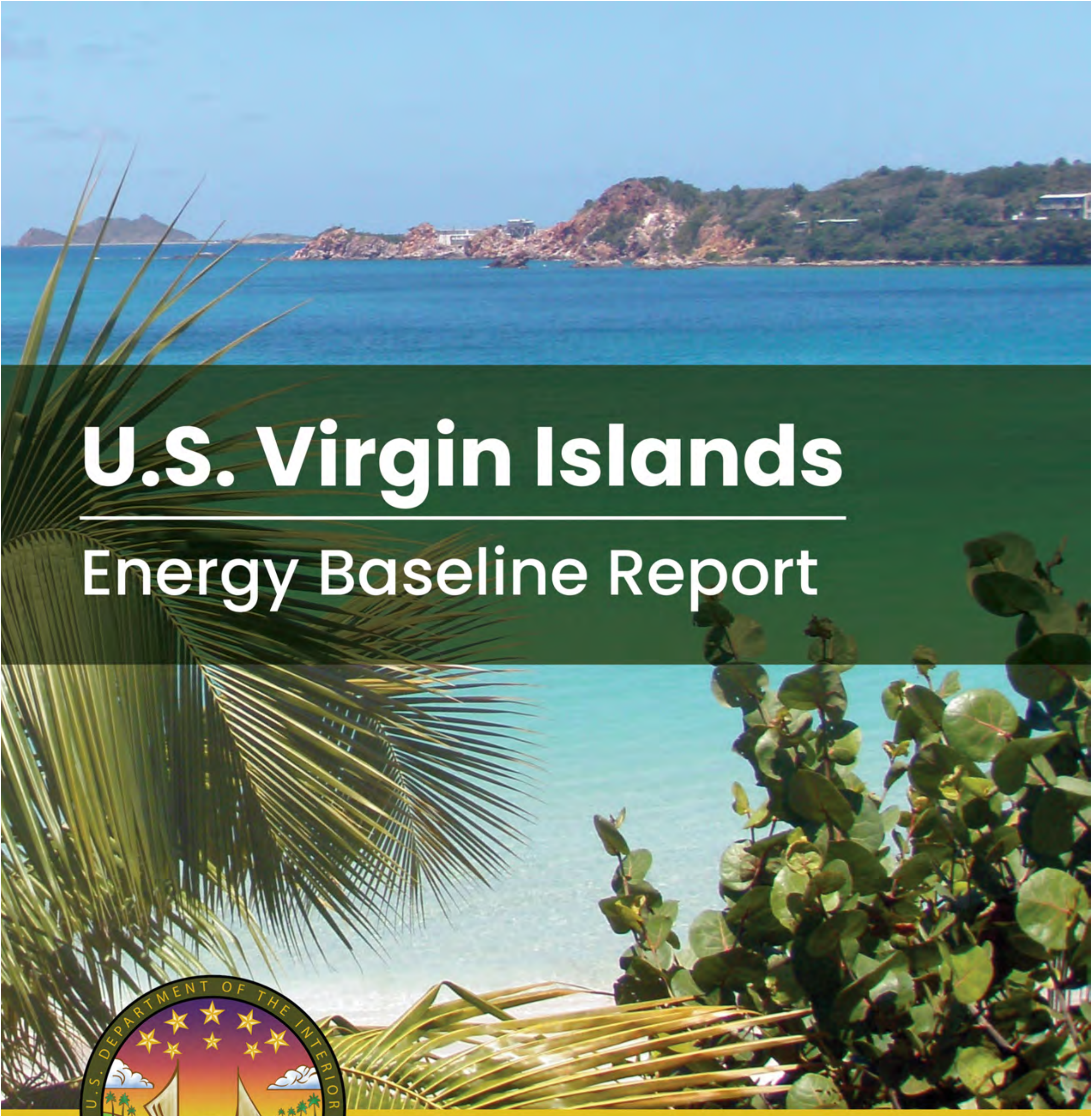

U.S. Virgin Islands

Energy Baseline Report

National Renewable Energy Laboratory
15013 Denver West Parkway, Golden, CO 80401
303-275-3000 • www.nrel.gov

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U.S. Virgin Islands 2023 Energy Baseline Report

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National Renewable Energy Laboratory

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Cover Photo by Alicen Kandt, NREL 18902.

List of Acronyms

BESS	battery energy storage system
EIA	U.S. Energy Information Administration
FEMA	Federal Emergency Management Agency
GDP	gross domestic product
GO FLEET	Government Operations Fleet Efficiency and Electrification Transformation
GVI	government of the Virgin Islands
HUD	U.S. Department of Housing and Urban Development
IPP	independent power producer
ITC	Investment Tax Credit
LPG	liquified petroleum gas
NEB	net energy billing
PPA	power purchase agreement
PV	photovoltaics
VIWAPA	Virgin Islands Water and Power Authority

Executive Summary

The U.S. Virgin Islands (USVI) includes the three main islands of St. John, St. Thomas, and St. Croix. The U.S. territory has a population of about 87,000 000 (U.S. Census Bureau 2022), and the primary industry is tourism (CIA 2023). USVI is highly reliant on fossil fuel for their energy and all fuels are imported. Fuel is used for power generation, water desalination, industry, and transportation.

The electricity and water sector utility is called the Virgin Islands Water and Power Authority (VIWAPA). It is a public-power utility and autonomous agency of the government of the Virgin Islands (GVI) (VIWAPA 2023b). In addition to generating, distributing, and selling retail electricity, VIWAPA is responsible for generation and distribution of potable water. VIWAPA serves approximately 56,000 individual power customer meters (EIA 2022) and 15,000 water meters. Electricity costs in the USVI are about 2.8 times higher than the U.S. national average. Retail electricity costs range from $0.41/kWh for residential customers to $0.47/kWh for commercial customers. These rates are inclusive of a $0.22/kWh fuel surcharge.

The territory has strong solar and wind resources that create the potential for cost-effective renewable power generation. Currently about 2% to 3% of VIWAPA's customer loads are provided by renewable energy from two solar power plants, while the balance of electricity is generated from fossil fuels. VIWAPA has plans to add approximately 90 MW of solar photovoltaics (PV) and 46 MW of wind power through a combination of federal funds and long-term offtake contracts with independent power producers (IPPs). On St. Thomas, the planned renewable generation capacity is approximately 175% of system peak, while on St. Croix it is approximately 194%. VIWAPA is planning battery storage additions to enable integration of these variable renewable resources.

To harden against future storms, VIWAPA, with Federal Emergency Management Agency (FEMA) support, has made significant progress in undergrounding distribution infrastructure and, in locations where undergrounding is not feasible, replacing wooden utility poles with stronger (more wind-resistant) carbon fiber poles. FEMA is also funding a number of microgrids, composed of conventional generation, renewable generation, and battery energy storage systems (BESS). Progress on microgrid development has not occurred at the target pace established at project approval.

The U.S. Department of Housing and Urban Development (HUD) has provided additional federal funding support to the power sector. On St. Thomas, recent HUD Community Development Block Grant Disaster Recovery investments have enabled installation of a 9-MW, 18-MWh BESS and 35 MW of conventional thermal generation. These assets are currently being commissioned. In addition, HUD has approved $145 million of Community Development Block Grant Mitigation funds for the acquisition of third-party-owned propane supply infrastructure, which is critical to generate electricity and produce potable water. At the time of this report, the deal had not officially closed.

The following energy-related challenges are identified by the report authors:

- For the USVI community, the dual concerns of high costs of electricity and poor reliability are paramount.

- USVI's exposure and vulnerability to extreme tropical storms is a regular threat. Extensive damage in both districts from 2017 hurricanes caused massive levels of damage to energy infrastructure, and rebuilding and hardening efforts are still ongoing.

- FEMA has committed more than $3.27 billion dollars to ensure recovery projects support the whole community, with an emphasis on hardening the infrastructure to decrease damage from future storms. The agency has significant staff supporting these efforts. However, the work burden falls on the USVI community, and the USVI workforce has constrained capacity. The level of effort for rebuilding and system hardening is taxing government and utility staff.

- FEMA has funded multiple microgrids, and VIWAPA has signed large-scale (relative to the systems loads) power purchase agreements (PPAs). These projects require engineering and project management, which are being done by a limited number of VIWAPA staff and consultants. There are not enough staff to lead and execute these projects in a timely manner, and staff who are doing the work are spread thin. Additionally, the planned near-term integration of high shares of renewable energy and utility BESS in the FEMA-funded microgrids and IPP PPAs requires state-of-the-art knowledge that VIWAPA staff are developing simultaneously while executing them. VIWAPA has engaged multiple consultants and engineering firms to support these projects; however, improved coordination and systems-level planning are needed. These challenges pose risks to the success of these projects.

- A lack of stakeholder engagement and analysis-based planning can lead to reactive decision-making and investments that may not result in achieving optimal outcomes. Rebuilding and hardening of infrastructure, financial strain, and limited bandwidth at VIWAPA are challenging the execution of best-practice, holistic planning for both near- and longer-term projects.

- VIWAPA has severe financial problems, including unpaid bills from large consumers, rate tariff structures that do not sufficiently cover operating costs, a steady increase in customer self-generation resources (i.e., load defection), and a high contribution requirement for USVI's public retirement system. VIWAPA has many outstanding debts that they are not paying because they do not have the money.

The USVI has a once-in-a-generation opportunity to build significantly more robust, reliable, and cost-effective power and water systems with federal funds, but is struggling to capitalize on the full breadth of the opportunity due to capacity constraints in terms of both the number of staff available as well as the technical complexity of the needs.

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1 Introduction

The objective of this report is to summarize energy sources, consumption, and the energy sector in the U.S. Virgin Islands (USVI). These data are meant to provide a high-level overview of USVI's energy sector and existing energy policy frameworks.

It is first helpful to better understand the political, geographic, and economic context for USVI's energy sector. USVI became a territory of the United States in 1917 when the United States purchased it from Denmark (CIA 2023). USVI citizens are citizens of the United States (OIA 2023).

The USVI is located in the Caribbean, between the Caribbean Sea and the North Atlantic Ocean, and is composed of three main islands—St. Croix, St. John, and St. Thomas (Figure 1). St. Thomas is located due east of Puerto Rico, and St. John is about 3 miles east of St. Thomas. St. Croix is located approximately 40 miles south of St. Thomas and St. John. The USVI's Caribbean location subjects the islands to many tropical storms. Two Category 5 hurricanes struck the USVI in 2017, causing significant damage to the environment, structures, and infrastructure.

The USVI has a total land area of 136 square miles and 604 square miles of water. Its subtropic climate, tempered trade winds, and beautiful beaches and waters have resulted in a robust tourism industry. The estimated population for 2023 is approximately 87,000 (U.S. Census Bureau 2022).

Figure 1. Map of USVI (CIA 2023)

As outlined in Table 1, USVI's estimated gross domestic product (GDP) as of 2021 is $4.4 billion (BEA 2023).

Table 1. GDP of the U.S. Territories (Millions $)

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

Data from BEA (2023)

The geographic remoteness and smaller-scale economy contribute to the USVI's high cost of electricity. USVI depends on petroleum imports for almost all its energy needs, so electricity prices in the territory are closely linked to global petroleum prices. USVI's residential electricity prices are currently $0.41 cents per kWh, while commercial customers pay $0.47/kWh (VIWAPA 2023c). These prices are almost three times higher than the U.S. average. As of 2021, the USVI's per-capita energy consumption was also about one-fourth higher than the 50 U.S. states (EIA 2023c). 100% of USVI's population has access to electricity (DOE 2020).

The rest of this report is organized into two sections: the first section provides an overview of the USVI energy sector, and the second section outlines the current energy policy landscape in the territory. Progress and challenges are addressed throughout the report.

2 Energy Sector Overview

USVI has no known indigenous coal, natural gas, or petroleum resources and relies almost entirely on imported fossil fuels for its energy needs (EIA 2023c). The remaining non-fuel energy consumption is produced from renewable energy, primarily solar photovoltaics (PV). Some small wind turbine generators also operate there, owned by homeowners and businesses.

Imported petroleum is received at multiple locations in the USVI. On St. Croix, VIWAPA receives fuel shipments directly at their power plant while fuels for transportation and industrial use come through the Ocean Point Terminal (formerly Limetree Bay Terminal). On St. Thomas, fuels enter through multiple points, including directly to Virgin Islands Water and Power Authority's (VIWAPA's) power plant and the ports for transfer to storage systems owned by consumers. Imported fuels provide most of the energy for USVI's power generation, transportation, and water treatment needs. Table 2 outlines some of the key organizations that support USVI's energy sector or are tangentially related based on their procurement and permitting roles.

Table 2. Key Energy Sector Organizations

Organization	Brief Description	Website
VIWAPA (or WAPA)	Public utility providing electricity and potable water	https://www.viwapa.vi/
Virgin Islands Energy Office	Government of the Virgin Islands (GVI) office that promotes sustainable energy and energy efficiency and administers U.S. Department of Energy State and Community Energy Program funds allocated to USVI. Oftentimes the lead agency for capturing and administrating other federal funds related to energy.	https://energy.vi.gov/
Virgin Islands Port Authority	Manages and operates the airports and seaports	https://www.viport.com/
Department of Planning and Natural Resources	Issues building permits, including for installation of rooftop solar	https://dpnr.vi.gov/
Department of Property and Procurement	Manages and controls GVI real property, which is often identified for potential installation of utility-scale renewable energy systems. Also responsible for purchase, management, and oversight of GVI vehicle fleet.	https://dpp.vi.gov/
Ocean Point Terminals (formerly Limetree Bay Terminal)	Fuels storage and marine terminal with 34-million-barrel storage capacity for crude and refined petroleum products. Provides fuel to commercial entities in the USVI. Jones Act exemption.	https://www.opterminals.com/

Snapshot: Electricity Generation

Between 2017 and 2022, USVI's annual electricity net generation has been approximately 461 to 618 MWh (EIA 2021). Imported fossil fuels constitute most of this generation, with small but growing generation provided by renewable energy generators. In 2021, solar power accounted for about 3% of VIWAPA's electricity sales (according to the National Renewable Energy Laboratory's estimate). This figure does not include VIWAPA customer load served by and generation from customer-owned, behind-the-meter renewable energy systems. The territory has substantial solar energy and wind resources (Roberts and Andreas 2023; Sengupta et al. 2018), and VIWAPA is in the process of executing multiple solar and wind power projects.

A fuel surcharge is applied to VIWAPA electricity rates to recover fuel costs. This surcharge is currently, as of January 2024, $0.22/kWh, or about half of the retail electricity rate (VIWAPA 2023c).

Snapshot: Primary Energy Consumption

Recent annual consumption of refined petroleum products in USVI is about 245,000,000 gallons per year, according to the U.S. Energy Information Administration (EIA) (EIA 2021). This includes gasoline, diesel, jet fuel, and liquified petroleum gas (LPG). Distillate fuel oil (also called diesel #2) accounts for most of the total consumption, followed by residual fuel oil (also called diesel #6), jet fuel, and LPG. VIWAPA is a large consumer of distillate fuel oil and LPG, so much if not most of these two fuel types might reasonably be attributed to VIWAPA use. Note, however, that there is inconsistency with LPG imports reported by EIA and LPG consumption data that VIWAPA has shared for this report. VIWAPA fuel use is described in 3.4. As described there, VIWAPA propane use in 2021 exceeded total imports reported by EIA by almost three times, so it raises a question as to whether fuel deliveries directly to VIWAPA are included in the EIA data.

Table 3. Annual Refined Petroleum Products Consumption in USVI, 2018–2021 (1,000 gallons)

Fuel	2018	2019	2020	2021
Total Consumption	245,000	245,000	230,000	245,000
Motor Gasoline	20,000	20,000	18,000	18,000[st]
Jet Fuel	28,000	28,000	26,000	28,000[st]
Kerosene	3,000	3,000		3,000
Distillate Fuel Oil	138,000	138,000	129,000	135,000[st]
Residual Fuel Oil	37,000	37,000	35,000	28,000[st]
LPG	28,000	28,000	26,000	28,000[st]

Data from EIA (2021)

Differences between Total Consumption and the sum of the fuel types are as reported by EIA and likely due to rounding errors.

st = EIA forecasts

3 Power Sector

The power sector in the USVI includes one vertically integrated utility, two independent power producers (IPPs) that sell power to the utility, and a number of distributed energy resource developers that sell solar and wind power systems to individual consumers, including homeowners and businesses.

The public-power utility, VIWAPA, was created in 1964 as an autonomous agency of the GVI (VIWAPA 2023b). In addition to generating, distributing, and selling retail electricity, VIWAPA is responsible for generation and distribution of potable water. VIWAPA serves approximately 56,000 individual customer meters (EIA 2022).

VIWAPA is overseen by a governing board of directors and is regulated by the Virgin Islands Public Service Commission. The chairman of VIWAPA's board, as designated by law, is also the director of the U.S. Virgin Islands Energy Office. VIWAPA environmental and construction activities are also regulated by both GVI agencies and federal agencies, including the U.S. Environmental Protection Agency (VIWAPA 2013).

Currently, VIWAPA's significant challenges include executing a high number of complex infrastructure projects to rebuild and harden the power system after the 2017 hurricanes, strained workforce capacity, power system reliability, and financial insecurity.

3.1 Utility Infrastructure: Overview

VIWAPA has two power districts, one serving St. Croix and one serving St. Thomas, St. John, and Water Island. The islands connected to the St. Thomas power system are interconnected by undersea cables. VIWAPA has one central power station in each district. Thermal generation includes combustion turbines and reciprocating engine generators. In addition, there are two solar PV plants (one in each district) that were developed by IPPs that sell power to VIWAPA under bilateral contracts.

VIWAPA's fuel is directly delivered to its power plants by ship and stored in on-site fuel tanks. Some generators burn diesel #2, some burn LPG, and some are dual-fuel capable (meaning they can burn either depending on availability). LPG is considerably cheaper than diesel fuel, so VIWAPA prioritizes utilizing generators that can run on LPG.

Electricity is distributed to customers both in overhead conductors strung up on utility poles and via underground feeders. VIWAPA, with FEMA support, has "undergrounded" significant portions of the distribution network to make the system more resilient to storm damage and has fortified overhead distribution by replacing wooden utility poles with stronger carbon fiber poles.

3.2 Electricity Production and Distribution

Existing WAPA and IPP-owned power plants are described in this section, including the types of generation, power ratings, year of installation, and fuel types. Next, the distribution networks and the planned, near-term power and energy storage capacity additions are described.

3.2.1 VIWAPA Power Plants

VIWAPA has reciprocating internal combustion engine generators and combustion turbine generators in both the Randolph E. Harley power plant on St. Thomas and the Richmond power plant on St. Croix. These thermal generators burn petroleum fuels. Table 4 lists the current operating generation at the St. Thomas plant, including each unit's nameplate power capacity, year of installation, and fuel type. The rating refers to the unit's original nameplate capacity. Some units may be derated by VIWAPA due to age or other reasons and therefore may no longer be able to provide the rated power. In total, the St. Thomas plant has approximately 167 MW of generating capacity. The new Wartsila reciprocating engines are the most efficient and therefore have lower operating costs than combustion turbines.

Table 4. VIWAPA Generation at St. Thomas Power Plant

Unit name	Type[a]	Rating (MW)	Installation Year	Fuel
14	CT	15.1	1973	Diesel
15	CT	26.6	1980	Diesel and LPG
23	CT	42	2004	Diesel
27	CT	26	2018	LPG
Wartsila 1	Recip	7	2018	LPG
Wartsila 2	Recip	7	2018	LPG
Wartsila 3	Recip	7	2018	LPG
Wartsila 4	Recip	9	2023	95% LPG, 5% diesel
Wartsila 5	Recip	9	2023	95% LPG, 5% diesel
Wartsila 6	Recip	9	2023	95% LPG, 5% diesel
Wartsila 7	Recip	9	2023	95% LPG, 5% diesel
Total		167		

[a] CT = combustion turbine; recip = reciprocating internal combustion engine

A 9 MW, 2-hour battery energy storage system (BESS) was also installed in 2023 at the St. Thomas power plant and is currently undergoing commissioning. This is the first utility-scale BESS installed on VIWAPA's system, and it will be used for black-start and frequency regulation. As more renewable energy systems are integrated, the BESS will likely be dispatched more regularly. This BESS and Wartsila units 5 through 7 were funded through the U.S. Department of Housing and Urban Development (HUD) Community Development Block Grant Disaster Recovery program (VIWAPA 2023c). Wartsila Units 5 through 7 are currently undergoing commissioning tests and are expected to be available for regular operation in the next few months.

Information about the thermal generation units at the St. Croix Richmond power plant is provided in Table 5. The Aggreko units are a bank of 18 reciprocating engine generators, each rated for 1.1 MW of power output. These units are not owned by VIWAPA but instead are owned and operated by Aggreko, an IPP, which sells the power directly to VIWAPA. The Aggreko units run on LPG, are most efficient, and are operated as baseload to maximize their usage.

Table 5. VIWAPA Generation at St. Croix Power Plant

Unit Name	Type[a]	Rating (MW)	Installation Year	Fuel
17	CT	21.9	1988	Diesel and LPG
19	CT	24.5	1994	Diesel
20	CT	24.5	1994	Diesel and LPG
Aggreko	Recip	19.8[b]	2019	LPG
Total		90.7		

[a]CT = combustion turbine; recip = reciprocating internal combustion engine

[b] (18) 1.1-MW units owned and operated by an IPP under a power purchase agreement (PPA)

As Table 4 and Table 5 indicate, VIWAPA burns both diesel #2 and LPG fuels in its generators. LPG is a lower-cost commodity, so VIWAPA prioritizes running units that run on LPG. Fuel supply contracts are not public, so current fuel costs to VIWAPA are not available. However, as representative of the potential cost differential between LPG and diesel, global annual commodity prices for each are shown in Table 6.

Table 6. Annual Average Commodity Price Comparison of LPG and Diesel #2, Dollars Per Gallon

Unit Name	Spot Price (2022)	Commodity Location
LPG	$1.11	Mont Belvieu, Texas
Distillate Diesel #2	$3.37	U.S. Gulf Coast

Data from EIA (2023d)

The costs to VIWAPA are higher than these spot prices, because VIWAPA's costs include significant delivery charges. However, the table indicates that the annual average diesel fuel cost was three times greater than LPG on the spot market in 2022, and underscores why VIWAPA has prioritized LPG use over diesel fuel.

In 2013, VIWAPA signed a contract with Vitol Group that would bring LPG to VIWAPA power plants (Ellis 2023). This agreement allowed VIWAPA to add an optional fuel type, LPG, as up to this point they were 100% reliant on diesel fuel. The agreement had Vitol build the import and fuel storage equipment, supply the fuel, operate and maintain the LPG equipment, and convert some existing generators to allow LPG use. LPG commodity prices are lower than diesel, so this tack was taken largely as a cost-saving measure but had other benefits, including allowing an alternative fuel and reduced carbon dioxide emissions.

Over time, despite the lower fuel cost, VIWAPA was unable to meet total cost obligations under the contract and Vitol stopped delivering fuel in 2018, which exacerbated financial hardship due to needing to burn higher-cost diesel. Funding from GVI to pay down Vitol debt allowed LPG deliveries to continue, yet the financial challenges remained, and so did the threat of further LPG delivery disruptions. In 2023, VIWAPA, GVI, and Vitol negotiated a USVI buyout of the Vitol infrastructure and fuel supply contract, and HUD approved use of $145 million of USVI Community Development Block Grant Mitigation program funds for the procurement. This is expected to reduce LPG supply risk (due to VIWAPA financial challenges) and result in lower costs for LPG (VIHFA 2023).

3.2.2 IPPs

BMR Energy owns and operates the two PV IPP plants in the USVI, a 4.2-MW AC plant on St. Croix and the recently rebuilt 5-MW AC plant on St. Thomas. In addition, VIWAPA has a PPA contract with Aggreko for operation and maintenance of 18 1.1-MW reciprocating engine generators at the St. Croix plant. VIWAPA provides the fuel for these units and pays a per-unit ($/MWh) price for the electricity Aggreko delivers to VIWAPA.

Table 7. IPPs

IPP	Generation Type	Rating (MW AC)	Installation Year	District
Aggreko	Reciprocating engines	19.8	2019	St. Croix
BMR Energy	Solar PV	4.2	2014 (NRG 2014)	St. Croix
BMR Energy	Solar PV	5	2023	St. Thomas

3.2.3 VIWAPA Distribution Networks

Power from VIWAPA is distributed to customers via feeders with voltage levels stepped down to the customer's service level. On St. Croix, some feeders operate at 13.2 kV and some at 25 kV. Feeders are connected at one of two substations, and the two substations are interconnected via a 69-kV underground line. On St. Thomas, power is transmitted from the central power plant to five substations, interconnected through a 34-kV loop. Customers are fed from the substations on 15-kV feeders.

Approximately 95% of VIWAPA's transmission and distribution system had to be repaired after the 2017 hurricanes (St. Thomas Source 2022a). Currently, VIWAPA is replacing wooden poles used for overhead lines with carbon fiber composite poles, which have a wind load rating of 200 mph of sustained winds (Buchanan 2023). In a September 2023 press release, VIWAPA reported that 88% (7,592) of the composite poles had been installed (VIWAPA 2023d). This program is funded by FEMA with a 10% matching requirement covered by HUD.

3.2.4 VIWAPA Planned Capacity Expansions and Microgrid Development

VIWAPA has significant capacity expansions in the execution phase. In addition to the new 9-MW BESS and 36 MW of Wartsila reciprocating engine generation that are currently being commissioned at the St. Thomas plant (see Section 3.2.1), VIWAPA has funding from FEMA to install microgrids on St. Thomas, St. John, and St. Croix, and has also signed PPAs for very large solar PV and wind power generation plants. These renewable energy projects are intended to displace costly power from fossil-fueled generators and protect customers from high fuel surcharge increases when fuel costs spike.

The microgrids and renewable power IPPs present both a huge opportunity and challenge for VIWAPA for integration of large shares of inverter-based variable generation resources.

The FEMA-funded microgrids are currently in the design phase. The microgrids and IPPs being interconnected to the St. Thomas system are described in Table 8, and the St. Croix systems are described in Table 9.

Table 8. St. Thomas–St. John Renewable Energy and BESS Capacity Additions

Location	Funding/IPP	Techs	Capacity (MW-DC)	Capacity (MW-AC)	BESS (MWh)
Coral Bay, STJ	VI Electron	PV+BESS[a]	24	19.5	18.4
Bovoni, STT	VI Electron	PV+BESS[b]	13	10.8	4.6
West End, STT	VI Electron	PV+BESS[c]	50	40.8	64.4
Bovoni, STT	Advance Power	Wind		16.5	
Bovoni, STT	FEMA	BESS coupled to wind IPP	-	-	30
St. John	FEMA	PV, BESS, and backup generators	4.7	4	8

[a, b, c] BESS is not included in the PPA contract but leased separately.

Data from VIWAPA, private correspondence

Table 9. St. Croix Renewable Energy and BESS Capacity Additions

Location	Funding/IPP	Techs	Capacity (MW-DC)	Capacity (MW-AC)	BESS (MWh)
Centerline Road	VI Electron	PV+BESS[a]	24	19.5	18.4
East End	VI Electron	PV+BESS[b]	16	13.1	9.2
Eastern Portion	Advance Power	Wind		29.7	
Frederiksted	VI Electron	PV+BESS[c]	13	10.8	4.6
Adventure	Federal Emergency Management Agency	PV+BESS	21	18	20

[a, b, c] BESS is not included in the PPA contract but leased separately.

Data from VIWAPA, private correspondence

In combination, these plans represent a capacity penetration of renewable power of approximately 175% on St. Thomas and 194% on St. Croix based on 2022 peak demands. Successful integration requires careful due diligence.

3.3 Electricity Consumption

Electricity demand from VIWAPA customers declined steadily from 2011 through 2015, from an average annual demand of 86 MW to 71 MW, a decrease of 17% over 5 years. Demand increased in 2016 before dropping off significantly, as illustrated in Figure 2, as a result of loss of service due to the dual hurricanes that caused significant damage to the territory's power infrastructure. Demand has recovered steadily since 2017 and was back to a 71-MW annual average in 2021.

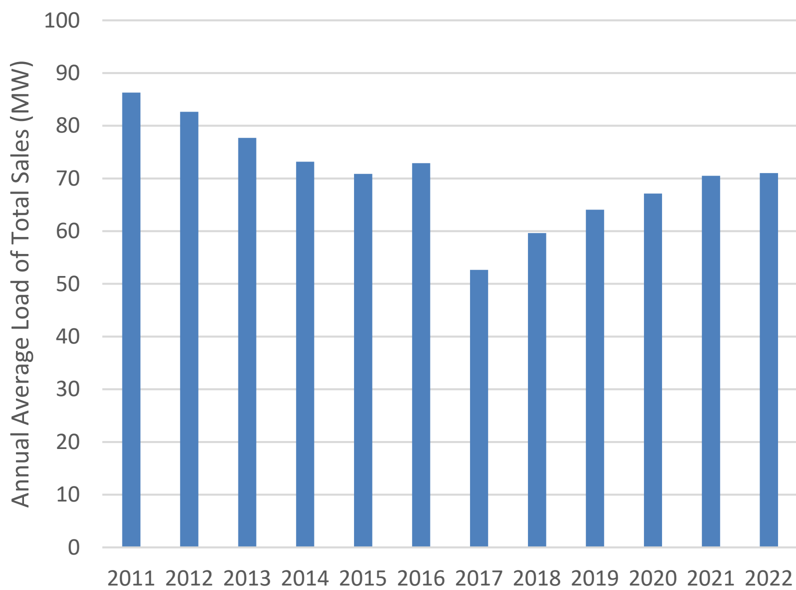

Figure 2. Annual average combined demand in both power districts from 2011 to 2022

Data from EIA (2023)

3.3.1 Power Demand

Figure 3 and Figure 4 show the hourly demand in each district in 2023. This data was provided by VIWAPA and is the sum of the load data on the feeders. The St. Croix system peak in Figure 3 is 39.4 MW and the St. Thomas system peak in Figure 4 is 57.0 MW. Per conversations with plant operators, the current peak in each district is slightly higher: 45 MW on St. Croix and 60 MW on St. Thomas.

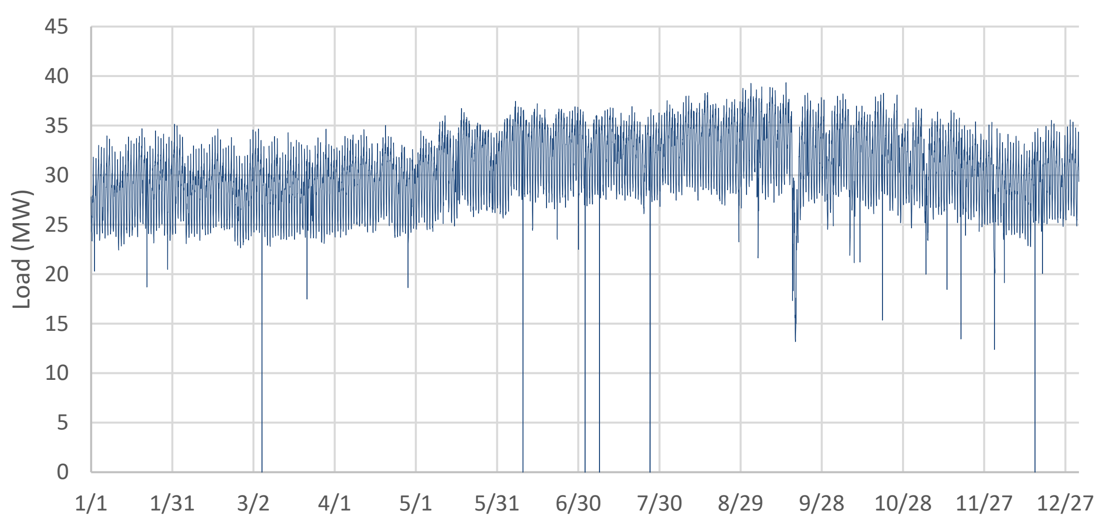

Figure 3. Electricity demand on St. Croix in 2022

Data from VIWAPA, private correspondence

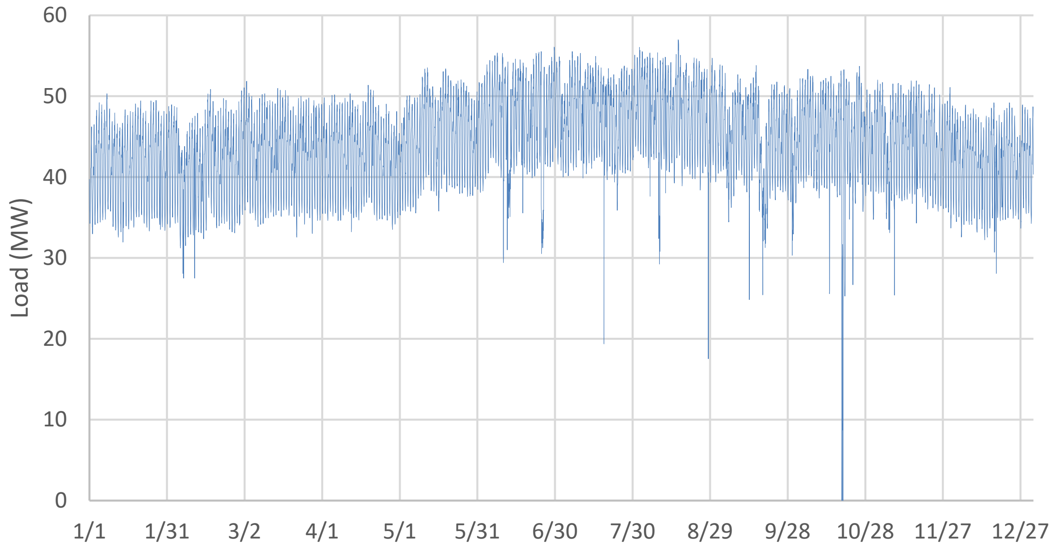

Figure 4. Electricity demand on St. Thomas in 2022

Data from VIWAPA, private correspondence

3.3.2 Sales by Rate Class

As reported by EIA, VIWAPA serves approximately 56,000 metered customers across both service districts (EIA 2022). The number of meters and annual energy delivered is broken down into three rate classes: residential, commercial, and industrial customers.

Figure 5 shows the fraction of customers by rate class in 2022. Eighty-two percent of all customers are residential, while 14% are commercial and 4% are industrial.

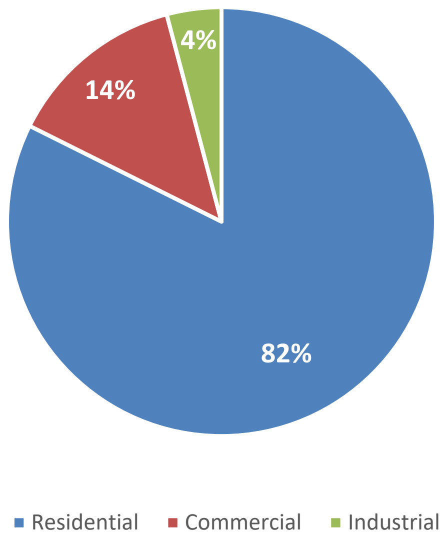

Figure 5. Number of VIWAPA metered customers by rate class in 2022

Data from EIA (2023)

The total energy consumption in 2022 was even between residential and industrial customers, at 42%, while commercial customers consumed 16% of generation (Figure 6).

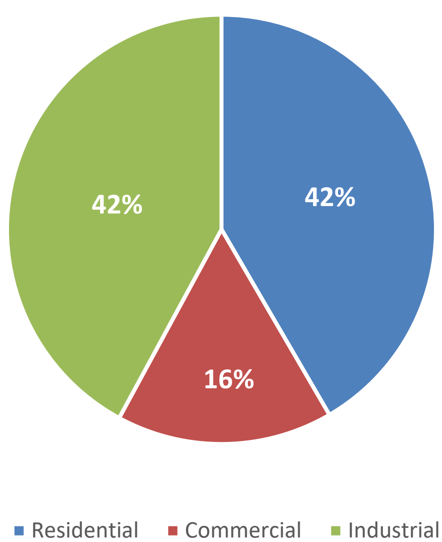

Figure 6. VIWAPA electricity 2022 sales volumes by rate class

Data from EIA (2023)

3.3.3 Rate Tariff

The price of electricity for end-use customers in cents/kWh is shown in Table 10. VIWAPA electricity prices include fuel surcharges and therefore are subject to global fuel market price fluctuations. This surcharge, called the levelized energy adjustment clause, is currently $0.22/kWh, or about half the retail electricity rate.

Table 10. Comparative Energy Rates, U.S. Average to VIWAPA Customers

Customer Type	U.S. Average, May 2023 (cents/kWh)	Customer Average, August 2023 (cents/kWh)
Residential	16.21	40.85 for first 250 kWh 43.47 for all other
Commercial	12.91	47.36
Industrial	8.09	47.36a

Data from EIA (2023c) and VIWAPA (2023a).

[a] VIWAPA rates published on their website are provided for residential and commercial customers only. This table includes the published commercial rate as the value for industrial customers in the USVI.

The cost of power for residential customers is 2.6 times the U.S. average; for commercial customers in the USVI, it is about 3.8 times higher.

3.4 Power Utility Fuel Consumption and Fuel Storage Capacity

VIWAPA staff provided monthly fuel consumption for 2020 through 2022. The data provided includes a breakdown of fuel type (distillate diesel and LPG) and district. The summary of this fuel consumption data is shown in Figure 7 and Figure 8. In 2022, VIWAPA generators burned 90,777,000 gallons of fuel, 23% diesel and 77% propane. On an energy basis, diesel contribution was 31% and LPG was 69%.

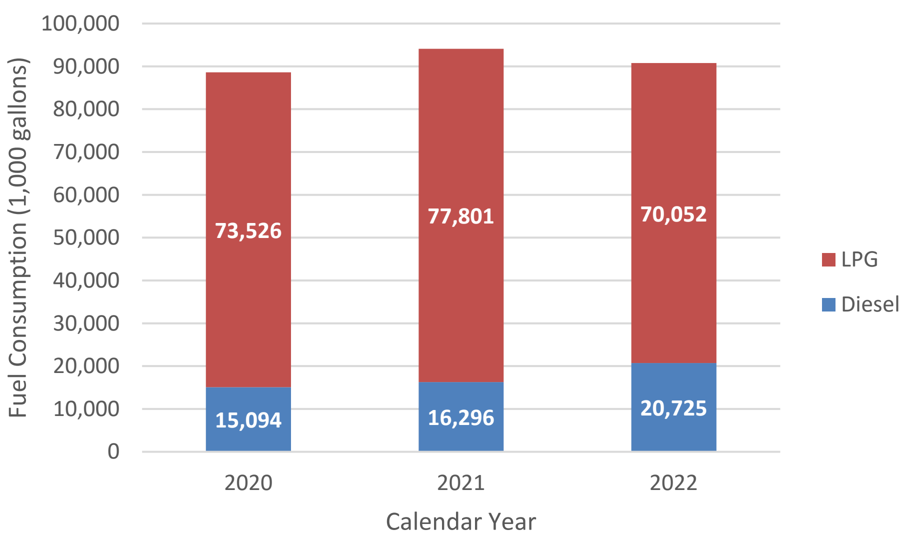

Figure 7. VIWAPA fuel consumption for 2020 through 2022

Data from VIWAPA, personal correspondence

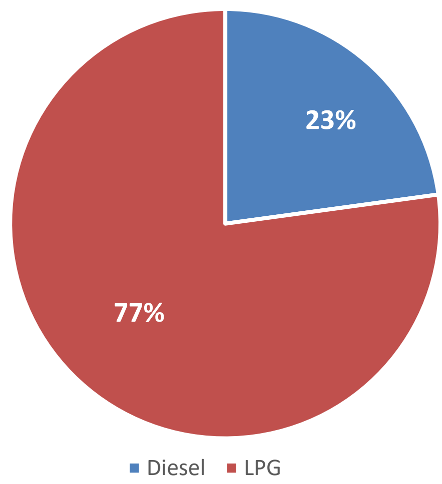

Figure 8. VIWAPA fuel consumption fraction by type in 2022

Data from VIWAPA, personal correspondence

Table 11 shows the fuel storage capacities on St. Thomas and St. Croix, the average daily consumption, and approximate days of fuel capacity available when the fuel tanks are full. The consumption rates are calculated using VIWAPA 2021 data, because the 2022 data has a spike in diesel consumption in December due to the LPG fuel supplier refusing to deliver more fuel as a result of unpaid invoices.

Table 11. Fuel Storage Capacities by Fuel Type and District

Fuel Type	District	Storage Capacity (1,000 gallons)[a]	Average Daily Usage in 2021 (1,000 gallons)	Days of Storage Capacity When Full
Distillate Diesel	St. Croix	3,757	6.1	620
LPG	St. Croix	2,268	118	19
Distillate Diesel	St. Thomas	3,226	39	84
LPG	St. Thomas	2,268	95	24

[a] LPG capacities are the total usable volume, not total tank capacity.

Data from VIHFA (2023) and personal correspondence.

3.5 VIWAPA Renewable Contribution

As previously described and shown in Table 7, there are currently two utility-scale solar PV IPPs on VIWAPA systems. Table 12 shows the fraction of VIWAPA power from renewable generation. Note that the St. Thomas plant was being recommissioned in 2022. It came online in April of 2022, and was fully operational in July of 2022 so the current renewable fraction is higher.

Table 12. VIWAPA Load Served by Renewable Energy

IPP PV Capacity (MW-AC)	District	Generation 2022 (MWH)	Fraction of VIWAPA Load Served
4.2	St. Croix	7,265	2.7%
5.0	St. Thomas	5,078[a]	1.3%

[a] This plant was destroyed in 2017 hurricanes and has been reconstructed. It came online in 2022; annual generation is expected to be higher in 2023.

Data from VIWAPA, personal correspondence

3.6 Customer-Sited Distributed Energy Resources

USVI has policies in place that allow utility customers to install renewable energy resources "behind the meter" and operate them in parallel with the utility. This means that customer consumption can be served part of the time by utility-generated power, in other times by customer-generated power, and at other times by a mix of power from both the utility and the customer's system. In addition to allowing customers to interconnect distributed energy resource systems to VIWAPA's distribution network, policies have provided compensation to distributed energy resource system owners for excess energy they generate and export to the grid. Section 5.1 includes more discussion of these policies.

A relatively large fraction of VIWAPA customers self-generate power with customer-owned PV. According to the Virgin Islands Energy Office, most behind-the-meter PV systems include battery storage to provide backup power in the event of loss of VIWAPA-provided power. Only a few commercial renewable energy installations are not grid-tied (i.e., have completely "defected" from VIWAPA's system). However, these customer distributed energy resources are almost completely considered to be "load-defected," meaning they rarely draw power from the grid. The systems remain connected to provide redundance, using VIWAPA as their backup resource (Fleming 2023).

3.7 VIWAPA Water

VIWAPA serves approximately 15,000 customers across both districts with potable water service. VIWAPA's potable water is produced from seawater using reverse osmosis, an energy-intensive process. VIWAPA water is sourced from Seven Seas Water, an independent water producer with reverse osmosis water production facilities located within each district's power plant. Seven Seas owns, operates, and maintains water production, and VIWAPA makes monthly contractual payments for the produced potable water. VIWAPA owns and maintains the water distribution networks.

The water distribution system on St. Croix suffered significant damage from the 2017 hurricane, and FEMA has approved replacement of the system using federal funds. It is anticipated that fully replacing the system will cost $1.5 billion dollars (VIWAPA 2024).

3.8 VIWAPA Long-Term Planning

Utility long-term investments plans are often developed through a process called integrated resource planning. The process can be mandated by law or by regulators and is considered a best practice for developing rational, informed, and cost-effective investment decisions (Synapse 2013). In 2019, VIWAPA published an integrated resource plan (VIWAPA 2019). Since that publication, new leadership at VIWAPA is pursuing their own identified priorities, and integrated resource planning does not seem to be informing current investment plans. There is no regular frequency for the integrated resource planning process in the USVI.

4 Transportation Sector

The transportation sector includes ground, air, and sea transport. Data for these sectors in the USVI is difficult to find, and therefore the transportation sector baseline review is largely a gap in this report. However, some limited data were provided and are presented here.

The Virgin Islands Energy Office provided vehicle registration data from the USVI Bureau of Motor Vehicles from April of 2023. Table 13 shows a summary of registered vehicles by vehicle type. There are over 70,000 registered vehicles, with 72% classified as cars, crossovers, SUVs, and minivans, and 21% classified as pickup trucks. According to the data provided, there were 227 electric vehicles, less than 0.5% of all registered vehicles.

Table 13. St. Croix Renewable Energy and BESS Capacity Additions

Vehicle Type	Count	Fraction
Bus/School Bus	28	0%
Cargo Van	696	1%
Cars, Crossovers, SUVs, Minivans	50,814	72%
Vans, Step Van/Walk-In Van	1,011	1%
Pickup Trucks	14,999	21%
Trucks	1,118	2%
Motorcycles	503	1%
Other	1,395	2%
Total	70,564	100%

Data provided by Virgin Islands Energy Office and sourced from USVI Bureau of Motor Vehicles

Records for fuel consumption specifically for the transportation sector could not be identified for this report.[1] Total fuel imports as reported by EIA, shown in Table 3, are broken down by fuel type, but not by end user. However, aviation fuel and likely all kerosene are easily attributed to the air transport sector. Motor gasoline is used by cars and light-duty trucks but is also used in small boats. Currently, the attribution to each cannot be estimated. Distillate fuel oil, while used at VIWAPA for generation, is likely also consumed by the industrial sector and a significant portion by both marine and ground transportation. VIWAPA no longer uses residual fuel oil, which is not a fuel for ground transportation. However, assignment to industrial or marine use cannot be readily made.

[1] Virgin Islands Energy Office staff have reached out to the USVI Department of Licensing and Consumer Affairs seeking fuel data; however, they had not received any at the time of this publication.

5 Current Energy and Security Policy Frameworks

Existing energy and security policies and programs related to power systems and transportation are described in this section. An approximation of home electricity cost burden is also included to demonstrate the relative magnitude of the high cost of electricity on households.

5.1 Grid-Related Policies

As described briefly in Section 3.5, USVI has policies in place that allow customers to interconnect distributed energy resource systems to VIWAPA's distribution network and to be compensated for renewable energy exported to the grid.

In 2009, Act 7075 was signed into law, and includes a number of provisions to promote deployment of energy efficiency technologies, efficient transportation, and solar water heating. The act also authorized net metering. It requires 30% of VIWAPA's peak generating capacity to be from renewable energy technologies by 2025 and calls for continued expansion of renewable energy until it accounts for more than 50% of capacity (Lantz, Olis, and Warren 2011).

Act 7075's net energy metering provision includes caps on customer renewable energy installations of 15 MW. VIWAPA reported that the limit was reached in June 2017 and closed the program to new applicants (VIEO 2023). Customers interconnected under Act 7075 net metering still receive retail credit for exported energy.

Currently, a temporary net energy billing (NEB) policy was adopted by consensus between GVI, VIWAPA, Virgin Islands Energy Office, and the Public Service Commission (GVI n.d.). This policy was publicly rolled out in late 2021. NEB does not have any published system size or program cap limits.

Customers who register their systems under the NEB program are compensated for exported energy at a rate of 75% of VIWAPA's avoided fuel cost, reflected in the fuel surcharge customers receive on their bills for purchased electricity (VIEO 2021). The fuel surcharge is currently $0.222/kWh, so exported energy from net billing systems is approximately $0.167/kWh. This policy is considered temporary and is intended to facilitate orderly customer interconnection and provide reasonable compensation following the suspension of the net energy metering program once it reached the program capacity caps as designated in law. There is no current effort to update this interim NEB program.

A standby tariff was approved by the Public Service Commission for large commercial and industrial customers who mostly self-generate power, some using fossil fuel, but are interconnected with VIWAPA and use utility power for backup. VIWAPA has not yet implemented this approved standby tariff. (Fleming 2023).

5.2 Partner and Stakeholder Engagement Policies

Many communities have mutual aid agreements that commit signatories to provide support to each other during and after emergencies. The USVI currently has no formal agreements with regional governments in the Caribbean related to recovery support and mutual aid. However, VIWAPA has mutual aid agreements with public power utilities in the United States for poststorm restoration. The utility received significant mutual aid from transmission and distribution line workers from the continental U.S. during the recovery period following the 2017 hurricanes.

5.3 Renewable Energy and Energy Efficiency

In addition to Act 7075 and NEB described above, VI Code Title 12, Section 1130, entitled, "Energy Efficiency Standards," applies to government-funded residential facilities and requires the purchase of energy-efficient equipment, including ENERGY STAR® appliances where available, to include solar water heating (Justia U.S. Law n.d.). VI Code Title 12, Section 1129, entitled, "Solar and renewable energy in public buildings and energy efficient buildings," includes the following provisions, among others:

- Installation of solar water heaters where cost-effective
- Energy efficiency requirements in lease provisions
- Sustainable design and energy efficiency in build-to-suit lease solicitations (Justia U.S. Law n.d.).

5.4 Transportation

The two laws mentioned above also include provisions for government vehicles. VI Code Title 12, Section 1129 states that the Virgin Islands Energy Office shall establish an energy-efficient fleet management plan, while Section 1130 says each government agency shall purchase the most fuel-efficient vehicles that meet the needs of their purpose, promote efficient operation of the vehicles, and collect and maintain information on each vehicle's fossil fuel usage in order to evaluate its efficiency.

Currently, GVI is executing their Government Operations Fleet Efficiency and Electrification Transformation initiative (GO FLEET). This initiative formalizes a goal for GVI to transition to an electric vehicle fleet and develop policy, regulatory, and programmatic strategies to encourage broad adoption. In addition, GVI's transportation electrification goals include increased power sales for VIWAPA and enhanced grid resiliency.

A 2021 U.S. Department of the Interior Energizing Insular Communities grant of $2.15 million was used to launch GO FLEET. With these funds, GVI purchased a number of electric vehicles and charging infrastructure (Bloomberg 2022). An additional $3.5 million U.S. Department of the Interior Energizing Insular Communities grant in 2022 supported additional vehicle electrification and the GO FLEET initiative by allowing GVI to purchase more light-duty vehicles and charging infrastructure (St. Thomas Source 2022b), and VIWAPA to purchase electric cars and three hybrid-electric bucket trucks (VIWAPA 2022).

5.5 Energy and Environmental Justice

USVI median household income is about two-thirds the U.S. national average, while electricity costs are three to four times higher. Table 14 shows this data and estimates the average home electricity burden, or fraction of total income spent on electricity. The National Renewable Energy Laboratory approximates that the average home electricity burden in the USVI is 4.5% of median household income.

A U.S. Department of Energy online map identifies significant areas of St. Thomas and St. Croix as meeting the low-income threshold and are therefore eligible for a 10% bonus federal Investment Tax Credit (ITC) for ITC-eligible renewable energy projects (DOE 2023) (Figure 9 and Figure 10). In addition, with the presence of the refinery on St. Croix, all of the USVI is considered an "energy community" per the Inflation Reduction Act and, therefore, ITC-eligible projects within the USVI also qualify for an additional 10% ITC bonus.

Table 14. Approximate Baseline Home Electricity Burden for U.S. Territories (2019)[2]

Geography	**Median Household Income** (USD) (2019)	**Average Residential Electricity Rate** (cents per 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** (USD) (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), U.S. 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.

[2] This table is meant to provide 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 A for additional notes on table methodology and data limitations.

Figure 9. St. Thomas low-income communities identified for 10% ITC bonus

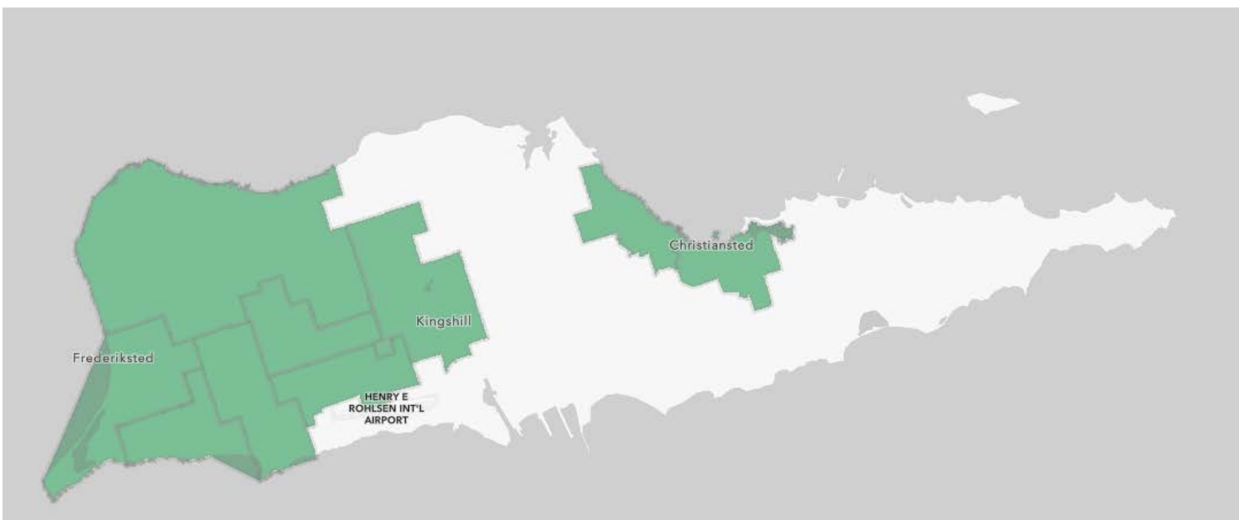

Figure 10. St. Croix low-income communities identified for 10% ITC bonus

6 Energy Goals and Progress

Territory goals related to energy efficiency and renewable energy are described in this section of the report.

6.1 Act 7075

Energy-related goals in Act 7075 remain the formal targets for the USVI. The net-metering limits have been met, as described above. The meaning of the 2025 requirement for 30% of VIWAPA's peak generating capacity to be from renewable energy technologies is vague. However, assuming the target is 30% of peak demand, it would suggest that VIWAPA should have approximately 31.5 MW of renewable energy capacity on their system in 2025.[3] Nine MW of IPP PV (4 MW on St. Croix and 5 MW on St. Thomas) plus 15 MW of customer distributed energy resources under net metering is 24 MW, or 76% of the 2025 goal. Additional customer distributed energy resources installed under the current NEB program is currently unknown but according to VIWAPA staff is in high demand.

6.2 60% Fuel Use Reduction Goal

Fourteen years ago, then Governor John DeJongh set a goal of reducing fossil fuel consumption by 60% by 2025 (Buchanan 2011). This was a goal, not a law. It is not clear if this is still a target or whether progress is being tracked by subsequent administrations.

6.3 VI100 Goal

The Virgin Islands Energy Office Director Kyle Fleming has received funding from U.S. Department of Energy Energy Efficiency and Conservation Block Grant funds to support what he calls the Virgin Islands Grid Resilience & Transition to 100% Renewable Energy Study, or "VI-100." The goal of the study is to develop analysis-based pathways to 100% renewable energy use in the USVI to help identify strategies and potential policies. Director Fleming emphasizes the need for informed decision-making and believes a comprehensive study could be the basis for new policies and territory goals.

[3] On a July 2023 site visit to both power plants, operators described that the current peaks are 45 MW on St. Croix and 60 MW on St. Thomas. 30% of these values is 31.5 MW total.

7 Challenges

These challenges are identified by the report authors based on years of engagement with local stakeholders in the USVI.

- For the USVI community, the dual concerns of high costs of electricity and poor reliability are paramount. The topics of VIWAPA costs and service are commonly overheard in public spaces, reported in the press, and discussed on talk radio. These topics also seem to be discussed regularly in USVI Senate hearings.

- The exposure and vulnerability of the USVI to extreme tropical storms is a regular threat. Extensive damage in both districts from 2017 hurricanes caused massive levels of damage to energy infrastructure, and the rebuild and hardening efforts are still ongoing.

- FEMA is strongly involved financially and has significant numbers of embedded staff supporting rebuilding and system hardening. However, the work burden falls on the USVI community, and the workforce has constrained capacity. The level of rebuilding and system hardening is taxing government and utility staff. In addition, FEMA has funded microgrids and VIWAPA has signed a number of large (relative to the system's loads) PPAs. These projects require engineering and project management, which are being done by a limited number of VIWAPA staff and consultants. There are not enough staff to lead and execute these projects in a timely manner, and staff doing the work are spread thin. Additionally, the planned near-term integration of very high shares of renewable energy and utility BESS in the FEMA-funded microgrids and IPP PPAs requires state-of-the-art knowledge that VIWAPA staff are developing simultaneously while executing them.

- Although an integrated resource plan was published in 2019, the plan does not currently appear to be informing near-term project prioritization. This is likely due to a number of reasons, including urgent prioritization of financial stabilization by current VIWAPA leadership. A lack of stakeholder engagement and analysis-based planning can lead to reactive decision-making and investments that may not result in achieving optimal outcomes.

- VIWAPA has severe financial problems for a number of reasons, including unpaid bills from large consumers (including some GVI agencies), rate tariff structures that do not sufficiently cover operating costs, a steady increase in customer self-generation resources (i.e., load defection), and a high contribution requirement for USVI's public retirement system. VIWAPA has many outstanding debts that they are not paying because they do not have the money. This can have a negative-feedback consequence of increasing the perception of risk to potential partners, for example IPPs.

8 Conclusion

This report was developed at the request of the U.S. Department of the Interior's Office of Insular Affairs for the purpose of establishing the current baseline conditions of the energy sector in the USVI.

The most pressing concerns in the USVI energy sector are high costs for electricity and poor reliability, while the greatest threats are both natural and human-caused. Some threats come from outside of the USVI, while others are a result of issues internal to the territory. Externally, hurricanes, climate change, and global fossil-fuel markets have a significant impact on power system availability and reliability, utility costs (for both power and water), and the financial condition of VIWAPA. Internally, rate tariffs do not cover the full cost of service, and the local workforce capacity is strained.

The USVI has a once-in-a-generation opportunity to build a significantly more robust power and water system with federal funds but is struggling to capitalize on the full breadth of the opportunity due to capacity constraints in terms of the number of staff available as well as the technical complexity of the needs.

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Appendix A. Supplemental Notes for Table 14. Approximate Baseline Home Electricity Burden for U.S. Territories (2019)

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

Geography	Median Household Income (USD) (2019) [1]	Average Residential Electricity Rate (cents per 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 (USD) (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), U.S. 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.

Methodology, Data Sources, and Limitations

Table A.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.[4]

We consider the home electricity burdens listed in Table A.1 to be approximate baselines because these data represent the estimated floor for electricity burdens, which are likely much

[4] https://www.census.gov/content/dam/Census/library/publications/2020/acs/acs_general_handbook_2020_ch02.pdf

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 post-COVID, and future studies should draw from post-COVID 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."[5] 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.[6] 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.[7]

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. EIA's *Electric Power Annual 2019*. The year 2019 was selected to maintain consistency with the most current available median household income data for the territories of American Samoa, Guam, the Commonwealth of the Northern Mariana

[5] https://www.census.gov/newsroom/press-releases/2022/2020-island-areas-guam.html
[6] https://www2.census.gov/programs-surveys/decennial/2020/technical-documentation/island-areas-tech-docs/demographic_profile/2020-iac-dpsf-technical-documentation.pdf
[7] https://bsp.guam.gov/census-of-guam/

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,[8] 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: U.S. EIA (2021). See Tables 2.4, 2.10, and 11.4-11.8.

[3] Residential Electricity Sales

Data Sources: All data from: U.S. 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.[9]

Data Sources: All data from: U.S. EIA 2021. See Tables 2.1, 2.11, 11.1, and 11.5-11.8.

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[8] 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 here: https://www.eia.gov/electricity/data/eia861/.

[9] 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 percent 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.