles is included in the following section on American Samoa's climate resilience work.

American Samoa is also working to take advantage of recent federal climate and infrastructure grant opportunities. Funding provided by legislation such as the American Rescue Plan Act, the Inflation Reduction Act, and the Bipartisan Infrastructure Law has helped address climate and energy issues in American Samoa. American Samoa did need to request a waiver of requirements for local matching funds included in specific provisions of these pieces of legislation. OIA granted American Samoa the waiver, but such requirements may present a burden to U.S. territories trying to access federal funds (American Samoa Governor's Office 2023b).

Discretionary financial assistance to American Samoa through OIA represents another important funding source for the territory. OIA funding helps support a range of on-island activities, from energy production to the protection of American Samoa's natural and cultural resources. In testimony before the U.S. Senate Committee on Energy and Natural Resources in February 2023, American Samoa Governor Lemanu P.S. Mauga requested an increase to the territory's annual OIA grant allocations—due mostly to steady increases in the cost of materials needed to complete projects (American Samoa Governor's Office 2023b).

In his February 2023 testimony, Governor Mauga also requested the establishment of a local Army Corps of Engineers office or representative in American Samoa. The Army Corps of Engineers representative could provide assistance on the federal environmental review and approval process for projects in American Samoa, because not all federal agencies provide an environmental point of contact for National Environmental Policy Act considerations. The proposed Army Corps of Engineers representative could help ensure territorial compliance, provide related training or technical assistance, and assist with environmental permits that present challenges for strict project timelines. This might be especially helpful for time-sensitive projects meant to address climate resilience in American Samoa (American Samoa Governor's Office 2023b).

3.1 Climate Resilience

Governor Mauga has stated that American Samoa is in a climate crisis (American Samoa Governor's Office 2023b). Natural hazards continue to impact the territory, with an Executive Order declaring an ongoing state of emergency related to flooding and landslides across American Samoa as recently as January 2024 (American Samoa Governor's Office 2024). Climate resilience is a territorial priority for American Samoa, and ongoing activities include both the work of the GRO and American Samoa's annual disaster resilience summits.

3.1.1 The GRO

According to the American Samoa Governor's Office (2023a), the purpose of the GRO is to coordinate a holistic and comprehensive approach to the territory's future planning and development initiatives. Acting as an arm of the American Samoa Resilience Commission, the GRO will work to identify vulnerable groups, communities, industries, ecosystems, and the potential economic ramifications of impacts related to climate change in American Samoa. The GRO's main functions include physical visitations to groups and places affected by climate change and the development of outreach, training, and educational programs. Based on site visit surveys, the GRO plans to conduct risk and needs assessments and submit recommendations to the American Samoa Resilience Commission.

Planned GRO initiatives and programs currently cover Tutuila, Aunu'u, and the islands of Manu'a. The GRO will also support other resilience initiatives in American Samoa, such as the territory's involvement in its first Regional Resiliency Assessment Program. The goal of the Regional Resiliency Assessment Program—spearheaded by the American Samoa Department of Homeland Security and the ASG, in coordination with the U.S. Department of Homeland Security's Cybersecurity and Infrastructure Security Agency—is to generate understanding and action among public and private sector partners to improve the resilience of American Samoa's critical infrastructure.[6]

The GRO is further working to finalize both a Territorial Climate Resilience Framework and a Territorial Climate Resilience Action Plan. The ASG employs a broad conceptual understanding of resilience, one that emphasizes the goal of networked resilience and that defines resilience as extending the concept of robustness through adaptive capacity. In the draft frameworks, the GRO has proposed additional subcommittees to cover resilience activities across the entire spectrum of climate change impacts. The proposed subcommittees include: (1) Food Security; (2) Energy Renewal; (3) Education; (4) Infrastructure; (5) Health; (6) National Security (homeland, biosecurity, cybersecurity, etc.); (7) Climate Policymaking; (8) Indigenous Cultural Heritage; (9) Economy; and (10) Coastal and Ocean Management (American Samoa Governor's Office 2023c).

3.1.2 Annual Disaster Resilience Summits

Since 2022, American Samoa has hosted annual disaster resilience summits. The inaugural event took place in September 2022, with the theme of "Bridging the Gap Between Government and Communities." U.S. federal attendance at the summit included representation from the Federal

[6] For more information, see https://www.cisa.gov/resources-tools/programs/regional-resiliency-assessment-program.

Emergency Management Agency, the U.S. Department of Transportation, the U.S. Geological Survey, and the American Red Cross. Local first responders were also present, as well as students representing schools from Tutuila, Manu'a, and Aunu'u islands. American Samoa positioned the summit as part of National Preparedness Month activities promoted throughout the continental states, Tribes, and territories. The objective of the 2022 summit was to engage the whole community on enhancing awareness of resilience efforts in preparation for, actively responding to, and recovering from all disasters. A special memorial ceremony was also held on September 29 to commemorate the thirteenth anniversary of the 2009 Samoa earthquake and tsunami, which claimed many lives in American Samoa (American Samoa Governor's Office 2023a).

American Samoa hosted its second annual disaster resilience summit in September 2023, with the theme of "Strengthening Disaster Resilience in Our Community." ODAPM hosted the 2023 event in partnership with the GRO. Summit agenda items included disaster management training sessions and panel discussions on communications emergency response coordination and infrastructure rebuilding and recovery (ODAPM 2023). Although these summits have focused on climate and disaster resilience to date, there may be opportunities to integrate more energy components in future.

3.2 Environmental and Energy Justice

To complement its work on climate resilience, American Samoa is also working to address issues related to environmental and energy justice. The EPA defines environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies" (EPA 2023). The concept of energy justice builds upon that of environmental justice, extending fair treatment and meaningful involvement from the environment to the energy system (Initiative for Energy Justice 2024). Prioritizing energy justice means: (1) developing inclusive energy solutions that enable all people to participate in the transition to sustainable energy; and (2) working toward the equitable distribution of energy benefits and burdens (NREL 2024).[7]

Energy justice is an important concept for American Samoa due in part to energy affordability issues. As Table 8 demonstrates, the approximate baseline home electricity burden in American Samoa in 2019 was 5.45%—compared to an approximate baseline U.S. home electricity burden of 2.11%. Annual estimated electricity consumption in American Samoa is low compared to U.S. consumption (4.38 MWh and 10.65 MWh, respectively); it is the cost of electricity and median household income that are the main drivers of the territory's home electricity burden.

According to the American Council for an Energy-Efficient Economy, a home energy burden above 6% is considered high (Drehobl, Ross, and Ayala 2020). Household averages for American Samoa and the other U.S. territories were approaching this 6% high home energy

[7] Energy justice is a complex topic, and this section is intended solely to introduce the concept and its relevance for American Samoa. For a more robust conceptual overview of energy justice, see for example: Jenkins, Kirsten, Darren McCauley, Raphael Heffron, Hannes Stephan, and Robert Rehner, 2016, "Energy justice: A conceptual review," *Energy Research and Social Science* 11: 174-182, https://doi.org/10.1016/j.erss.2015.10.004.

burden threshold on the basis of data related only to home electricity use (i.e., not data for other home fuel use or transportation) and in 2019, before the COVID-19 pandemic prompted a shift to remote work and sharp increases in global commodities prices. Although data availability is an obstacle for understanding current home electricity and energy burdens in the U.S. territories, it is likely that both burdens are even higher in 2024.

Table 8. Approximate Baseline Home Electricity Burden for U.S. Territories (2019)[8]

Geography	**Median Household Income** (U.S. dollars) (2019)	**Average Residential Electricity Rate** (Cents/kWh) (2019)	**Residential Electricity Sales** (MWh) (2019)	**Number of Residential Customers** (2019)	**Estimated Average Annual Residential Electricity Consumption** (MWh) (2019)	**Estimated Average Annual Residential Electricity Spending** (U.S. dollars) (2019)	**Approximate Baseline Home Electricity Burden** (%) (2019)
American Samoa	$28,352	35.26	47,127	10,762	4.38	$1,544	5.45%
Commonwealth of the Northern Mariana Islands	$31,362	25.28	76,795	11,525	6.66	$1,684	5.37%
Guam	$58,289*	24.99	514,829	44,226	11.64	$2,909	4.99%
Puerto Rico	$20,474	21.43	6,205,152	1,341,424	4.63	$992	4.85%
U.S. Virgin Islands	$40,408	38.75	217,003	46,283	4.69	$1,817	4.50%
Hawaii	$83,102	32.06	2,760,000	438,352	6.30	$2,020	2.43%
U.S. Average	$65,712**	13.01	1,440,288,909	135,249,616	10.65	$1,386	2.11%

Data from U.S. Census Bureau (2020a, 2020b, 2020c, 2020d); EIA (2021)

*Median household income for Guam excludes people in military housing units.
**U.S. average does not include the territories of American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and the U.S. Virgin Islands.

The American Samoa Governor's Office (2023a) notes that, in 2022, soaring food and energy prices eroded real incomes. The costs of inflation were particularly severe for those who already represent the most vulnerable groups across the territory's villages. Although energy burdens pose a real challenge in American Samoa, the territory is working to advance energy justice. For example, the Territorial Energy Office provides home energy efficiency programs to help reduce energy costs for low-income households.

[8] This table is meant to illustrate approximate baseline home electricity burdens for relative comparison purposes. 2019 data are used due to limited data availability for median household income in the U.S. territories. Estimated burden calculations apply only to home electricity use. See Appendix C for additional notes on table methodology and data limitations.

American Samoa is also making strides on environmental justice initiatives. In 2021, American Samoa became the first U.S. territory to receive an Environmental Justice grant under the EPA's State Environmental Justice Cooperative Agreement program. The EPA granted the American Samoa Environmental Protection Agency $200,000 to address COVID 19-related air quality issues across the island of Tutuila (EPA 2021). The American Samoa Environmental Protection Agency plans to use part of the grant to purchase air quality monitoring equipment, which it will place throughout Tutuila to collect live air quality data. American Samoa plans to make these data available to the public, to students of the Finafinau Group (an island community-service project focused on environmental conservation and resilience), and to all other interested parties for science projects and related activities (American Samoa Governor's Office 2023a).

4 Climate and Energy Challenges: A Summary

American Samoa faces various challenges to meeting its ambitious climate and energy goals. The territory is heavily dependent on imported fossil fuels, leaving it vulnerable to supply chain risk and price volatility—resulting in high electricity costs for residents and businesses. ASPA is motivated to increase renewable energy and reduce the use of imported petroleum for electricity generation, but large penetrations of inverter-based resources on island electric grids (especially those of smaller sizes like American Samoa's) represent a unique challenge that must be carefully handled. Technical challenges to the management of inverter-based resources in American Samoa include issues related to intermittent power and the territory's rainy season.

Beyond its dependence on imported fossil fuels, American Samoa's local economy is reliant on the territory's tuna fishing and canning industry. Several factors—including the high cost of energy—have led to fishing operations and canning factories moving out of American Samoa. Further shutdowns would have economic repercussions.

Given American Samoa's remote geographic location, the territory only has two fuel providers. An associated potential risk is that a dramatic reduction of fuel imports could affect delivery cost and even result in a provider's business decision to discontinue delivery service. Close coordination with the fuel providers will be necessary to avoid disruptions while reducing American Samoa's dependence on fossil fuels.

American Samoa's location in the Pacific Ocean also makes the territory vulnerable to climate change (especially rising sea levels) and destructive natural hazards such as tsunamis, tropical storms, and cyclones. For example, the 8.1 magnitude earthquake American Samoa experienced in 2009 destroyed a power plant and cut ASPA generating capacity in half (EIA 2023a). Cyclones have severely impacted American Samoa in the past as well, with Tropical Cyclone Heta damaging power lines in 2004 and Cyclone Wilma leading to power outages in 2011 (Bundhoo, Shah, and Surroop 2018). More recently, Tropical Storm Gita hit American Samoa in 2018. In its preliminary damage assessment report for Tropical Storm Gita, the Federal Emergency Management Agency calculated that the disaster would cost approximately $6.4 million in total public assistance—primarily to help repair damage to utilities (FEMA 2022).

American Samoa also faces specific challenges related to renewable energy adoption. These challenges include the lack of commercially viable geothermal resources, siting constraints associated with American Samoa's communal land ownership system, and issues training technicians and maintaining new energy assets such as batteries. ASREC is an important entity in overcoming some of these challenges. Although ASREC did not meet for several years (due in large part to the COVID-19 pandemic), it reconvened in 2023 and continues to meet periodically. ASREC works with government and business interests to discuss both obstacles and solutions (including funding and technical assistance opportunities available from various federal agencies). ASREC members are committed to sharing goals, progress, and lessons learned to facilitate peer-to-peer learning and provide a solid foundation for further clean energy advancements in American Samoa. There is also a major overlap of goals and visions among ASREC, the American Samoa Resilience Commission, and the GRO—which can now work together to revisit pre-COVID objectives and missions (Territorial Energy Office representative, personal communication, February 14, 2024).

5 Conclusion

The objective of this energy baseline report for American Samoa is to provide a high-level overview of the territory's energy sector and related policy landscape. American Samoa shares some of the same climate and energy resilience challenges faced by many Pacific Islands countries and territories: geographical remoteness, dependence on imported fossil fuels, and increased vulnerability to natural hazards like earthquakes, cyclones, and tsunamis (Bundhoo, Shah, and Surroop 2018). Other challenges more unique to American Samoa include lack of land to build new projects, a high concentration of sea spray, and a lack of technician training for operations and maintenance.

American Samoa has demonstrated its commitment to addressing these resilience challenges, including through the adoption of ambitious renewable energy goals. In 2016, ASREC adopted goals to meet 50% of American Samoa's energy needs with renewable resources by 2025 and to reach 100% by 2040 (EIA 2023a). The territory has also participated in several strategic planning exercises and regional frameworks related to climate change and clean energy. The recent creation of the GRO and collaboration with federal partners to advance energy and environmental justice in American Samoa are important steps toward a more resilient and secure energy future.

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Appendix A: Supplemental Power Sector Data

Table A-1. Number of Ultimate Electricity Customers, 2012–2022

Year	Residential	Commercial	Industrial	Total
2012	10,736	1,437	4	12,177
2013	10,945	1,411	4	12,360
2014	11,561	1,386	4	12,951
2015	11,023	1,356	4	12,383
2016	10,916	1,363	6	12,285
2017	10,930	1,386	4	12,320
2018	10,866	1,395	4	12,265
2019	10,762	1,450	4	12,216
2020	10,720	1,452	4	12,176
2021	10,802	1,522	4	12,328
2022	10,893	1,575	4	12,472

Data from EIA (2023c)

Table A-2. Sales of Electricity to Ultimate Customers, 2012–2022 (MWh)

Year	Residential	Commercial	Industrial	Total
2012	39,935	71,952	22,539	134,426
2013	40,719	71,069	23,724	135,512
2014	41,029	70,598	23,142	134,769
2015	43,306	72,007	25,974	141,287
2016	46,493	69,617	32,232	148,342
2017	49,538	71,173	26,699	147,410
2018	45,621	72,185	24,546	142,352
2019	47,127	75,151	25,415	147,693
2020	50,304	74,463	25,714	150,481
2021	55,625	72,814	24,867	153,306
2022	56,424	70,418	24,745	151,587

Data from EIA (2023c)

Table A-3. Revenue From Sales of Electricity to Ultimate Customers, 2012–2022 (thousand dollars)

Year	Residential	Commercial	Industrial	Total
2012	17,343	29,092	8,233	54,668
2013	15,809	27,905	8,339	52,053
2014	17,286	27,553	8,076	52,915
2015	15,035	22,981	7,695	45,710
2016	13,184	18,402	7,962	39,548
2017	15,020	20,626	7,294	42,940
2018	15,434	23,557	7,668	46,659
2019	16,617	25,328	8,211	50,155
2020	16,513	23,480	7,680	47,672
2021	17,640	22,745	7,335	47,720
2022	25,373	31,668	10,835	67,875

Data from EIA (2023c)

Table A-4. Average Price of Electricity to Ultimate Customers, 2012–2022 (cents/kWh)

Year	Residential	Commercial	Industrial	Total
2012	43.43	40.43	36.53	40.67
2013	38.82	39.26	35.15	38.41
2014	42.13	39.03	34.90	39.26
2015	34.72	31.91	29.63	32.35
2016	28.36	26.43	24.70	26.66
2017	30.32	28.98	27.32	29.13
2018	33.83	32.63	31.24	32.78
2019	35.26	33.70	32.31	33.96
2020	32.83	31.53	29.87	31.68
2021	31.71	31.24	29.50	31.13
2022	44.97	44.97	43.79	44.78

Data from EIA (2023c)

Table A-5. ASPA Billing Rates, January 2024

Billing Rates for January 2024	Additional Base Rate *(Renewable Energy per kWh)*	Energy Base Rate *per kWh*	Total Energy Rate *per kWh*	Fuel Surcharge *per kWh*	System Rate *per kWh*	Demand Rate	Service Charge *per Meter*
Residential							
Government Residential	0.002	0.0954	0.0974	0.31272	0.41012		6.00
Residential	0.002	0.0954	0.0974	0.31272	0.41012		
Small General Service							
Government Small General Service	0.002	0.1045	0.1065	0.31272	0.41922		1 PHSE 5.00
Small General Service (Private)	0.002	0.1045	0.1065	0.31272	0.41922		3 PHSE 10.00
ASPA Small General Service	0.002	0.0498	0.0518	0.31272	0.36452		
Large General Service *(Note: Minimum demand charge $125)*							
Government Large General Service	0.002	0.0876	0.0896	0.31272	0.40232	$5.00/kW	25.00
Large General Service (Private)	0.002	0.0876	0.0896	0.31272	0.40232		
ASPA Large General Service	0.002	0.0498	0.0518	0.31272	0.36452		
Net Meter Customers							
Residential	0.002	0.0954	0.0974	0.31272	0.41012		6.00
Small General Service	0.002	0.1045	0.1065	0.31272	0.41922		5.00
Large General Service	0.002	0.0876	0.0896	0.31272	0.40232	$5.00/kW	25.00
Industrial Block Rate							
Industrial 1: First 1 Million	0.002	0.0700	0.0720	0.31272	0.38472	$8.25/kW	25.00
Industrial 2: Over 1 Million	0.002	0.0650	0.0670	0.31272	0.37972		
Streetlight Charges							
Streetlight 70 High-Pressure Sodium					7.50		
Streetlight 100 Watts					10.50		
Streetlight 170 m (Mercury Vapor)					18.50		
Streetlight 250 Watts					27.00		
Streetlight 400 Watts					43.00		
NSTL Illuminated Sign					35.00		

Table continued next page

Water						
	Base Rate	Water Surcharge	Total System Rate			Service Charge
Commercial	0.00315	0.001364	0.00451	Per gallon		15.21
Residential						
0–10,000 gal	0.00292	0.001364	0.00428	Per gallon		15.21
10,001–20,000 gal	0.00342	0.001364	0.00478			
20,001–30,000 gal	0.00392	0.001364	0.00528			
Above 30,000 gal	0.00442	0.001364	0.00578			

Solid Waste	System Rate
Residential	12.57
Small General Services	52.79
Large General Services	419.10
Residential Multi-Tenant Units or Multiple Meters	4.91
Small and Large General Services (Multiple Electric Meters)	35.93
Small General Services (No Human Occupancy)	35.93
Large General Services (No Human Occupancy)	35.93
Disposal Facility Fees	
Small and Large General Services	
Weight	$0.156/lb
Volume	$20.63/cubic yd
Industrial Services	
Weight	$0.045/lb
Volume	$6.00/cubic yd

Groundwater Protection	Volume Charge	Service Charge per Meter
Residential	-	24.97
Residential Multi-Dwelling	$1.85/1,000 gallons	24.97
Small and Large General Service	$2.84/1,000 gallons	24.97

Data from ASPA (2024)

Appendix B: Supplemental Transportation Sector Data

Table B-1. Registration of Motor Vehicles by Type, FY2012–FY2022

	Commercial					Others			
Year	Total	Bus	Rental	Taxi	Cargo	Private Vehicles	Motor Bike	Trailers	ASG Vehicles
2012	8,227	155	105	125	323	6,721	79	86	633
2013	9,364	181	91	115	395	7,665	100	78	739
2014	9,453	169	90	115	452	7,735	91	73	728
2015	9,647	191	110	124	503	7,774	124	96	725
2016	8,373	151	96	111	407	6,739	61	72	736
2017	9,387	164	120	147	108	7,908	102	108	730
2018	9,647	140	110	102	300	8,200	95	75	625
2019	9,890	137	134	118	305	8,413	77	106	600
2020	11,287	178	213	182	438	9,459	79	108	630
2021	12,167	163	254	241	468	10,191	76	124	650
2022	12,098	149	266	252	519	10,131	97	84	600

Data from ASDOC (2023)

Table B-2. Vessel Traffic at Pago Pago Harbor, FY2012–FY2022

	Type	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Incoming Vessels	Total Incoming	901	841	926	892	786	666	713	635	455	383	437
	Cruise Ships	19	18	21	13	16	14	17	17	7	-	-
	Freighters	67	83	112	125	122	146	152	149	116	115	114
	Tankers	35	37	29	29	30	31	29	26	21	24	21
	Fishing Boats	591	541	573	538	444	339	342	295	269	194	220
	Yachts	76	67	86	86	76	56	98	68	7	5	36
	Military/Naval Ships	8	6	4	1	4	4	1	9	2	9	5
	Barges/Tugs	-	-	2	2	-	-	1	1	1	-	-
	Reefers	14	12	16	19	8	3	5	4	2	7	8
	Others	91	77	83	79	86	73	68	66	30	1	33
Outgoing Vessels	Total Outgoing	785	841	926	892	786	666	713	635	455	352	437
	Cruise Ships	26	18	21	13	16	14	17	17	7	-	-
	Freighters	66	83	112	125	122	146	152	149	116	113	114
	Tankers	30	37	29	29	30	31	29	26	21	24	21
	Fishing Boats	-	541	573	538	444	344	342	295	269	175	220
	Yachts	62	67	86	86	76	56	98	68	7	2	36
	Military/Naval Ships	3	6	4	1	4	4	1	9	2	6	5
	Barges/Tugs	-	-	2	2	-	-	1	1	1	-	-
	Reefers	7	12	16	19	8	3	5	4	2	4	8
	Others	591	77	83	79	86	68	68	66	30	1	33

Data from ASDOC (2023)

Table B-3. Aircraft Operations by Type at Pago Pago International Airport, FY2012–FY2022

Type	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
All Movements	3,477	3,665	3,099	3,580	4,020	5,476	9,866	9,912	1,744	1,084	2,980
Air Carriers	136	170	163	168	174	126	296	169	118	600	248
Air Taxi	3,101	3,354	2,734	3,261	3,656	-	9,464	-	49	30	2,530
General Aviation	140	56	147	70	66	89	78	10	56	198	72
Military	100	85	55	81	124	24	50	54	14	70	130

Data from ASDOC (2023)

Appendix C: Supplemental Notes for Table 8. Approximate Baseline Home Electricity Burden for U.S. Territories (2019)

Table C-1. Approximate Baseline Home Electricity Burden for U.S. Territories (2019)

Geography	Median Household Income (U.S. dollars) (2019) [1]	Average Residential Electricity Rate (Cents/kWh) (2019) [2]	Residential Electricity Sales (MWh) (2019) [3]	Number of Residential Customers (2019) [4]	Estimated Average Annual Residential Electricity Consumption (MWh) (2019) [5]	Estimated Average Annual Residential Electricity Spending (U.S. dollars) (2019) [6]	Approximate Baseline Home Electricity Burden (%) (2019) [7]
American Samoa	$28,352	35.26	47,127	10,762	4.38	$1,544	5.45%
Commonwealth of the Northern Mariana Islands	$31,362	25.28	76,795	11,525	6.66	$1,684	5.37%
Guam	$58,289*	24.99	514,829	44,226	11.64	$2,909	4.99%
Puerto Rico	$20,474	21.43	6,205,152	1,341,424	4.63	$992	4.85%
U.S. Virgin Islands	$40,408	38.75	217,003	46,283	4.69	$1,817	4.50%
Hawaii	$83,102	32.06	2,760,000	438,352	6.30	$2,020	2.43%
U.S. Average	$65,712**	13.01	1,440,288,909	135,249,616	10.65	$1,386	2.11%

Data from U.S. Census Bureau (2020a, 2020b, 2020c, 2020d); EIA (2021)

*Median household income for Guam excludes people in military housing units.
**U.S. average does not include the territories of American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and the U.S. Virgin Islands.

C-1. Methodology, Data Sources, and Limitations

Table C-1 provides a method for estimating electricity burden in the U.S. territories. It compares indicators of estimated electricity burden across the U.S. territories and includes the U.S. and state of Hawaii for additional context. As noted in the table, the U.S. average does not include the territories of American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and the U.S. Virgin Islands.[9]

[9] For more information, see https://www.census.gov/content/dam/Census/library/publications/2020/acs/acs_general_handbook_2020_ch02.pdf.

We consider the home electricity burdens listed in Table C-1 to be approximate baselines because these data represent the estimated floor for electricity burdens, which are likely much higher as of early 2024. The estimated burden calculation also applies only to home electricity use. It accounts for neither other home fuel use (such as propane for cooking) nor transportation-related energy consumption. Since our burden calculations only account for home electricity use, total energy use per household could only be higher than the estimates presented.

Due to the limited availability of current income data for U.S. territories, the year 2019 is used across all data sources. Actual home electricity burdens are likely higher following the COVID-19 pandemic, and future studies should draw from post-COVID-19 pandemic income data as these become available. Future energy burden calculations would also ideally include home fuel use and transportation energy, as well as the impacts of future electrification.

[1] Median Household Income

Methodology: The 2020 Island Area Census data are the most recent available for the U.S. territories of American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and the U.S. Virgin Islands. According to the U.S. Census Bureau, "income questions on the census asked about income for the prior calendar year." 2019 median household income is thus used, setting the timeframe for burden analysis to maintain data consistency.

Limitations: Median household income is an accepted indicator of an area's average income, but there is an inherent data limitation in using a median that can be insensitive to outliers. Future studies could examine a range of income brackets to understand how electricity burdens impact low- and moderate-income households in the U.S. territories with more granularity.

An additional data limitation is that due to the COVID-19 pandemic, the 2020 Island Area Census did not collect household data for group quarters or military housing units.[10] This is methodologically atypical, and impacted 2020 data tables should not be compared to 2010 and other past census data tables reporting the same characteristics. Guam is the only U.S. Island Area with military housing.[11]

Data sources:

- 2019 median household income for American Samoa, the Commonwealth of the Northern Mariana Islands, Guam, and the U.S. Virgin Islands (U.S. Census Bureau 2020a)
- 2019 median household income for the state of Hawaii (U.S. Census Bureau 2020b)
- 2019 median household income for Puerto Rico (U.S. Census Bureau 2020c)
- 2019 median household income for the U.S. (U.S. Census Bureau 2020d).

[2] Average Residential Electricity Rate

Methodology: Data come from the U.S. Energy Information Administration's (EIA's) *Electric Power Annual 2019*. 2019 was selected to maintain consistency with the most current available

[10] See https://www2.census.gov/programs-surveys/decennial/2020/technical-documentation/island-areas-tech-docs/demographic_profile/2020-iac-dpsf-technical-documentation.pdf.
[11] See https://bsp.guam.gov/census-of-guam/.

median household income data for the territories of American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and the U.S. Virgin Islands. EIA reports electric power average prices for ultimate customers in Chapters 2 and 11.

Limitations: EIA rate data may not always accurately depict monthly customer charges or fuel surcharges. EIA uses aggregated data from Form EIA-861 to record average residential electricity prices for the U.S. territories,[12] but a review of some publicly available territorial rate tariffs indicates EIA rate data may not always include all relevant surcharges. Examples of such surcharges in different territories include (but are not limited to) levelized energy adjustment clauses, renewable energy rates, and monthly customer charges. Territorial utilities do not consistently publish historic rate data, so EIA data give us the closest available approximation of 2019 average residential electricity rates in the U.S. territories. Collecting more representative rate data is an area for potential improvement in future studies.

Data sources: All data from: EIA (2021). See Tables 2.4, 2.10, and 11.4–11.8.

[3] Residential Electricity Sales

Data sources: All data from: EIA (2021). See Tables 2.2, 2.8, 11.2, and 11.5–11.8.

[4] Number of Residential Customers

Limitations: There is a difference between the number of households in a geographic area and the number of residential customers in the area, so EIA residential customer data may not match the number of households reflected in U.S. Census Bureau income data. There may be multiple "customers" (as defined by the EIA) per census-designated "household," or there may be households that are not electric utility customers. We note the possible discrepancy between "number of households" and "number of residential customers" as a data limitation that has implications for our burden calculations, which is why we present these burden calculations as approximations for relative comparison purposes.

Given that the 2020 Island Area Census did not collect household income data for military housing units in Guam, the inclusion or exclusion of military units from "number of residential customers" is relevant here. EIA collects information on the number of ultimate residential customers directly from the Guam Power Authority via Form EIA-861. The Guam Power Authority classifies military housing units as U.S. Navy rather than residential customers, so EIA's number of residential customers for Guam should not include U.S. Department of Defense housing units or customers.[13]

Data sources: All data from: EIA (2021). See Tables 2.1, 2.11, 11.1, and 11.5–11.8.

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[12] Form EIA-861, Annual Electric Power Industry Report, and Form EIA-861S (the shortform) collect data from distribution utilities and power marketers of electricity. This survey is a census of all United States electric utilities. For more information on Form EIA-861, see: https://www.eia.gov/electricity/data/eia861/.
[13] Guam Power Authority representative, personal communication, April 2, 2024.

[5] Estimated Average Annual Residential Electricity Consumption

Methodology: Estimated residential electricity sale amounts in Column 3 were divided by the ultimate number of residential customers in Column 4.

[6] Estimated Average Annual Residential Electricity Spending

Methodology: Units of electricity consumption from Column 5 were converted from MWh into kWh, then multiplied by the average residential electricity rate (in cents/kWh) from Column 2. Results are rounded to the nearest dollar.

[7] Approximate Baseline Home Electricity Burden

Methodology: Home electricity burden is the percentage of household income spent on electricity. To calculate approximate baseline home electricity burden, the estimated average annual residential electricity spending amounts in Column 6 were divided by the median household incomes in Column 1.

Limitations: Burden calculations apply to home electricity use only. These estimates account for neither other home fuel use (such as propane for cooking) nor transportation-related energy consumption. Given these exclusions and the data limitations already discussed (i.e., the lack of more recent median household income data for the U.S. territories), these home electricity burdens should be taken as an estimated baseline rather than a precise percentage. More research is needed to further explore home electricity and energy burdens in the U.S. territories, especially in the context of the COVID-19 pandemic and recent global increases in commodities prices.