Guam Strategic Energy Action Plan

2023 Update

Updated by: Morgan Leon Guerrero, Guam Energy Office

Guam Energy Action Plan written by: Misty Dawn Conrad and J. Erik Ness

Guam Strategic Energy Plan written by: Misty Dawn Conrad

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GUAM ENERGY OFFICE
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Update Prepared and Facilitated by:

Morgan Leon Guerrero, Special Projects Coordinator, Guam Energy Office, under the guidance of
Rebecca Resipicio, Director, Guam Energy Office

Approved by:

Austin Shelton, Ph.D., Director, University of Guam Center for Island Sustainability and Sea Grant

Originally prepared and facilitated by Misty Dawn Conrad and J. Erik Ness of the National Laboratories of the Rockies (formerly the National Renewable Energy Laboratory) under the guidance of the Guam Energy Task Force

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Guam Energy Task Force: Members

NLR: Kari Burman, Caley Johnson, John Nangle, Judy Powers, Sheila Hayter, and Stephanie Savage.

NOTICE

The University of Guam Center for Island Sustainability and Sea Grant (UOG CIS & SG) was awarded by the U.S. Department of the Interior an Energizing Insular Communities Grant Award No. D21AP10224, titled *Update 2023 Guam Strategy Energy & Action Plan.* Through this grant opportunity, UOG CIS & SG were tasked with creating an updated framework to guide Guam towards meeting Guam's 100% Renewable Portfolio Standard.

Through this grant, UOG CIS & SG contracted the GEO to lead the development and writing of the updated plan. Through initial discussions between the UOG CIS & SG and GEO, it was established that the two separate documents, "The Guam Strategic Energy Plan" and "The Guam Energy Action Plan," will be merged and updated into one document named the *Strategic Energy Action Plan (hereafter referred to as "The Plan")*.

The Plan will encompass energy-related developments since 2013, including relevant policies, GPA energy master plans, Integrated Resource Plans, and other studies that showcase Guam's energy development. The Plan will delve into new and proposed energy strategies, including expert guidance on developing renewable energy and energy efficiency projects, as well as necessary program financing. It will also address disaster preparedness and recovery planning for energy systems, including planning for extreme weather events and storm hardening.

The Plan will serve as a roadmap with well-planned, actionable steps that government entities and partners can take to meet local energy-related mandates. The updated planning process will foster a unified approach to energy resilience across all energy-related entities on the island. Furthermore, The Plan will serve as a collaborative body of work to ensure a comprehensive and well-rounded plan that facilitates a smooth and timely transition to an energy-resilient future.

The Plan is a living body of work and will be updated as Guam continues its energy transition.

Document Overview

This document combines the findings and recommendations from the 2013 Guam Strategic Energy Plan and the 2013 Guam Energy Action Plan. Additionally, this document includes updated information, including current energy-related laws, regulations, and technologies deployed on Guam.

This document will review the strategic framework discussed, then review the prioritized actions found in The Energy Action Plan, and discuss the outcomes of those strategies. Additionally, this document will discuss long-term goals available to Guam.

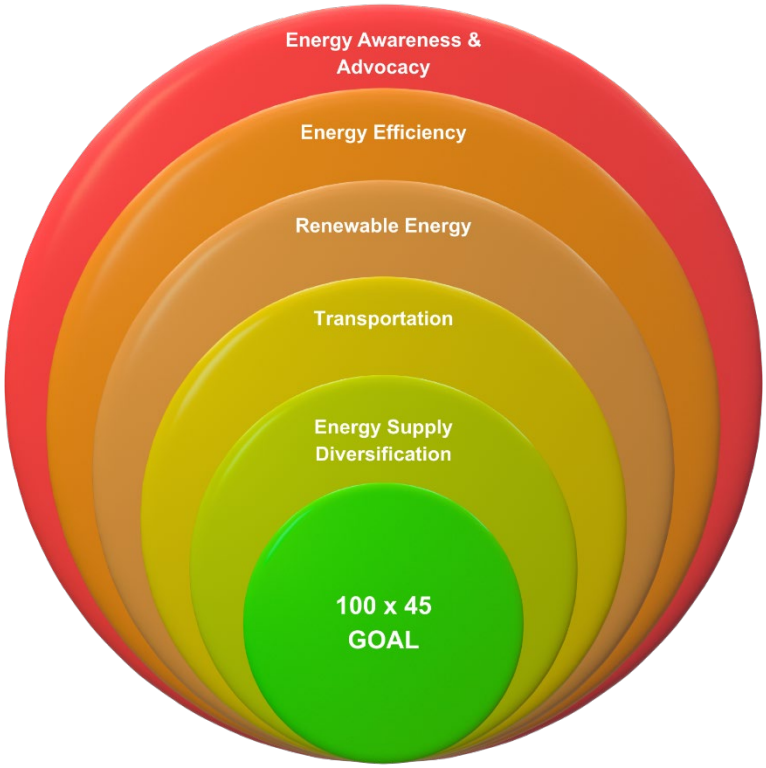

Figure 1. Areas to be addressed in order to reach Guam's 100 x 2045 goal

To achieve the 100 x 45 goal, Guam should use the following energy strategies:

1. Outreach & Energy Literacy
2. Demand-Side Management & Energy Financing
3. Sustainable Materials & Waste-to-Energy Pathways
4. Transportation Electrification
5. Utility-Scale Solar, Storage & Capacity
6. Distributed Energy Resources & Virtual Power Plant
7. Grid Modernization, Resilience, & Microgrids
8. Building Codes & Public Facilities
9. Clean Energy Workforce & Local Industry
10. Integrated Planning & Data Transparency

Energy education and outreach are addressed in detail in the report because of their impact on fossil fuel consumption across all energy categories. Effective energy education and outreach strategies can significantly reduce fossil fuel consumption and do not require large capital investments. Education and outreach strategies listed include building and energy code education and enforcement, providing energy efficiency courses for industry stakeholders, ensuring that energy projects remain transparent and accessible to the public, and using websites, events, and other outlets to educate the public on renewable energy and energy efficiency. Strategies for implementing energy efficiency, renewable energy, transportation, and energy supply diversification are addressed and summarized in tables. Energy efficiency, renewable energy, and transportation strategy recommendations for Guam include:

1. Use of energy conservation measures for buildings
2. Implementation of a cool roof and cool pavement program
3. Use of efficient outdoor lighting
4. Increased efficiency in the utility's generation and distribution of electricity
5. Use of waste-to-energy technologies
6. Use of biofuels
7. Use of wind energy
8. Use of solar water heaters
9. Use of solar photovoltaics
10. Use of seawater air-conditioning
11. Use of geothermal technologies
12. Reductions in vehicle miles traveled
13. Vehicle fuel-economy improvements
14. Reductions in vehicle idle time
15. Use of electric vehicles
16. Use of biodiesel
17. Improvements in traffic flow

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Introduction: Guam's Energy Profile

Guam is a U.S. territory located in the Western Pacific, with a population of approximately 153,836 (excluding military personnel living on military installations).[1] The island has no fossil fuel resources and is reliant on imported fuel, primarily from Asia, to meet its energy and transportation needs.[2]

Electricity

Guam is served by a single utility provider, the Guam Power Authority (GPA). Established in 1968 through the Guam Power Authority Act, GPA functions as a public corporation and enterprise fund under the jurisdiction of the Government of Guam. It is governed by the Consolidated Commission on Utilities (CCU), and it operates under the regulation of the Guam Public Utilities Commission (GPUC).

Guam's residential electricity costs, including fuel surcharges, are more than double the U.S. average. Despite this, Guam's electricity rates remain among the lowest in the Pacific region. Since nearly all of Guam's electricity is generated from petroleum products, GPA applies a fuel surcharge, known as the Levelized Energy Adjustment Clause (LEAC), which is reviewed and adjusted every six months to reflect fluctuations in fuel prices.[3]

At a glance, GPA serves 53,777 customers (as of FY2024)[4] and provides electricity and services to four (4) primary segment demographics: Residential, Commercial, Government of Guam, and the United States Navy.[5] Residential customers make up the largest consumers of electricity in FY2024, accounting for 35% of energy sales. This was followed by Commercial customers at 33%, the U.S. Navy at 21%, and lastly, the Government of Guam at 11%.[6]

GPA owns and manages the island's electric grid, maintaining 354 MW of generating capacity, which includes 379 MW of Oil-fired Generation Capacity and 85.3 MW of Renewable Generation Capacity, 1,839 miles of combined transmission and distribution lines, and 32 substations.[7] GPA's major fuel types are Ultra-Low Sulfur Diesel (ULSD) and Low Sulfur Residual Fuel Oil (LSRFO).

Renewable Energy

In 2008, rising oil prices prompted Guam's leadership to recognize the critical need for developing alternatives to the island's near-total reliance on imported fossil fuels. They acknowledged that energy security is essential for Guam's economic future and sustainability, necessitating long-term strategic planning. Consequently, Guam's legislature enacted Public Law 29-62, establishing a renewable portfolio standard (RPS) aimed at diversifying fuel types used for production to help offset costs and implement technology that uses renewable energy resources already found on Guam, such as wind, solar, ocean thermal, wave, and biomass resources in new production

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[1] Bureau of Statistics and Plans. n.d. 2020 Demo Dashboard. Retrieved September 24, 2025, from Housing and Population: https://bsp.guam.gov/census-of-guam/
[2] National Renewable Energy Laboratory. 2024. Guam: 2023 Energy Baseline Report. Retrieved September 24, 2025, from https://docs.nrel.gov/docs/fy24osti/88454.pdf
[3] U.S. Energy Information Administration. 2025. Territory Profile and Energy Estimates. Washington, DC, April 17. Accessed October 14, 2025, from https://www.eia.gov/state/analysis.php?sid=GQ#36
[4] Guam Power Authority. n.d. GPA's 2024 Annual Report. Retrieved October 14, 2025, from Guam Power Authority, from 2a3775_80eaac67ae864c5a91042949bdc02040.pdf
[5] Guam Power Authority. n.d. GPA's Fact Sheet. Retrieved October 14, 2025, from Guam Power Authority, from GPA Overall Fact Sheet(web)
[6] Guam Power Authority. n.d. GPA's FY24 Citizen-Centric Report. Retrieved October 14, 2025, from Guam Power Authority, from https://182c0114-a36a-4c47-a6af-d4b80a8a49e8.usrfiles.com/ugd/182c01_22ed5813d49142668ebf0760eae5644b.pdf
[7] Guam Power Authority. n.d. GPA's 2024 Annual Report. Retrieved October 14, 2025, from Guam Power Authority: GPA Overall Fact Sheet(web)

facilities. [8] The RPS mandates that GPA diversify existing fuel sources to include renewable sources to generate 5% of its net electricity sales by 2015, 8% by 2020, 10% by 2025, 15% by 2030, and 25% by 2035.[4]

In response to the energy volatility Guam faced in 2008, Governor Felix Camacho established the Guam Energy Task Force (GETF) through Executive Order 2010-15. GETF was established in 2010 to facilitate a transition toward a more sustainable energy future utilizing the island's natural resources. In 2013, the GETF completed the Guam Strategic Energy Plan and Energy Action Plan[9] intending to diversify fuel sources and reduce fossil fuel consumption by 20% by 2020.[10]

In 2019, the Guam Legislature enacted Public Law 35-46, amending § 8311 of Article 3, Chapter 8, Title 12. This law elevated the renewable energy goals for GPA to 5% of its net electricity sales with wind, solar, ocean thermal, wave, and biomass resources by 2015, 50% by 2035, and 100% by 2045.[11]

Currently, Guam has two utility-scale solar photovoltaic (PV) facilities across the island, generating 85 MW of renewable energy.[12] In 2015, Guam's first commercial solar PV facility—26 MW Dandan solar farm with more than 120,000 solar panels—began operations, producing enough electricity to power approximately 10,000 homes.[13] In 2022, a 60 MW solar farm in Mangilao began operating, contracted to produce 141,000,000 kWh annually, estimated to serve 14,000 residential customers.[14]

Through the GPA's Clean Master Plan, the island is forecasted to reach 100% renewable energy by 2040. This strategy includes the deployment of 40 MW utility-scale batteries, baseload units burning cleaner fuel—such as ultra-low sulfur diesel and exploring liquid natural gas—alongside renewable energy projects with battery support to enhance reliability, and efforts aimed at ensuring compliance with the USEPA Consent Decree and air quality standards.[15]

Impacts of COVID-19

The COVID-19 pandemic had significant effects on Guam's energy systems, programs, and overall progress toward energy resilience. The economic slowdown, public health restrictions, and disruptions to global supply chains reshaped energy demand patterns and delayed critical energy initiatives across the island.

Impacts on Energy Demand and Grid Operations

During the pandemic, overall electricity consumption on Guam declined due to the closure of schools, government offices, hotels, and other commercial facilities, particularly in the tourism sector, a major driver of the island's economy. In contrast, residential energy use increased as more

[8] Government of Guam, Legislature. 2008. An act to promote the development of renewable energy; to require the Guam Power Authority to establish renewable portfolio standard goals and to request the Public Utility Commission to study the feasibility of implementing a rate structure to encourage. Hagåtña, Guam, March 29. Accessed October 14, 2025. https://archives.guamlegislature.gov/Public%20Laws/Public_Laws_29th/P.L.%2029-62%20(Bill%20No.%20166%20EC).pdf
[9] Conrad, M. D. (2013). *Guam Strategic Energy Plan.* Guam: National Renewable Energy Laboratory. Retrieved July 23, 2025
[10] Guam Power Authority, 2015 Annual Report, p. 20.
[11] Government of Guam, Legislature. 2019. An Act To Amend § 8311 Of Article 3, Chapter 8, Title 12, Guam Code Annotated, Relative To Raising The Renewable Portfolio Standards Of The Guam Power Authority. Hagåtña, Guam, March 29. Accessed October 14, 2025. https://archives.guamlegislature.gov/35th_Guam_Legislature/Public_Laws_35th/P.L.%20No.%2035-46.pdf
[12] Guam Power Authority. n.d. GPA's Fact Sheet. Retrieved October 14, 2025, from Guam Power Authority: GPA Overall Fact Sheet(web)
[13] Guam Power Authority, 2015 Annual Report, p. 20.
[14] Guam Power Authority, 2023 Annual Report, p. 9.
[15] Guam Power Authority. (n.d.). GPA's Fact Sheet. Retrieved October 14, 2025, from Guam Power Authority: GPA Overall Fact Sheet(web)

residents stayed home due to executive orders and public health advisories.

Delays in Renewable Energy and Energy Efficiency Projects

COVID-19 caused widespread project delays due to supply chain disruptions, contractor workforce shortages, and restrictions on in-person activities. Construction of solar and battery energy storage projects slowed, and public facilities retrofits, audits, and inspections were postponed. Energy efficiency (EE) projects, such as home retrofits, weatherization, and appliance rebate programs, experienced pauses or reduced participation due to health restrictions and safety protocols.

Workforce and Training Impacts

The pandemic disrupted local workforce development initiatives related to clean energy and energy auditing. Training sessions, certifications, and community outreach events were canceled or shifted to virtual formats, limiting participation. These challenges slowed progress in building the skilled labor force necessary for advancing Guam's clean energy transition.

Community and Policy Implications

The pandemic highlighted the crucial need for energy resilience and self-sufficiency in island communities. Interruptions in the global fuel supply chain and rising petroleum costs highlighted Guam's heavy dependence on imported fossil fuels across the island's sectors. In response, there has been renewed policy emphasis on diversifying energy sources, improving efficiency, and accelerating investment in renewable energies and storage to reduce vulnerability to external shocks.

Impacts of Mawar

In May 2023, Guam was struck by Category 4 Typhoon Mawar with sustained winds of up to 140 mph, heavy rainfall totaling 1.5-2 feet throughout the island, and storm surge of up to 14 feet in some coastal areas.

Nearly 100% of Guam's customers lost power during Typhoon Mawar. GPA noted Typhoon Mawar wreaked havoc on generation facilities, disrupting power generation and exacerbating the island's energy woes.[16] Widespread damage impacted the entire island-wide power system.[17]

After Typhoon Mawar damaged Guam's generation assets, the island faced severe load shedding from September to November 2023. Scheduled rotating outages were used to manage grid stability during generator repairs. One-hour rotating outages across the island and an interruptible load program for large customers were active when electricity demand exceeded available generation capacity. Utility-scale photovoltaics (PV) and the associated Battery Energy Storage Systems (BESS) survived the typhoon with little damage; some distributed rooftop and ground-mounted PV also survived well, while other distributed systems did not." [18] The Ukudu Power Plant, scheduled for commissioning in 2024, sustained extensive damage to its treated water and fuel oil

[16] Guam Power Authority, 2023. Annual Report, p. 08
[17] Guam Power Authority, 2023. Annual Report, p. 08
[18] National Renewable Energy Laboratory. 2024. *Guam: 2023 Energy Baseline Report.* Retrieved September 24, 2025, from https://docs.nrel.gov/docs/fy24osti/88454.pdf

tanks, extending the commissioning to January 2026.[19]

To address shortfalls, GPA secured 20 MW of temporary power through an agreement with Aggreko, repaired and rehabilitated existing units (Cabras 2, Piti 7 CT, Yigo CT, and smaller peaking units), and deployed 16 MWh BESS and utilized the U.S. Navy's Orote Power Plant during peak hours.[20]

History of the strategic energy plan and energy action plan

Guam Energy Task Force

The GETF was established by Executive Order 2010-15 on May 10, 2010, with a vision of a secure, sustainable, and economically prosperous future for Guam. The GETF was a nonregulatory advisory group led by the Executive Committee and four subcommittees—Energy Technologies, Policy and Finance, Education and Outreach, and Federal Facilities—that brought together local volunteer leaders from diverse sectors and federal representatives to support the mission of the GETF.

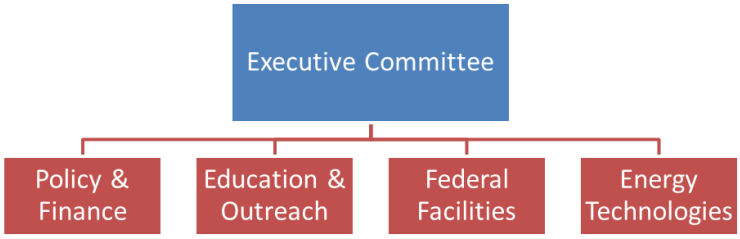


Figure 2. GETF organizational structure

The GETF's mission, as stated in Executive Order No. 2010-15:

1. Reduction of reliance and expenditures on fossil fuels
2. Development of indigenous and renewable energy sources
3. Improvement of energy generation infrastructure
4. Resource preservation, restoration and enhancement
5. Training and education regarding energy efficiency and conservation
6. Development of funding and financial strategies for sustainability and economic development
7. Engagement in national and regional efforts to address island energy concerns
8. Develop funding and financial strategies for sustainability and economic development
9. Engage in national and regional efforts to address island energy concerns
10. Support energy literacy curriculum in all educational institutions
11. Develop a vision, mission, and goals for reducing dependence on fossil fuels, improving energy efficiency, and developing renewable energy resources
12. Establish an organizational structure to appropriately develop a comprehensive, long-term

[19] Guam Power Authority, 2024. Annual Report, p. 4
[20] Guam Power Authority, 2024. Annual Report, p. 4

Guam's Energy Goal

Guam's goal is to secure its energy future and increase autonomy by diversifying fuel sources and reducing fossil fuel energy consumption by 100% by 2045. This includes all energy consumed for power generation (utilities) and ground-based transportation (vehicles), but does not include air or sea transportation.

Strategies for Achieving the Goal

These approaches, as shown in Figure 3, are broken down into five categories: energy awareness and advocacy, energy efficiency, renewable energy, transportation, and energy supply diversification. Each approach includes strategies to successfully reduce fossil fuel consumption. To facilitate their success, these strategies are broken down by the time required to plan, assess, and implement them. On the path to achieving the 100 x 2045 goal, the strategies will be implemented in three phases: near-term (1-2 years), mid-term (3-5 years), and long-term (6-8 years).

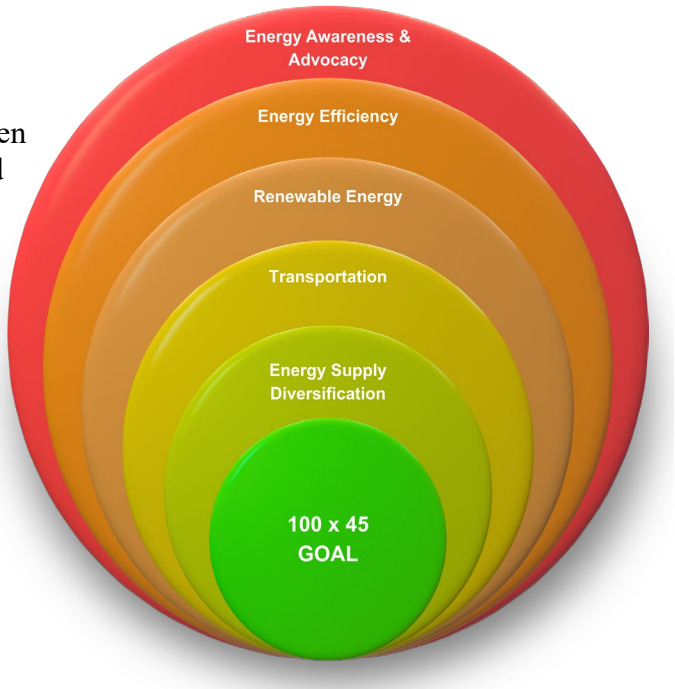


Figure 3. Areas to be addressed in order to reach Guam's 100 x 2045 goal

Metric for Evaluation

Progress towards Guam's Energy Goal will need to be measured to determine if it has been met. *All fossil fuel consumption will be compared to 2010 levels*. Jet fuel reduction strategies are not being investigated and pursued as part of the reduction goal, and so jet fuel will not be included in the measurement calculations. The total number of gallons of fossil fuel consumed on Guam for any given year will be calculated by adding the total fuel sales by petroleum companies, minus jet fuel, to the amount of fossil fuels consumed by the GPA.

The number of gallons sold by petroleum companies is tracked by the Guam Energy Office,[21] and GPA can provide the data on the annual amount of fossil fuel consumed for power generation. The total number of gallons of fossil fuels consumed will then be divided by the current population to provide per capita consumption. **This measurement will account for growth**.

Census data is available for 2010, the baseline year, and will be available for 2045, the target year for achieving the 100% reduction in fossil fuel consumption. For all other years during which census data is unavailable, population growth will be estimated based on GPA customer growth. The resulting measurement will then be compared to the identical measurement in 2010 to determine the reduction in fossil fuel consumption.

Total fossil fuel use for Guam, excluding jet fuel, in 2010 was 120,040,739 gallons, with a population of 159,358, yielding an annual per capita fossil fuel consumption of 753 gallons.

[21] Fuel Sales By Petroleum Companies | GEO

Progress toward Guam's Energy Goal was measured using 2010 baseline data. The resulting gallons-per-person figure indicates overall energy efficiency and reduced dependence on fossil fuels.

For consistency, fossil fuel use excludes jet fuel and combines petroleum company sales with GPA's reported fuel consumption for power generation (see Appendices 4-6). Population estimates for non-census years are scaled using GPA customer growth (including the navy and commercial customer base). This approach ensures that changes in energy intensity, rather than population size alone, drive the reduction percentage.

See the graph below for identified averages and tracked growth. *See Appendices 4-6 for a full breakdown of the calculations.*

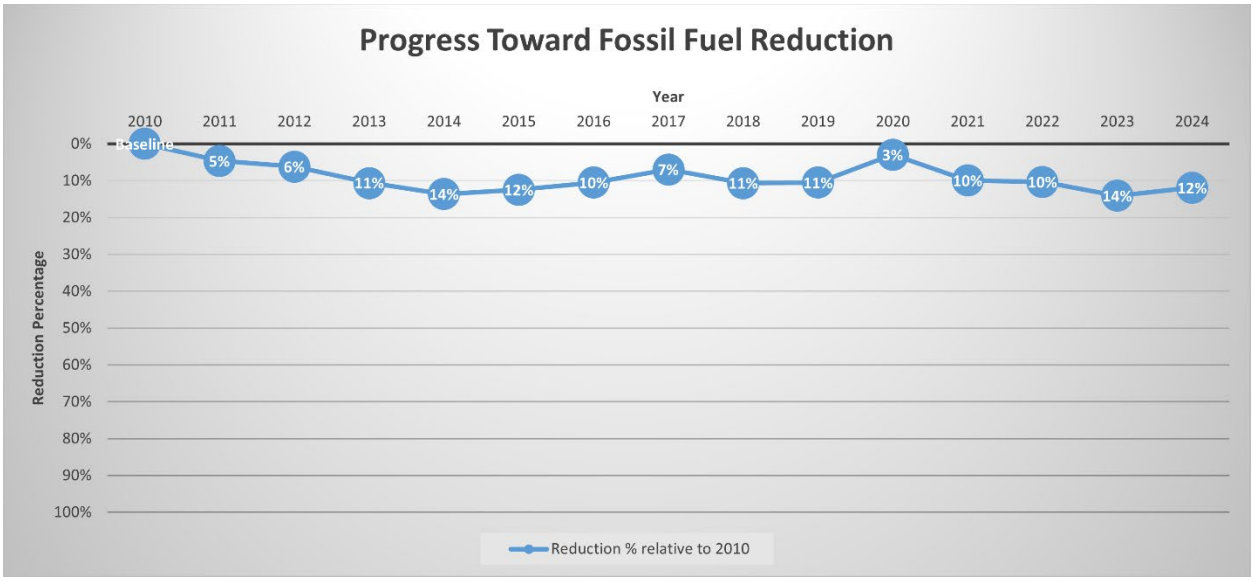


Figure 4: Reduction Percentage Relative to 2010

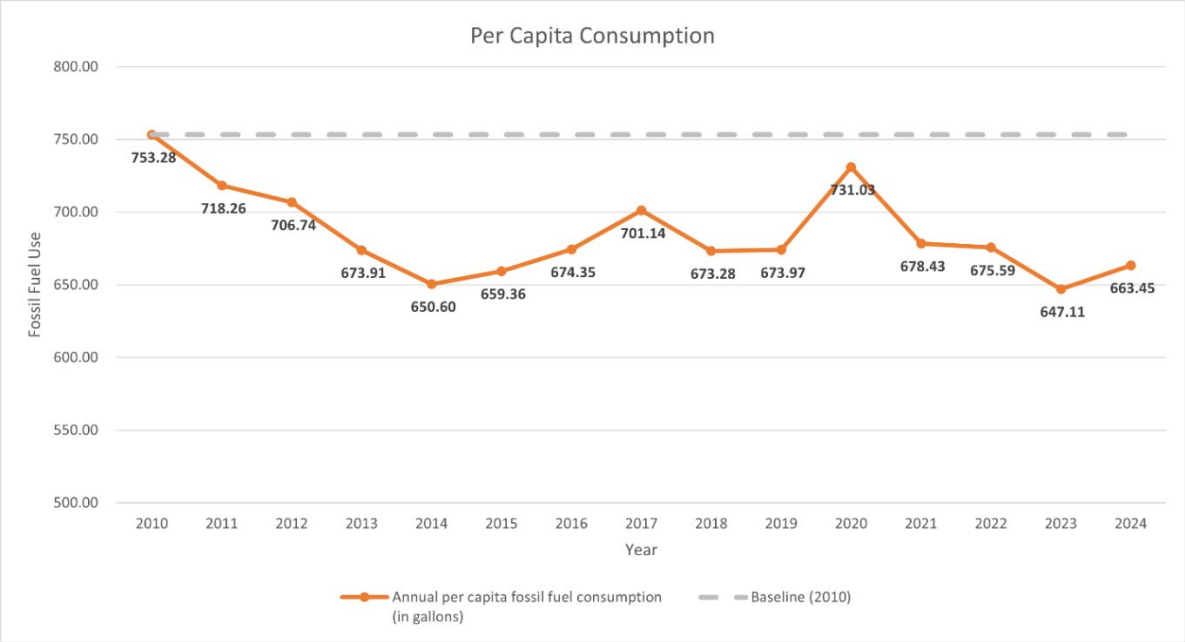


Figure 5. Per Capita Consumption

Key Findings and Interpretation of Results

The visual analysis of per capita fossil fuel consumption shows a clear downward trend relative to the 2010 baseline. This decline indicates meaningful progress toward the GETF original goal of reducing fossil fuel use.

It is essential to note that, due to the COVID-19 limitations and restrictions in 2020, the annual population data used in our calculations may contain inconsistencies beyond our control, which is why we observed a larger fluctuation in 2020.

Between 2010 and 2020, Guam made measurable reductions in per capita fossil fuel use, reflecting advancements in energy efficiency, the adoption of distributed renewable energy, and the gradual modernization of GPA's generation fleet. In subsequent years, continued reductions are observed, although the pace of improvement varies based on system conditions. Periods of temporary increase may coincide with extraordinary events, e.g., the COVID-19 Pandemic, Typhoon Mawar, supply chain disruptions, changes in generation availability, or shifts in economic activity, which can temporarily influence fossil fuel demand.

Overall, the visuals underscore that Guam is moving in the right direction, with long-term trends demonstrating declining fossil fuel intensity per resident and increasing alignment with Guam's clean energy and resilience objectives.

Drivers of Change

Multiple factors have contributed to the gradual decline in per capita fossil fuel consumption. Over the past decade, Guam has seen a steady growth in renewable energy deployment, including both residential rooftop systems and utility-scale solar PV projects. This increased penetration of renewable resources has reduced reliance on petroleum for electricity generation.

Similarly, updated building energy codes, expanded energy efficiency programs and education,

along with higher-efficiency appliances and household systems, have contributed to lower household energy consumption.

Some external events also shaped Guam's energy consumption patterns. COVID-19 temporarily reduced economic activity and energy demand, while major typhoons influenced generation availability and fuel use during recovery periods. Despite these fluctuations, fossil fuel reduction strategies have generally advanced, driven by policy directives and technological improvements.

Policy Framework and Project Development

Policy is an effective tool for addressing clean energy adoption and subsequent development; see Figure 6 below. The policy development process addresses social concerns through public participation. A policy is typically described as a principle or rule to guide decisions and achieve rational outcomes(s). The term is not commonly used to denote what is actually done. This is normally referred to as either procedure or protocol.

Whereas a policy will describe the "what" and the "why," procedures and protocols address the "what," the "how," the "where," and the "when." Policies are generally adopted by the Board of, or the senior governance body within, an organization, whereas procedures or protocols are developed and adopted by senior executive officers.

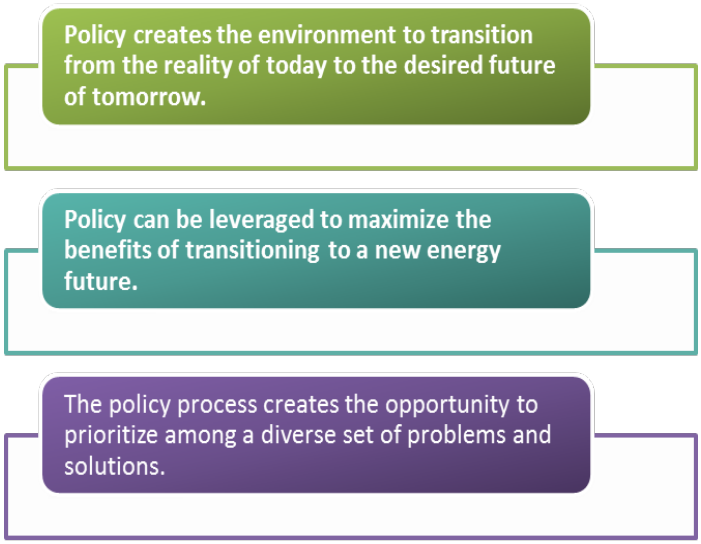


Figure 6. Advantages of a strong policy framework

A precursor to directing Guam's energy transformation is establishing energy-related policies. The key principles that will guide Guam toward a reliable, affordable, secure, and sustainable energy future are listed below. The challenge in developing principles and policies is that at some level, inconsistencies, gaps, and overlaps are inevitable — for example, when balancing sound economics with ecological integrity.

1. Enhance the general quality of life through energy strategies that will benefit Guam
2. Promote environmentally friendly propositions that create a healthy environment
3. Support opportunities for local economic vitality

4. Emphasize alternative power sources
5. Support options that will reduce market volatility, stabilize rates, and increase reliability. It is important to have a robust set of policies that are:
6. Comprehensive — Barriers to renewable energy and energy efficiency are diverse; growth may be halted from any number of wholly unrelated barriers
7. Broad-based — Applies across all types of entities and sectors
8. Multifaceted — Attacks problems and barriers from various angles
9. Multitiered — Includes mandates or quotas but also addresses siting and permitting
10. Practical — Focus on small victories
11. Long-term — Create the market conditions to build a real and sustainable industry

CLEAN ENERGY POLICY CONSIDERATIONS FOR GUAM

UPDATED OCTOBER 2025

- ✓ RENEWABLE PORTFOLIO STANDARD
- • ENERGY EFFICIENCY PORTFOLIO
- • LEAD BY EXAMPLE
- ✓ LATEST BUILDING CODES
- ✓ ENERGY CODES
- ✓ PERMITTING AND SITING STANDARDS
- ✓ NET METERING
- ✓ INTERCONNECTION
- ✓ APPLIANCES EXCHANGES AND REBATES
- ✓ SMART METERING

- • *LOCAL* TAX INCENTIVES
- ✓ FEDERAL TAX INCENTIVES
- • INDUSTRY RECRUITMENT INCENTIVES
- ✓ REBATES AND GRANT PROGRAMS
- • LOAN AND LOAN GUARANTEES
- • PUBLIC BENEFIT FUND
- • PUBLIC FINANCING PROGRAMS

✓ Denotes policy Guam has implemented

The following Comparison graph shows Guam's progress in implementing clean energy policy considerations from 2013 to 2025. The green bars (2025) show notable expansion in policy adoption, especially in renewable standards, codes, permitting, and incentive programs, compared to 2013 (blue).

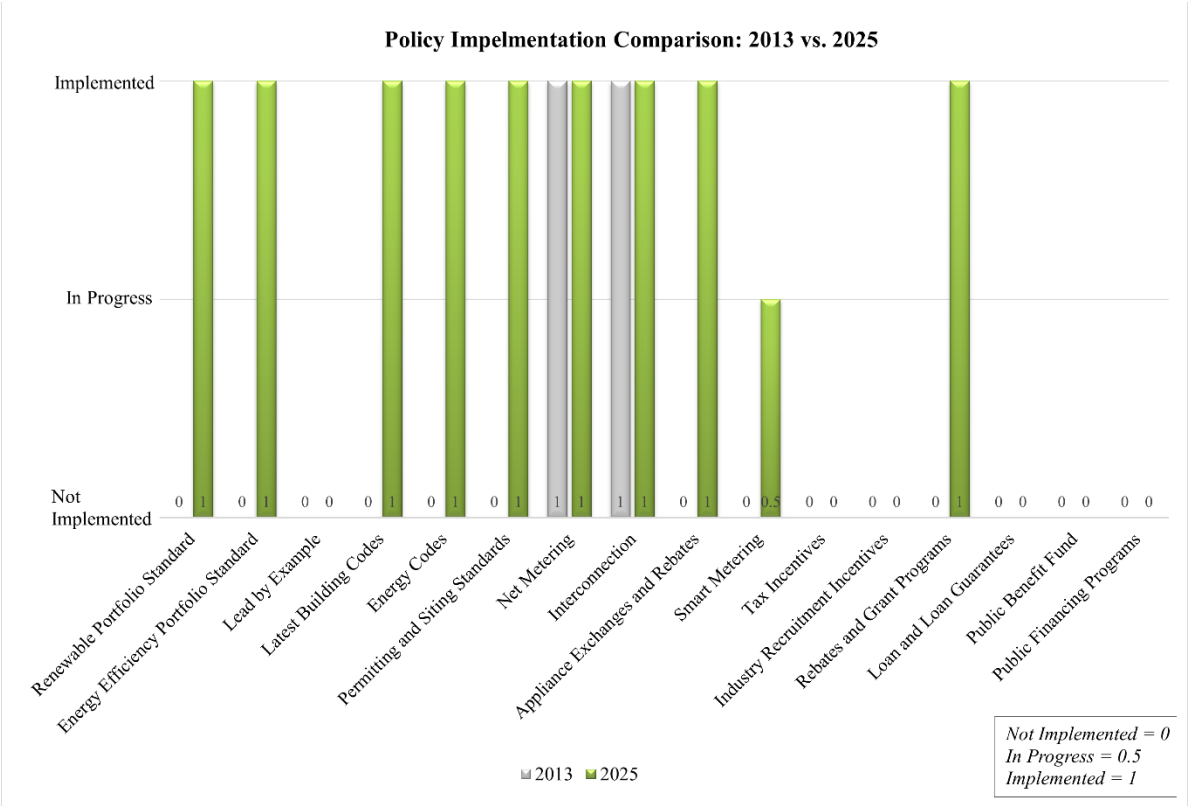


Figure 7. Policy Implementation Comparison

No single policy exists in isolation. Policy success is often determined by the ability to address multifaceted barriers with the appropriate mix of tools. One of the key benefits of policy development is that, through this process, a specific set of challenges can be identified and strategies developed to address them; it does not necessarily attempt to be everything to everyone all at the same time. This process is incremental and topic-specific. A deliberate and methodical approach can help to minimize policy gaps and failures. Consider alternatives — think creatively.

Policy Recommendations

The following are some policies that could attract greater investment in renewable and energy efficiency technologies and facilitate project development.

Develop Financial Mechanisms and Opportunities

1. Explore public-private partnerships with local businesses, developers, and banks with the idea of creating local markets for renewable power generation, energy efficiency, and energy conservation products and services.
2. Investigate third-party financing.
3. Pursue subsidies for renewable projects

4. Consider opportunities such as peak pricing, grants, and subsidies to reduce the overall cost of electricity.

Standardize the Development Process

To entice investment, communities are trying to reduce project uncertainty as much as possible. Several strategies can be implemented, such as identifying and providing quality information to potential investors through the request for proposal mechanism. This provides potential investors with accurate information and the level of detail necessary to reduce their risk and increase their interest. This also casts a wider net, bringing in high-quality companies. Providing information on a community's legal requirements for building a project—including site access, permitting and environmental processes, and what types of project ownership structures are recognized—can also be highly beneficial to potential investors. Communities are surveying their processes, eliminating unnecessary steps, and streamlining processes as an incentive to bring in investors. This strategy has multiple benefits: it organizes a community, encouraging people to survey what exists and develop what is needed; it provides consensus; and offers investors high-quality information and reduces their uncertainty. A project development framework is provided in the Appendices.

Education and Outreach Recommendations

Education and Training

1. Code Enforcement
    - Once building and energy codes are updated, it will be necessary to educate the agencies and departments responsible for executing them and train enforcement officers for both inspection and enforcement capabilities.
    - Regularly update codes to match industry standards and best practices.
    - Guam Energy Codes History
        - Guam Building Energy Code, implemented in 2000, based on the ASHRAE 90.1-1989 standard, was enforced by the Guam Department of Public Works until 2009, when the ICC codes were implemented.
        - Model Tropical Energy Code was completed in 2009, based on the 2006 IECC / ASHRAE 90.1-2004 standard. This was never implemented.
        - Through the collaborative efforts of the Guam Energy Office (GEO), the Guam Building Code Council (GBCC), and the Guam Energy Task Force (GETF), the Guam Tropical Energy Code was developed to provide minimum design requirements for achieving energy efficiency in buildings constructed in Guam.[22] As of January 2023, Guam is following the Guam Tropical Energy Code (Public Law 35-145).
2. Courses and Materials
    - Develop training courses and materials for both architects and construction workers to improve energy awareness. Energy efficiency in retrofit, renovation,

[22] Guam Tropical Energy Code Presentation. 23-0322GTEC-seminar

and new construction can be included in design, materials, and equipment. Organizations creating courses and materials should follow industry best practices when developing them and partner with subject-matter experts to ensure the materials are accurate and applicable.

3. Guidebooks

    - Create guidebooks and self-assessment checklists. These guidebooks could be designed as stand-alone products for specific sectors or integrated into training courses described above.

Outreach Campaigns

1. Visibility

    It is essential for organizations leading Guam's energy transition to have visibility and credibility with all stakeholders, especially Guam's citizens, so that their recommendations have maximum impact. This can be accomplished by establishing a strong identity or brand. Organizations can develop their own process to increase their visibility and credibility as voices and leaders in the energy transition of Guam; some examples include:

    - Example One: Embark on a contest within the school system for materials such as a logo, song, tag line, etc.
    - Example Two: Establish a website where all materials and calendars can be viewed, and a blog or feedback loop implemented for people to comment on said materials and their concerns.

2. Energy Literacy

    Create citizen buy-in for new technologies, programs, and policies by holding educational fairs, creating fact sheets, radio announcements/ shows, electronic newsletters, and a variety of activities that promote energy literacy from cradle to grave. Organizations can develop their own process to create buy-in; some examples include:

    - Example One: Understanding where energy comes from
    - Example Two: How energy is moved and used
    - Example Three: How to be more energy efficient in their everyday lives
    - Example Four: How to conserve energy and energy's life cycles.

Federal Facilities

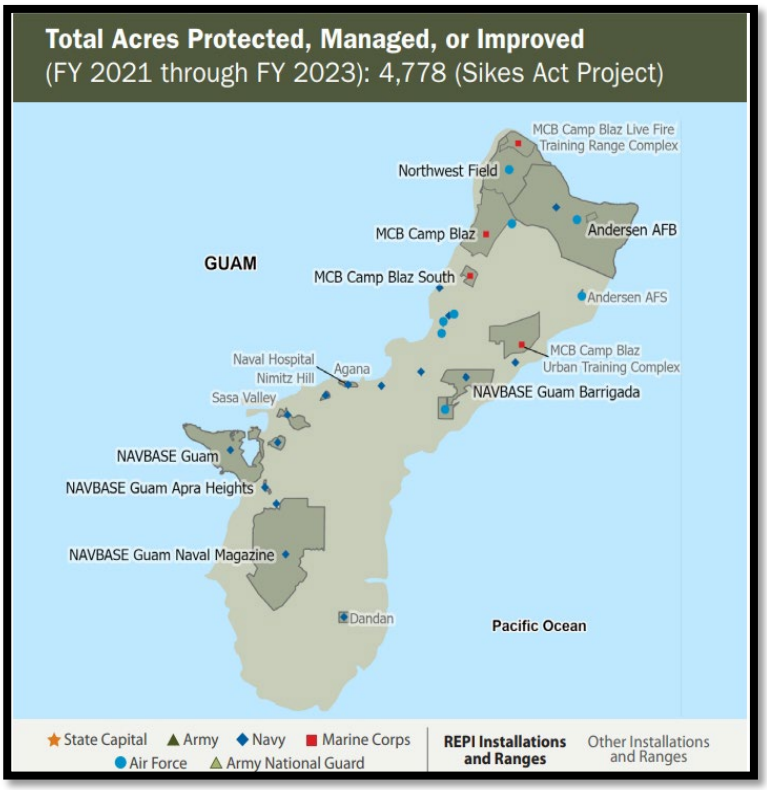
The Department of War (DoW) has considerable representation on Guam, accounting for ~20% of Guam's energy consumption.[23] An extensive understanding of the relationship between Guam's DoW installations and the rest of the island is necessary to establish energy-efficiency and renewable energy baselines and potential.

The 2013 Guam Strategic Energy Plan indicated, "NREL's assessment team concentrated on baseline factors taking into account DoW presence. This report focuses on island-wide utility generation and consumption patterns, not specific DoW energy efficiency and renewable energy activities. DoW has its own internal goals for renewable energy and energy efficiency. As DoW seeks to meet these goals, there may be impacts on the operations and economics of GPA; it is important for DoW and GPA to continue to work together to understand these impacts and seek to develop win-win solutions."[24]

While this is still true in 2023, more information is available to provide continued insight into the impact of Federal Facilities on Guam's energy grid. As stated above, U.S. military bases account for approximately 20% of the island's total energy use, or one-fifth of Guam's energy consumption (including military housing).[25] The DoW occupies about 25% of Guam's 212 square miles, comprising three military installations: Anderson Air Force Base, Marine Corps Base Camp Blaz, and Navy Base Guam (NBG). The Navy oversees all military installations' electricity accounts with GPA, and all installations rely entirely on GPA's grid, with limited on-site generation for backup purposes. In this document, "DoW" will refer to all military operations, base names, and related terms.[26]

The DoW continues to implement building energy-efficiency and renewable energy projects to comply with federal mandates and Executive Orders on energy efficiency, renewable energy adoption, and vehicle electrification. However, continued base expansion and the addition of new defense systems are expected to significantly influence GPA's peak load and Guam's overall energy demand profile.[27]

[23] National Renewable Energy Laboratory. 2024. Guam: 2023 Energy Baseline Report. Retrieved October 20, 2025, from https://docs.nrel.gov/docs/fy24osti/88454.pdf
[24] Conrad, M. D. (2013). *Guam Strategic Energy Plan.* Guam: National Renewable Energy Laboratory. Retrieved July 23, 2025
[25] National Renewable Energy Laboratory. 2024. Guam: 2023 Energy Baseline Report. Retrieved October 20, 2025, from https://docs.nrel.gov/docs/fy24osti/88454.pdf
[26] National Renewable Energy Laboratory. 2024. Guam: 2023 Energy Baseline Report. Retrieved October 20, 2025, from https://docs.nrel.gov/docs/fy24osti/88454.pdf
[27] National Renewable Energy Laboratory. 2024. Guam: 2023 Energy Baseline Report. Retrieved October 20, 2025, from https://docs.nrel.gov/docs/fy24osti/88454.pdf



Source: U.S. Department of Defense, Readiness and Environmental Protection Integration Program.
State Fact Sheets: Guam. Retrieved October 20, 2025, from Guam_ALLFacts.pdf

Figure 8. Military Area Map

Department of War (DoW) Energy Footprint on Guam:[28] [29]

Energy Use Snapshot (2023):

1. DoW accounts for ~20% of Guam's total energy use
2. Includes military housing and base operations
3. DoW occupies ~25% of Guam's 212 sq. miles

Energy Infrastructure:

4. 100% GPA grid-dependent
5. Backup generation limited to critical facilities
6. Ongoing energy efficiency and renewable projects

Implications:

7. Expansion and new defense system → higher peak load
8. Need for cross-agency coordination with GEO & GPA

Key Consideration

Military expansion and federal energy mandates will shape future energy demand, infrastructure planning, and grid reliability. Island and DoW leadership will need to continue working closely to ensure grid reliability, energy affordability, and security.

Policy Implication

Strengthening coordination between the Guam Energy Office, Guam Power Authority, and the DoW is essential to ensure integrated planning, grid stability, and alignment with Guam's clean energy and resilience goals.

[28] National Renewable Energy Laboratory. 2024. Guam: 2023 Energy Baseline Report. Retrieved October 20, 2025, from https://docs.nrel.gov/docs/fy24osti/88454.pdf
[29] U.S. Department of War, Readiness and Environmental Protection Integration Program. State Fact Sheets: Guam. Retrieved October 20, 2025, from Guam_ALLFacts.pdf

Energy Technology Options

There are numerous technological approaches to achieve Guam's 100 x 45 goal. These technology approaches are broken down into four sectors: *Energy Efficiency, Renewable Energy, Transportation, and Energy Supply Diversification*. Each technology approach includes strategies that can be implemented to successfully reduce fossil fuel consumption. To facilitate their success, these strategies are categorized by the time required to plan, assess, and implement them. On the path to achieving the 100x45 goal (figure 10), the strategies can be implemented in three phases: near-term (1-2 years), mid-term (3-5 years), and long-term (6-8 years). Additional projects that will not be completed by 2045 can be placed in a longer time frame. The time structure will allow stakeholders and island leaders to focus on a select group of strategies and set project completion milestones. Tables 1 through 4 present the technology options, technology details, barriers to implementing the technologies, strategies for overcoming these barriers, and the achievable time frames for implementation.

GEO has updated these tables with the most accurate information available as of 2025 and included an "Implemented/Completed" column to indicate the status of milestones.

Table 1. Technology Strategy: Energy Efficiency

N = NEAR-TERM M = MID-TERM L = LONG-TERM B = BEYOND

Y = MET/ IMPLEMENTED N = NOT MET/ IMPLEMENTED IP = IN PROGRESS

ENERGY EFFICIENCY					
TECHNOLOGY TYPE / SECTOR	TECHNOLOGY DETAILS	BARRIERS	STRATEGIES	TIME FRAME	IMPLEMENTATION STATUS AS OF 2023
BUILDINGS: PUBLIC (EXISTING)	• Measures identified in energy audits • Measures installed in EE retrofits • Additional energy conservation measures (ECM)	• Funding • Costs • Lack of on-site expertise and capacity to conduct energy audits	Energy Audit Training Programs for On-site facility managers and staff	N	**Y** GPA, GEO, and other entities provide funding to attending training programs for employees/qualified contractors
			Energy assessments and modeling training	M	**Y** Guam relies on individual entities to perform energy assessments.
			Revolving loan fund	B	**N** There are no revolving loan funds for energy-related projects at this time.
BUILDINGS: RESIDENTIAL (EXISTING)	• Low-income subsidies	• Lack of "how to" knowledge	Awareness and education campaigns	N	**IP** GEO, GPA, and other entities provide educational outreach

	• Accelerate weatherization programs • Efficient lighting, control settings, etc.	• Lack of will to change behavior • Lack of knowledge of what is available to the consumer • Perception of high initial costs	Pilot real-time feedback program utilizing smart measuring devices	M	**Y** Since 2014, GPA has implemented the Smart Grid Advanced Metering Infrastructure (AMI) and smart meters.[30] GPA deployed over 50,000 smart meters to residential & commercial customers.[31]
			Revolving loan fund	B	**N** There are no revolving loan funds for energy-related projects at this time.
BUILDINGS: COMMERCIAL (EXISTING)	• Energy audits • EE retrofits • Utilize ECMs	• Costs • Lack of on-site expertise and capacity to conduct energy audits	Energy Audit Training Program for on-site facility managers and staff	N	**Y** GPA, GEO, and other entities provide funding to attending training programs for employees / qualified contractors
			Energy assessment and modeling training	M	**Y** Guam relies on individual entities to perform energy assessments.
			Revolving loan fund	B	**N** There are no revolving loan funds for energy-related projects at this time.
BUILDINGS: INDUSTRIAL (EXISTING)	• Energy audits • EE retrofits • Utilize ECMs	• Costs • Lack of on-site expertise and capacity to conduct energy audits	Energy Audit Training Program for on-site facility managers and staff	N	**Y** GPA, GEO, and other entities provide funding to attending training programs for employees / qualified contractors
			Energy assessment and modeling training	M	**Y** Guam relies on individual entities to perform energy assessments.
			Revolving loan fund	B	**N** There are no revolving loan funds for energy-

[30] Guam Power Authority. (2022). 2022 Integrated Resource Plan. Retrieved October 24, 2025, from https://admin.guampowerauthority.com/uploads/GPA_2022_Integrated_Resource_Plan_b16ef41f9e.pdf?updated_at=2022-09-20T07:24:07.680Z

[31] National Renewable Energy Laboratory. 2024. Guam: 2023 Energy Baseline Report. Retrieved November 19, 2025, from https://docs.nrel.gov/docs/fy24osti/88454.pdf

					related projects at this time.
BUILDINGS: NEW CONSTRUCTION & MAJOR RENOVATIONS	• Adopt and enforce updated building codes • Integrated design and systems integration: HVAC, plumbing, electrical, lighting, etc. • Integrating renewables to achieve efficiency (e.g., building orientation)	Lack of: • Expertise and knowledge in employing an integrated system design approach and whole building design practices • Expertise and capacity to operate and maintain such systems • How to measure building performance	Identify and publicize funding sources (ESPCs[32], etc.)	N	**N** No publicized funding source as of 2023
			• Provide informative resources describing whole building design practices and systems integration • Training programs for O&M and M&V managers and technicians	M	**IP** GEO, Guam Building Code Council, and other relevant entities are working to provide resources and training
			Revolving loan fund	B	**N** There are no revolving loan funds for energy-related projects at this time.
COOL ROOFS & PAVEMENTS	Light colored surfaces (white or reflective)	Potential increased short-wave irradiation through large-scale installation of reflective surfaces could increase cooling loads (unintended consequence)	Develop a detailed land use database	M	**Y** There are several databases available to the public: 1. BSP Land Use & Planning Program map[33] 2. Department of Land Management's Land Information System Program[34]
			Perform detailed analysis (Energy Impacts)	M	**N** Development of a baseline measurement/survey will be needed
			Develop implementation programs (roofs, pavements, trees)	L	**N**
			Develop a feedback system	M	**N**
			Develop energy codes, standards, guidelines	N	**Y** GEO and the Guam Building Code Council developed the 2017 updated codes, which were adopted and signed into law by the Guam Legislature in 2021 as P.L. 35-145.

[32] See below, Glossary of Energy Management and Energy Efficiency Concepts, p. 74
[33] Source: Land Use and Planning Program | The Bureau of Statistics and Plans Guam
[34] Source: https://dlm.guam.gov/division-of-geographic-information-system-land-information-system/

			Develop demonstration projects	L	**N**
EFFICIENT OUTDOOR LIGHTING	• Fixture selection • Lighting standards • Energy consumption	• Initial costs and tight budgets • Concerns over lighting color • Proper design capacity	Training on photometric analysis combined with life cycle cost and energy analysis	M	**N**
UTILITY EFFICIENCY	• Transmission • Distribution • Generation	• Funding • Load balancing challenges • Voltage optimization	Loss assessment study	N	**IP** GPA has conducted studies that include loss assessment components within their distribution and transmission system analyses.
			Ensure that all consumption is metered	M	**Y** GPA has developed and implemented with the Advanced Metering Infrastructure and Smart Grid Project.
			Waste heat recovery	L	*More information is needed to verify if GPA has implemented or will implement system-wide heat recovery strategies.*
			System upgrades	M	**IP** GPA is currently undergoing system improvements and infrastructure investment efforts.

Table 2. Technology Strategy: Renewable Energy

N = NEAR-TERM M = MID-TERM L = LONG-TERM B = BEYOND

Y = MET/ IMPLEMENTED N = NOT MET/ IMPLEMENTED IP = IN PROGRESS

As Indicated in Public Law 29-62 and Public Law 35-46

RENEWABLE ENERGY					
TECHNOLOGY TYPE / SECTOR	TECHNOLOGY DETAILS	BARRIERS	STRATEGIES	TIME FRAME	IMPLEMENTATION STATUS
BIOMASS/ WASTE-TO-ENERGY (WTE)	• Landfill gas (LFG) • Biomass • Anaerobic digestion	• Public Law No. 25-175[35] • Characteristics of the waste feedstock • Tipping fees are usually required to make WTE projects economically viable	Form a working group to address WTE and PL 25-175	M	**N** There is no existing group
			Repeal PL 25-175	L	**N**
			Biomass resource assessment	L	**Y**
			WTE feasibility studies: Waste characterization; economic and technical analyses; island-specific case studies[36]	L	**N**
BIOFUEL	• Ethanol • Coconut oil	• Limited land area • Limited feedstock supply	Biofuel feasibility study is necessary	L	**N** There is no publicly available feasibility study regarding ethanol/ coconut oil feedstock covering the full pathway (feedstock → production → market).
OCEAN THERMAL ENERGY CONVERSION (OTEC)	• Closed-cycle OTEC plant • Open-cycle OTEC plant • Hybrid- cycle OTEC with desalination • Floating platform OTEC[37]	• High capital costs • Integration • Variability • Few commercial examples • Social acceptance • Local capacity • Extreme weather events	Conduct a feasibility study of Guam's thermal gradient and deep-water resources	L	**IP** There are feasibility studies initiated and published featuring Guam.[38] GPA has yet to initiate a feasibility study on OTEC.
			Pilot demonstration project (small scale)	B	**N** There is no evidence that a small-scale OTEC demonstration

[35] Public Law No. 25-175, An Act to Approve and Amend the Integrated Solid Waste Management Plan, Accessed 2025, archives.guamlegislature.gov/Public Laws/Public_Laws_25th/P.L. 25-175.pdf

[36] Waste Management World. (2009). WTE in American Samoa. Retrieved October 23, 2025 from, Rogoff-Nichols_WTE_in_American_Samoa.pdf

[37] Pacific Northwest National Laboratory. (N.d.). OTEC: Capturing energy using temperature gradients across water depths. Retrieved October 23, 202t from, https://tethys.pnnl.gov/technology/otec

[38] Source: Feasibility of Ocean Thermal Energy Conversion (OTEC) Development for U.S. Islands

					project has been deployed on Guam.
			Develop an environment permitting framework	B	**N** There is no existing framework adopted
			Link with desalination/ cooling systems for co-benefit	B	**N** There is no existing project
SOLAR PV	• Large-scale distributed systems • Off-grid systems • Must consider optimal panel tilt for efficiency and protection from extreme weather events • Must incorporate corrosion-and wind-resistant components	• Cost • Integration • Variability	Redevelop/ Repurpose capped landfill(s) for utility-scale Solar PV	L	**IP** There is active planning for repurposing capped landfills between GPA and the Guam Solid Waste Authority.
			Local rebate for residences	M	**N** There is no local initiative at this time.
			Microclimate studies specific to planned PV sites	L	**N** No publicly available microclimate studies for planned PV sites. GPA and other solar entities may have more information.
			Revolving Loan Fund	B	**N** There are no revolving loan funds for energy-related projects at this time.
SOLAR WATER HEATERS (SWH)	• Flat-plate collector • Integral collector-storage system • Evacuated-tube solar collectors	• Social acceptance of the technology	Rebate program	M	**IP** GEO completed the Solar Water Heater Rebate Pilot Program in 2014. There are no existing publicly available projects as of 2023.
			Outreach program to encourage home, energy, and water conservation	M	**Y** GEO regularly conducts education and outreach activities around energy and water conservation.

			Mandatory SWHs on government buildings	L	**N** There is no existing mandate.
SEA WATER AIR CONDITION (SWAC)	• District cooling system	• Few commercial examples • High initial cost	Local feasibility study	N	**Y** There are feasibility studies about the adoption and implementation of SWAC on Guam. 1. "Sea Water Air Conditioning (SWAC) at Naval Base Guam Cost-Benefit Analysis and Acquisition Strategy."[39]
			Develop a business plan for implementation (permitting, financing, etc.) for public and private adoption	M	**IP** There is no available plan for public or private adoption, but the feasibility study covers cost-benefit and acquisition strategies that may be applicable outside the military bases.
			Contract procurement	L	**N**
WAVE	• Point-absorber buoys • Floating devices • Wave energy farms	• Extreme weather events • Wave climate variability • Costs • Environmental and cultural practice concerns • Permitting in territorial waters	Work with an organization or agency that houses existing wave mapping data	L	**Y** Existing wave mapping/ data for Guam is under the BSP program.
			Pilot project (sheltered, near-shore)	L	**N** There is no existing project.
			Coordinate with reef and marine habitat agencies	L	**IP** There is work being done to regarding mapping and resource assessment that can be used for wave energy when needed.
			Develop typhoon-resilient design standards	L	N There is no project or design standards.

[39] Source: calhoun.nps.edu/server/api/core/bitstreams/cfe9adff-887a-46f4-aeef-7feea8f734e1/content

			• Engage with experienced vendors • Engage with the local community	M	**IP** Energy and Environmental agencies and organizations regularly engage with the public regarding potential and new energy projects
WIND	• Typhoon-rated turbines • Turbines that can be lowered	• Cost • Integration • Social acceptance • Local capacity • Extreme weather events	Social acceptance and outreach program	L	**IP** Relevant agencies and organizations provide public outreach and education.
			Environmental and radar impact study	B	**N**
			Investigate typhoon-rated turbines	B	**N**
			Permitting for available sites	B	**N**
			Environmental reviews, economic modeling, and interconnection studies	B	**N**
			Wind from project implementation	B	**N**
OFFSHORE WIND	• Fixed-foundation offshore wind farm in shallow waters • Floating turbines in deeper waters • Typhoon-rated large turbines • Hybrid wind and storage offshore systems	• Extreme weather events • High costs • Seabed/foundation challenges • Integration • Social acceptance • Environmental concerns	Conduct offshore resource assessment and typhoon wind-extreme design studies	L	**N**
			Identify pilot offshore or near-shore site(s)	B	**N**
			Adopt typhoon-rated turbine designs	B	**N**
			Engage stakeholders (fisheries, shipping, tourism)	M	**N**
GEOTHERMAL	• Direct use of geothermal • Electricity production • Heat pumps	• May not be cost-effective • Uncertainty over resource availability	Assess geothermal potential	M	**N** Discussed briefly in several reports.
			Environmental, economic, and interconnection studies	B	**N**

Table 3. Technology Strategy: Transportation

N = NEAR-TERM M = MID-TERM L = LONG-TERM B = BEYOND

Y = MET/ IMPLEMENTED N = NOT MET/ IMPLEMENTED IP = IN PROGRESS

TRANSPORTATION					
TECHNOLOGY TYPE / SECTOR	TECHNOLOGY DETAILS	BARRIERS	STRATEGIES	TIME FRAME	IMPLEMENTATION STATUS
MILES TRAVELED REDUCTIONS	• Public transportation system • Bicycle and pedestrian travel • Work from home and carpool programs	• Funding • Coordination between multiple sectors • Reliance on personal automobiles • Behavior change	• Rideshare incentives • Integrated Mobility & Carpooling Apps	N	**IP:** Ride-hail exists; There is a need for carpool and transit integration.
			Island-wide bike route designation	N	**Y** Guam has marked bike lanes, but they are shared lanes.
			Coordination plan for taxis and GRTA	N	**N**
			Bus tracking and coordination for public use	N	**IP** GRTA is undergoing this update
			Telecommute/employer telework policies	N	**N**
			Bike share system	N	**N** No public bike share system. Private E-bike system exists
			Coordinate ADA compliance with biker and pedestrian-friendly facilities	N	**N**
			Fuel Efficiency/ Electric buses and new routes	N	**N**
			Mobility as a Service (MaaS) app for ALL riders	B	**IP** App available for Paratransit, but not for Fix Transit Riders
			Micro transit for villages	B	**N**
			Mobility hubs at transit/ ports/ airports	B	**N**
IDLE TIME REDUCTIONS	• Auxiliary power (Shore power) • Anti-idling school buses and delivery fleets	• Lack of knowledge of idling impacts • Difficulty in enforcing idling policies	• Idle reduction limitations for trucks and school buses • Expand anti-idling policy	M	**N**

	• Smart queue management at port/airport		• Auxiliary power (shore power) for passenger buses	M	**N**
			• Use mobile emissions testing/telematics for compliance	L	**N**
ELECTRIC VEHICLES (LIGHT DUTY & FLEETS)	• Electric vehicles • Electric/solar-electric charging stations (Public/neighborhood DC chargers, Level 2 chargers at multi-unit dwellings, public buildings, etc.) • Airport GSE electrification[40] • Vehicle-to-home (V2B) for shelters • Managed charging	• Cost • Fleet turnover rate • Supply chain issues/shipping constraints • Government Procurement • Grid capacity • Access to infrastructure and land necessary for charging stations	• Government of Guam EV fleet procurement	M	**N**
			• EV incentive program	L	**N**
			• Align charging with the US federal standard- National Electric Vehicle Infrastructure Standards and Requirements[41]	M	**IP** Private entities lead Guam's charging infrastructure.
			• Resilient charging (PV+BESS microgrids at shelters, port, and airport)	M	**N**
BIODIESEL	• Waste grease and coconut oil esterification	• Collection and framing systems • Processing infrastructure	• Improved enforcement of grease disposal laws	N	**IP** Guam EPA and Guam Waterworks Authority have oversight on regulations, inspections, and fines. Improvements on education, enforcement, and recycling incentives are needed.
			• Waste grease to biodiesel	B	**IP** **GSWA pilot program launched 2026.**
			• Coconut oil to biodiesel	B	**N**

[40] European Commission. (n.d.). Electric ground support equipment at airports. Retrieved October 23, 2025, from https://alternative-fuels-observatory.ec.europa.eu/transport-mode/aviation/electric-ground-support-equipment
[41] https://www.federalregister.gov/d/2023-03500

			• Construct a new biodiesel refinery for coconut oil processing	B	**N**
TRAFFIC FLOW IMPROVEMENT	• Adaptive signal control • Transit signal priority • Roundabouts at high-delay junctions • Traffic signal coordination	• Funding • Interagency coordination • Asset maintenance	• Central coordination center	M	**N**
TRANSIT MODERNIZATION	• Zero-emission buses • Depot chargers • On-route overhead charging • Dispatch optimization	• Capital cost • Workforce • Infrastructure	• Pursue funding (local and federal) for EV buses	L	**N** No programs or funding as of 2023, but funding opportunities exist federally.
			• Workforce training opportunities	L	**IP** Training programs for bus driving, maintenance & and technical skills are provided through GRTA.

Table 4. Technology Strategy: Energy Supply Diversification

N = NEAR-TERM M = MID-TERM L = LONG-TERM B = BEYOND

Y = MET/ IMPLEMENTED N = NOT MET/ IMPLEMENTED IP = IN PROGRESS

ENERGY SUPPLY DIVERSIFICATION					
TECHNOLOGY TYPE / SECTOR	TECHNOLOGY DETAILS	BARRIERS	STRATEGIES	TIME FRAME	IMPLEMENTATION STATUS
LNG (WILL NOT CONTRIBUTE TO FOSSIL FUEL REDUCTION GOAL)	• Import terminal • LNG open rack vaporizers or submerged combustion vaporizers • Dual fuel generators	• Capital cost • Investment risks • Conversion of the existing system	RFP to acquire a bidder for land permitting/ engineering/ commissioning/ warranties/ O&M	M	Y
			Reduce risk: design, build, or design-build operate approach; fixed price contract: contract with one lead contractor; convert existing units early to dual fuel ability	L	Y
CLEAN HYDROGEN (NOT LISTED IN THE OFFICIAL RPS GOAL)	• Green H_2 production co-located with large PV • Port fuels trials • Small fuel cells for critical sites	• Costs • Safety codes • Not enough market uptake for adoption	Track 45V Hydrogen Credit rules[42]	B	N
			Explore delivered H_2 for the port/ airport	B	N
			Consider adoption at new power plant (if feasible)- pilot project	B	N

[42] Clean Hydrogen Production Tax Credit (45V) Resources | Department of Energy

Guam's 100 x 2045 Timeline

GPA published their Clean Energy Master Plan Progress Update, which indicates the power systems that are operational and to be commissioned. This provides a broad overview of GPA's plan for Guam's energy future and its approach to meeting the 100% RPS goal before the 2045 deadline.

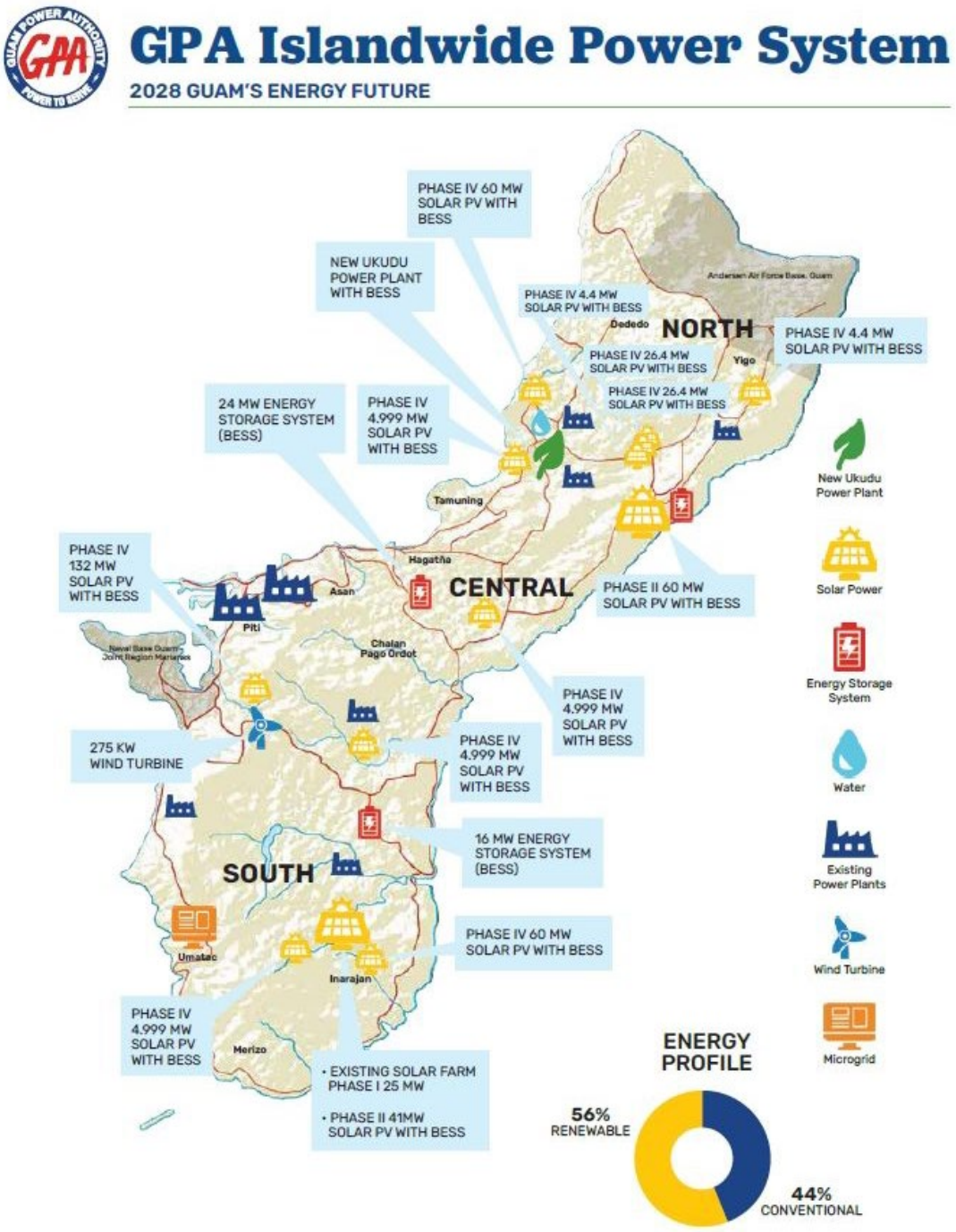


Figure 9. Clean Energy Master Plan Progress Update

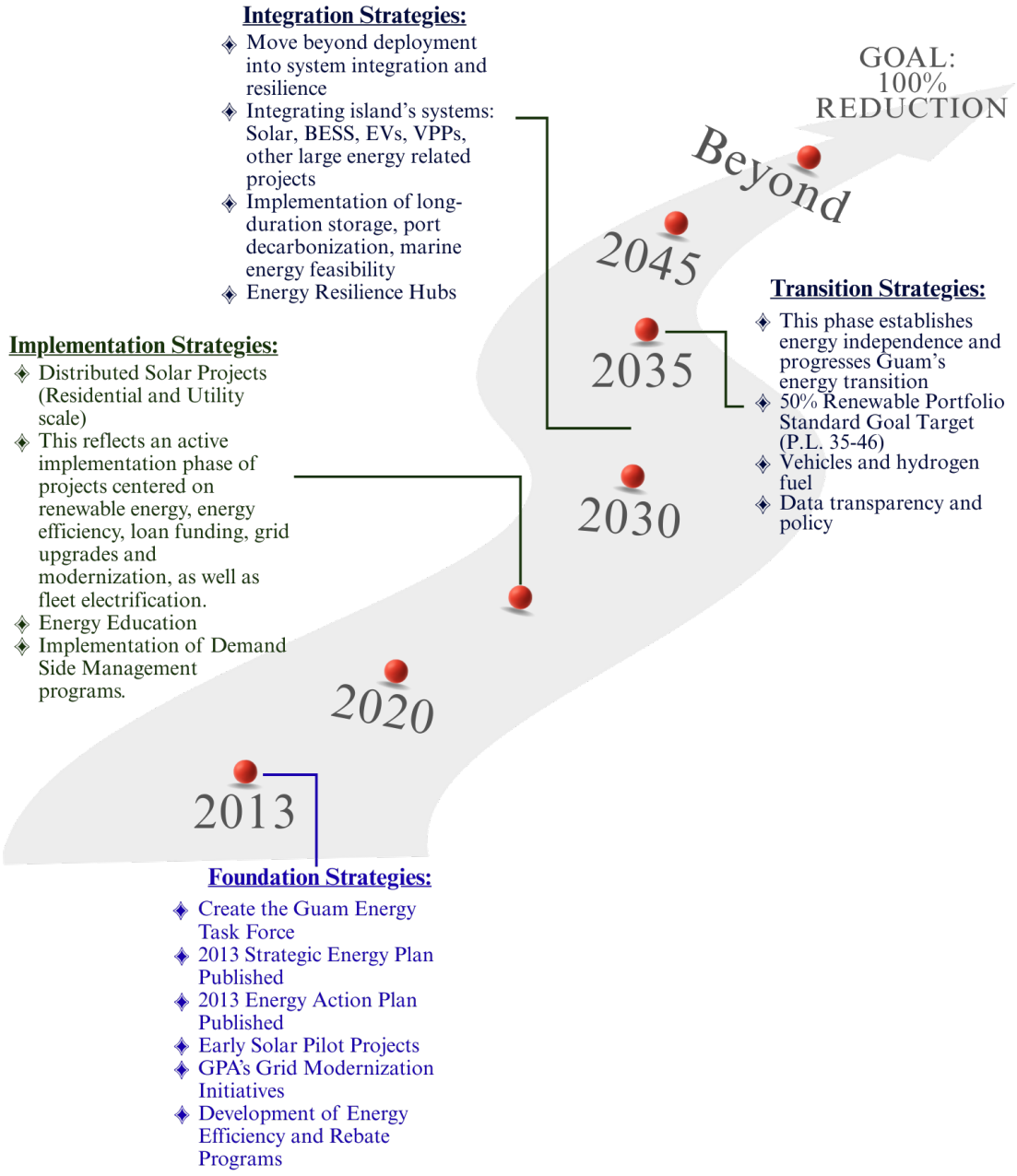


Figure 10. Timeline for Achieving the Energy Goal

The categories in Figure 10 represent Guam's energy transition from 2013 to 2045. It is structured to mirror federal programs and local plans, short-term buildout → mid-term scaling → long-term integrating and resilience.

Foundation Strategies (2013-2020): Established Guam's institutional, policy, and technical base for current energy planning and efficiency measures.

This period reflects Guam's early energy efforts:

- In 2013, created the Guam Energy Task Force (GETF) and published the 2013 Strategic Energy Plan. Publishing the 2013 Energy Action Plan and implementing programs under the U.S. Department of Energy (DOE) State Energy Program (SEP).
- This period saw early solar pilot projects, grid modernization initiatives, and the development of energy-efficiency and rebate programs through GPA, GEO, and other island partners.
- This period built the administrative and technical foundation that made future large-scale clean energy investments possible.

Implementation Strategies (2021-2030): Deploy and scale existing technologies across the island to increase clean generation, efficiency, and zero-emission transportation.

This period reflects Guam's active implementation efforts:

- Federal initiatives and programs that support clean energy adoption, grid upgrades and modernization, energy-efficiency measures, government fleet electrification, etc.
- During this phase, Guam is implementing projects, transitioning from plans to actual projects and measurable impacts.
- This period also includes the introduction of new programs, such as smart metering, virtual power plants, and updated energy codes.
- This phase highlights expansion and coordination between energy agencies and organizations, utilities, and the military.

Integration Strategies (2030-2035): Moves beyond deployment into systems integration and resilience through connecting generation, storage, transport, and community-level microgrids.

- This period will focus on integrating energy systems, such as solar, BESS, EVs, microgrids, and marine/port electrification
- During this phase, there are plans for long-duration storage, port decarbonization, and marine energy feasibility.
- Potential for strengthening data systems and regional collaboration. Guam will see more grid management, policy planning, research, and local government alignment, shifting from project-by-project implementation to coordinated energy system operations.

Transition Strategies (2035 and beyond): Establishes energy independence and completes Guam's clean energy transition.

- Figure 4 ends at 2035 because it aligns with GPA's Integrated Resource Plan (IRP) targets.[43]
- This phase represents a practical, achievable midpoint before the long-term 2045 net-zero vision.

[43] Guam Power Authority. (2022). 2022 Integrated Resource Plan. Retrieved October 24, 2025, from https://admin.guampowerauthority.com/uploads/GPA_2022_Integrated_Resource_Plan_b16ef41f9e.pdf?updated_at=2022-09-20T07:24:07.680Z

- By 2035, the island's focus should shift from installation to optimization, for example, a potential technology includes hydrogen integration, circular fuel economy, resilience hubs, and data-driven policy coordination.

The Guam Strategic Energy Action Plan is a living document and should be updated as significant changes happen regarding Guam's energy landscape. Future updates could be triggered by the need for:

1. Policy Alignment:

- GPA's IRP and current energy goals are benchmarked to 2035 as an intermediate target (50% clean energy generation).

2. Planning Realism:

- The planning horizons for most IRPs span 10 to 20 years,[44] which will allow for measurable policy and project outcomes.
- 2035 is the realistic planning horizon for evaluating progress toward 2045 and beyond to get Guam to complete decarbonization.

3. Flexibility:

- As the major milestones approach, per the RPS, relevant agencies and organizations will need to reassess and republish new roadmaps. These roadmaps could include new technologies, such as green hydrogen, marine renewables, and AI-driven grid management.
- Updating The Plan post-2035 will allow for the inclusion of the discussion that the associated agencies and organizations determine as relevant and practical.

The Energy Action Plan

The Energy Action Planning Process

The 2013 Energy Action Plan selected a handful of specific strategies that are achievable in the short term (1-3 years). These strategies were chosen during deliberations at several action planning workshops held in March 2013 and a follow-up discussion in April 2013. The GETF reached consensus on four strategies to focus on and break down into feasible, incremental steps; identified the stakeholders and desired outcomes; identified the organizations and individuals responsible for implementing the actions; and set a timeline for each step.[45]

The Strategic Energy Action Plan will update the original strategies found in the 2013 Action Plan and add additional strategies to better understand what is needed to realistically move Guam to 50% by 2035 and 100% by 2045 under P.L. 35-46 and GPA's Clean Energy Master Plan and 2022 Integrated Resource Plan.

It is important to note that the Strategic Energy Action Plan is a living document that will be regularly updated. Programs and strategies will be modified or replaced as new information about

[44] Lawrence Berkeley National Laboratory. (2024). Best Practices in Integrated Resource Planning: A guide for planners developing the electricity resource mix of the future. Retrieved on October 24, 2025, from https://www.energy.gov/sites/default/files/2024-12/best_practices_irp_nov_2024_final_optimized.pdf
[45] Guam Energy Action Plan

different approaches to reducing energy consumption emerges, as new technologies for generating electricity and reducing transportation fuel consumption emerge, or as existing, previously impractical technologies become commercially viable.

The following table briefly shows the evolution from 2013 to 2023.

Summary: Strategy Evolution

Strategy	2013	2023
1. Public Outreach & Literacy	Yes	UPDATED
2. DSM & Efficiency Financing	Yes	UPDATED
3. Sustainable Materials / Waste Pathways	Yes	REPLACED
4. Clean Mobility / EVs	Yes	UPDATED
5. Utility-Scale Solar & Storage	No	NEW
6. DER & Community Solar	No	NEW
7. Grid Modernization & Microgrids	No	NEW
8. Building Codes & Public Facilities	Yes	UPDATED
9. Workforce & Equity	No	NEW
10. Integrated Planning & Governance	No	NEW

Strategy 1. Public Outreach and Energy Literacy

I. Focus Area

Energy efficiency, conservation, and energy awareness

II. Description

Energy awareness and outreach are among the strategies in the strategic plan identified as having the greatest potential impact on energy consumption in Guam.

For energy outreach campaigns to have maximum impact, it is important that the involved organizations be perceived by the citizens of Guam as a voice of authority. This involves raising awareness of the leading organization and its role in tandem with energy education initiatives, as this will maximize the impact of those initiatives.

Organizations focused on this strategy should scale up the original GETF outreach work into a coordinated, island-wide "energy literacy and action" program that links every campaign directly to the RPS milestones (50% by 2035, 100% by 2045).

III. Lead / Key Organizations

GEO, University of Guam CIS & Sea Grant (UOG CIS and SG), GPA, Mayor's Council of Guam (MCOG), Guam Department of Education (GDOE), Guam Community College (GCC), non-profits, Department of Energy (DOE) / Department of the Interior, Office of Insular Affairs (DOI-OIA) / National Laboratories (technical support).

IV. Actions

- Build a consistent Guam clean energy brand (building off GETF branding ideas in the 2013 Energy Action Plan[46]).
- Develop tiered campaigns:
    - Basic: bill inserts, social media, radio, school programs on energy efficiency measures and costs.
    - Advanced: workshops on solar & batteries, EVs, and energy efficiency upgrades
- Integrate real GPA data into outreach (renewables share, savings from solar, etc.), so people see progress and why it matters.
- Create an energy model to directly help households and small businesses in high-burden communities.

V. Timeline

1. Short Term (now-2030): Relaunch island-wide campaign; build online hub; integrate with GPA bills & GEO website; focus on no-cost/ low-cost actions.
2. Mid-term (2030-2040): Shift emphasis to educating energy usage and expectations in a 70-90% renewable system (load shifting, storage, EV charging behavior, etc.)
3. Long-term (2040-2045): Celebrate 100% goal; focus on efficient and equitable usage as electrification grows.

Strategy 2. Comprehensive Demand-Side Management & Efficiency Financing

I. Focus Area

Energy efficiency, demand-side management (DSM), on-bill and revolving loan programs

II. Description

Energy-saving investments are very effective because people communicate their savings (for example, installing more efficient air conditioners) to their neighbors and friends. Existing rebate programs have led to accelerated sales of efficient air conditioners in Guam, but these units are very expensive, and demand for rebates for these and other technologies consistently exceeds supply. There is also a risk that companies that honor the rebates will raise their prices during the rebate program, putting consumers at a greater risk.

Rebate programs can be useful but have limited impact and are not sustainable. Another alternative that can be developed in parallel with rebate programs is to establish a revolving loan fund (RLF) that can continue in perpetuity because it is financially self-sustaining.

Demand-side management (DSM) revolving loan programs allow electricity customers to borrow money to purchase energy-efficient appliances or pay for other energy-saving measures, such as weatherization improvements or cool roofs. The fund is repaid over time, typically out of the money saved by those customers on their utility bills. This allows the fund to make additional

[46] Guam Energy Action Plan, p. 4

loans to other customers.

A. Fund Structure

There are several ways to structure an RLF, including the following.

1. The utility company can lend the money and require customers to keep paying the same monthly bill or add a small premium to the bill, even though their consumption of electricity is lower, until the loan is paid off.
2. An independent entity can lend the funds, with the utility company repaying the lending entity through savings on a customer's utility bill.
3. A financial institution can establish a line of credit specifically for energy-saving measures, with customers being required to make regular payments until their loan is paid off. This option has two disadvantages: (1) customers with low credit scores tend to be excluded unless another entity offers to be a loan guarantor, and (2) these funds tend to be more expensive to administer due to the higher cost of recovering unpaid debts.

B. Financial Considerations

There are a variety of other financial considerations involved in setting up an RLF, such as ensuring the program maintains a minimum level of funds in the bank to accrue interest, which can then be used to cover fund administration expenses and bad debts. It is a good idea to set a dollar limit for the loan based on an individual's creditworthiness (FICO score) and customer payment history (from GPA records). Setting an overall dollar limit per individual will prevent people who own multiple properties, such as apartment complexes, from cornering the market.

C. Eligible Technologies

There are also technology considerations with setting up a DSM RLF. Guam's DSM RLF could be implemented in phases, with the first phase providing loans only for relatively inexpensive technologies that offer a quick return on investment, such as cool roofs, weatherization improvements, and two-pane windows.

The second phase could include more expensive equipment and appliance purchases, such as solar hot water systems, efficient air conditioners, and refrigerators. Installation of larger equipment, such as roof-mounted solar hot water systems, also incurs the cost of ensuring the installation meets safety standards and building codes.

Structuring the RLF in this way ensures that more people can tap into the fund at its inception.

D. Educating Customers

A well-designed DSM RLF also includes an education component. For example, customers with cool roofs need to understand the importance of regularly cleaning their roofs to prevent darkening, which would reduce the energy savings from the initial investment. Periodic inspections by a third party can help to ensure that maintenance requirements are met.

Many customers would benefit from having energy conservation "best practices" explained to them. This aspect of the DSM RLF could be combined with the energy awareness outreach program described under strategy.

E. Other Considerations

There are other issues to consider when developing an RLF, such as whether to structure the program so renters can take advantage of it as well as homeowners. This could include requiring additional guarantees or collateral to mitigate the higher risk of lending to renters, as well as limiting renters' technology choices. Efficient appliances can move with the renter, whereas cool roofs can't.

It can be a good idea to include information on the electric utility bill that helps customers to see the impact of their energy-saving purchase on their monthly bill, such as including the amount of electricity consumed in the same month of the previous year. This makes it easier for people to see how much their power bill has dropped. In Guam, water bills currently include information on past consumption, but electricity bills do not.

III. Lead / Key Organizations

GEO, GPA, Guam Housing Corporation (GHC), Guam Economic Development Authority (GEDA), and DOE/ DOI-OIA/ National Laboratories (technical support).

IV. Actions

- Establish a DSM revolving loan fund or portfolio of programs that cut demand, free up capacity for renewables, and reduce bills: lighting, HVAC, building envelope, controls, and targeted industrial/ commercial efficiency.
- Launch revolving loan/ on-bill repayment for homes and small businesses (Energy Efficiency + rooftop solar + batteries).
- Develop measurement and verification protocols to track kWh savings against 2010/2020 baseline and RPS scenarios.

V. Timeline

4. Short Term: Stand up a full DSM portfolio/revolving loan fund; implement a pilot on-bill program; target government buildings first.
5. Mid-term: Scale DSM and EE financing; align incentive levels and IRP resource assumptions to avoid overbuilding generation.
6. Long-term: Maintain high EE penetration to keep overall system costs down in a 100% renewable grid.

Strategy 3. Sustainable Materials & Waste-to-Energy Pathways

I. Focus Area

Waste, methane reduction, and non-incineration energy options

II. Description

Waste-to-energy (WTE) power generation could be useful on Guam because it provides baseload power and could make productive use of some of the trash that is currently disposed of in landfills. However, WTE development is a longer-term strategy due to existing legislative hurdles and the need to conduct waste characterization studies before selecting the most appropriate WTE

technology. In an effort toward island sustainability, waste reduction is encouraged.

Before exploring WTE options in more detail, it is important to 1) investigate existing legislation, 2) review the status of current technologies, and 3) evaluate other waste initiatives. In addition to WTE, other strategies that are consistent with the current Guam law, which prohibits municipal solid waste incineration and WTE incineration, emphasize landfill gas capture and organics management.[47]

III. Lead / Key Organizations

Guam Solid Waste Authority (GSWA), Guam Environmental Protection Agency (GEPA), GPA, GEO, private developers, DOE & National Laboratories (technical support).

IV. Investigate Guam's Existing Waste-to-Energy Legislation

Public Law (PL) 25-175, which was adopted in December 2000, appears to restrict the development of WTE facilities in Guam.

For example, on page 3 of the document, it states: "No officer or agency of the government of Guam shall implement or expend funds, or commit resources to implement any portion of the Integrated Solid Waste Management Plan for the Island of Guam which is disapproved or deleted by this Act or any waste-to-energy facility, or any incineration project aimed at reduction of municipal solid waste."

The full text of the law is at: http://guamlegislature.com/Public_Laws_25th/P.L.%2025-175.pdf.

To advance this strategy, key organizations will need to examine the law's original intent, its current interpretation, and the likelihood of clarifying or amending it to permit WTE facilities in Guam. It is believed that many legislators would like to see WTE projects on the island, so there may be a willingness to overcome this apparent obstacle to development.

V. Review the Status of Waste-to-Energy Power Generation Technologies

WTE power generation encompasses a wide variety of technologies, including anaerobic digestion of organic wastes and sewage, landfill gas (methane) capture, direct combustion (incineration), cofiring with other fuels (such as biomass or coal), gasification (to produce a combustible gas), and pyrolysis (producing bio-oils that can be used to generate electricity). Not all of these technologies are equally viable or appropriate for Guam.

Lead/Key Organizations will need to investigate various WTE technologies. It may be possible that National Laboratories have done feasibility assessments.

VI. Evaluate Other Waste Initiatives

Some essential information is necessary in order to properly evaluate other waste initiatives:

1. Waste stream

[47] Guam Energy Strategies

2. Synergies with, and impacts of, existing recycling/no littering campaigns, such as the i*recycle program.
3. Potential impact of changes in the way the military disposes of its trash.

VII. Timeline

1. Short Term: Feasibility assessments; integrate into IRP as an optional resource; secure grants for landfill methane capture; investigate P.L. No. 25-17.
2. Mid-term: Build one or more biogas/landfill gas projects; use them primarily for resilience and GHG reduction; feasibility assessments of WTE; law amendments.
3. Long-term: maintain as niche, non-combustion-alternative additions (not core to the 100% renewable pathway); implement successful WTE plant (core to the 100% renewable pathway).

Strategy 4. Transportation Electrification & Clean Mobility

I. Focus Area

Transportation, transport fuels, EVs, fleets, and supporting policy

II. Description

The original 2013 strategy focused on near-term tasks that were forecasted to cut fossil fuel consumption in the transportation sector, including various approaches to reducing miles traveled, improving the fuel economy of vehicles, encouraging the use of flex-fuel vehicles by using vehicle registration rebates, and introducing electric vehicles to Guam. The updated strategy expands the original actions into a comprehensive plan for transitioning the island toward low-emission and zero-emission mobility.

The updated strategy expands earlier EV efforts into a comprehensive clean mobility plan that includes fleet electrification, charging infrastructure, smart charging management, and community access. It supports a Guam EV Roadmap, public transit electrification, workplace and village charging, and rate design that encourages daytime charging to align with solar generation. Electrification cuts fuel imports, stabilizes costs, and integrates transportation into Guam's broader clean energy transition.

III. Lead / Key Organizations

GEO, GPA, Guam Department of Public Works (DPW), Port Authority, Guam International Airport Authority (GIAA), MCOG, GEDA, DOE / DOI-OIA/ National Laboratories (technical support).

IV. Specific Actions

1. Develop a Guam EV Roadmap with targets for public fleets, Strategy 3. Sustainable Materials & Waste-to-Energy Pathways.
2. Update vehicle registration and taxation policy so that high-efficiency / EVs are favored, and high-consumption vehicles internalize more of the external costs.

3. Scale charging infrastructure at workplaces, multi-unit housing, government facilities, and key corridors.
4. Coordinate EV TOU rates and smart-charging to avoid creating new evening peaks and to absorb solar.

V. Timeline

1. Short Term: EV Roadmap; pilot bus and fleet electrification; initial public charging network.
2. Mid-term: Widespread charger build-out; majority of new vehicle sales electric; integrate EV into demand response.
3. Long-term: Very high EV penetration with managed charging to support grid flexibility at 80–100% renewables.

Strategy 6. Distributed Energy Resources & Virtual Power Plants

I. Focus Area

Rooftop solar, batteries, community solar, and DER integration

II. Description

This strategy expands access to solar energy by supporting rooftop PV, behind-the-meter batteries, and the implementation of Virtual Power Plant Projects. It includes interconnection standards, DER management tools, and programs that allow aggregated DERs to function as VPPs. VPP- and LMI-focused DER programs reduce energy burdens, improve resilience on critical feeders, and ensure that renters and underserved communities share the benefits of clean energy.

III. Lead / Key Organizations

GPA, GEO, GEDA, MCOG, local NGOs, Housing Agencies, and DOE/ DOI-OIA/ National Laboratories (technical support).

IV. Specific Actions

1. Implement or expand community solar pilots tied to churches, schools, municipal roofs, and other host sites, with bill credits for participating households.
2. Update interconnection rules and technical requirements so DERs can support, not destabilize, a high-renewable grid.
3. Create standard offer tariffs or “virtual power plant” programs that pay aggregators or customers for providing capacity and grid services via behind-the-meter PV + batteries.
4. Prioritize DER deployment in disadvantaged and remote communities to improve resilience and reduce energy burden.

V. Timeline

1. Short Term: Launch VPP program and LMI-targeted rooftop initiatives; DER interconnection updates.

2. Mid-term: DERs provide measurable peak shaving and grid services; integration into IRP as a resource category.
3. Long-term: DERs and community solar form a significant share of capacity, especially for resilience at the distribution level.

Strategy 7. Grid Modernization, Resilience & Microgrids

I. Focus Area

Transmission & distribution (T&D), BESS, microgrids, and typhoon resiliency

II. Description

Guam's grid must be strengthened to operate under high renewable penetration and withstand typhoons. This strategy prioritizes upgrades across transmission and distribution systems, advanced metering, feeder automation, and utility-scale BESS for grid services. It also accelerates microgrids for critical facilities, hospitals, water plants, shelters, ports, and the airport, to maintain services during outages and support faster system restoration. These upgrades safeguard reliability while enabling a flexible, renewable-dominant grid.

III. Lead / Key Organizations

GPA, GCCU, GPUC, Port Authority, GIAA, Guam Memorial Hospital (GMH), and major critical facilities, and DOE/ DOI-OIA/ National Laboratories (technical support).

IV. Specific Actions

1. Implement IRP-driven T&D upgrades: reconductoring, substations, advanced protection, and control systems to accommodate large amounts of solar and BESS.
2. Deploy additional utility-scale BESS for frequency regulation, contingency reserves, and "black start" capability.
3. Develop critical-facility microgrids (port, airport, hospitals, shelters, water/wastewater infrastructure, emergency centers) with islanding capability during typhoons.
4. Roll out advanced metering infrastructure (AMI) and distribution automation to enable demand response, fault location, and better outage management.

V. Timeline

1. Short Term: Prioritize microgrids and hardening for top-tier critical facilities; secure federal resilience funding.
2. Mid-term: Wide AMI coverage; grid configured for 50–80% renewable operation without stability issues.
3. Long-term: Fully modern, flexible grid able to maintain reliability at 100% renewables and during extreme events.

Strategy 8. Building Codes, Government "Lead by Example", & Public Facilities

I. Focus Area

Building energy performance, public sector leadership

II. Description

This strategy updates building energy codes to reflect efficient cooling, cool roofs, insulation, and solar- and EV-ready design. It launches a "Lead by Example" program that benchmarks public building performance, prioritizes high-use facilities for retrofits, and integrates solar and storage where feasible. Strong codes and government leadership reduce system-wide demand, cut operation costs, and drive consistent market demand for energy-efficient technologies.

III. Lead / Key Organizations

DPW, GEO, Guam Legislature, Guam Building Code Council, all line agencies, GPA, and DOE/ DOI-OIA/ National Laboratories (technical support).

IV. Specific Actions

1. Update and enforce energy-efficient building codes for new construction and major renovations, including requirements or incentives for cool roofs, efficient HVAC, and solar-ready design.
2. Implement a Government Facilities Energy Performance Program: benchmark public buildings, set reduction targets, and track progress annually.
3. Pair this with bundled retrofits financed via loans or revolving funds and supported by GPA incentives where appropriate.

V. Timeline

1. Short-term: Adopt/refresh codes; start benchmarking; identify top 50–100 public buildings for upgrades.
2. Mid-term: Complete deep retrofits in most major public facilities; all new public buildings built to high-performance standards.
3. Long-term: Maintain high performance through commissioning and continuous improvement.

Strategy 9. Clean Energy Workforce, Local Industry & Equity

I. Focus Area

Workforce, local business development, and equitable benefits

II. Description

Achieving 100% renewable energy requires a skilled local workforce and equitable distribution of benefits. This strategy builds clean energy training pathways through GCC, UOG, Trader Academy, and industry partnerships for solar installers, BESS technicians, energy auditors, and EV technicians. It supports local businesses through procurement policies and ensures disadvantaged communities benefit from clean energy programs, job opportunities, and targeted bill savings. Equity is integrated into all program design and deployment.

III. Lead / Key Organizations

GEO, UOG CIS and SG, GCC, Department of Labor, GEDA, GPA, Guam Trades Academy, and DOE/ DOI-OIA/ National Laboratories (technical support).

IV. Specific Actions

1. Establish training pathways for solar installers, BESS technicians, energy auditors, building operators, and EV/charging technicians.
2. Build requirements or incentives for local hire and apprenticeship programs into major GPA renewable RFPs and public sector projects.
3. Use energy programs (community solar, EE loans, etc.) to target high-burden communities, ensuring lower bills and improved resilience reach those most impacted by high energy costs

V. Timeline

1. Short-term: Identify skills gaps; launch priority training programs and apprenticeships tied to upcoming projects.
2. Mid-term: A strong local workforce meets most renewable, EE, and grid modernization labor needs.
3. Long-term: A mature local clean energy sector that can maintain and innovate in a 100% renewable system

Strategy 10. Integrated Planning, Governance & Data

I. Focus Area

Energy governance, planning alignment, and data transparency

II. Description

Effective coordination is essential as Guam transitions to a more complex, renewable-based system. This strategy establishes a formal energy governance structure that aligns with the Strategic Energy Plan, IRP, Clean Energy Master Plan, RPS implementation, and resilience initiatives. Annual progress reporting, shared datasets, and public dashboards increase transparency and accountability. Centralized coordination ensures consistent policy direction, reduces duplication, and provides a unified pathway toward the 2035 and 12045 energy goals.

III. Lead / Key Organizations

Governor's Office, Legislature, GEO, GPA, CCU, PUC, and DOE/ DOI-OIA/ National Laboratories (technical support).

IV. Specific Actions

1. Formalize or update an energy council or similar body with clear authority to advise on energy policy, track RPS progress, and coordinate cross-agency work (building on GETF).

2. Align the Strategic Energy Plan, Clean Energy Master Plan, IRP, and Guam Energy Strategies under a single monitoring framework with annual public reporting (renewables %; LEAC impacts; reliability; equity metrics).
3. Maintain a public data dashboard (building on existing GPA and government dashboards) that tracks progress towards 50% by 2035 and 100% by 2045.

V. Timeline

1. Short-term: Establish council; adopt updated SEP/Action Plan; set clear indicators.
2. Mid-term: Annual progress reports; course corrections in IRP and programs based on data and community input.
3. Long-term: Ongoing governance framework that maintains 100% renewables while adapting to new technologies and demands.

Conclusion

Since 2013, Guam has continued to adopt and implement the necessary policies, technologies, and energy strategies to ensure the island's energy is secure, reliable, and affordable for all residents.

Guam continues to push for more sustainable energy systems for the island. Due to Guam's location, political status, and dependence on imported fuels, it continues to be a main priority for island leaders, GPA, GEO, and residents to continue to implement energy efficiency measures to ensure savings and adopt reliable, renewable energy sources that support a clean energy future and Guam's clean energy goals.

Guam is envisioning ways to change how consumers make purchasing decisions, based on habits, cultural norms, and old ways of thinking. Creating new realities in which utilities make decisions based on the green economy and "three generation thinking, setting our sights on implementing policy strategies for legislators which will transcend policies originally based on political "experience" and party-line thinking, and asking financiers to embrace the "triple Bottom Line," instead of making investments based on traditional methods of risk assessments and analysis.

To evolve beyond the status quo:

1. Consumers need to expand their knowledge of renewable energy technologies and make informed, sustainable choices
2. Utilities will need to open the door to new ways of doing business, such as increasing efficiency, encouraging energy conservation, and interconnecting with distributed generators
3. Government will need to shift its focus from politics to public interest by striving to reduce energy costs, developing sustainable energy policies, and embracing new, commercially proven technologies
4. Investors will need to take advantage of incentives, such as RE subsidies, and take a long-term view when weighing the risks and returns of energy projects.

Most importantly, Guam continues to see the importance of securing our energy infrastructure to ensure reliability, affordability, and security as well as making continued strides to increase

sustainability efforts both within public and private spaces by actively supporting current and future clean energy goals and strategies. Energy transformation involves a revolutionary shift in how entire communities think about and use energy.

Appendices

A.1 A Model for Energy Planning

GPA, GEO, UOG CIS, and SG, and other stakeholders are participating in the community energy planning process. With technical assistance from National Energy Laboratories, in 2026, Guam will have an updated model for energy planning that details the different paths forward for the island. The original GETF subcommittees participated in a community energy planning process, described below and shown in Figure 7.

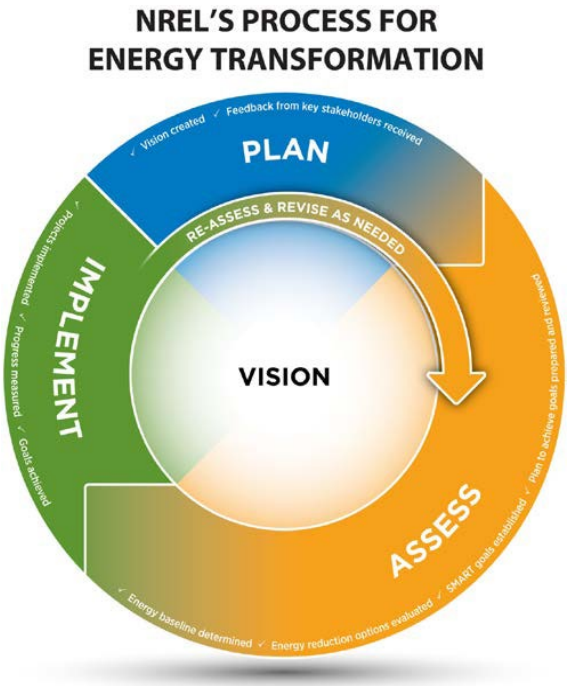


Figure 11. NLR's Process for Energy Transformation

Plan

The planning phase includes these steps:

1. Identify and ring together stakeholders
2. Develop a vision for the community's energy transformation

Assess

The assessment phase includes these steps:

1. Determine an energy baseline
2. Evaluate options
3. Develop goals
4. Prepare an energy plan
5. Solicit feedback on the plan from a broad set of stakeholders.

The goals of this phase are to:

1. Determine the community's energy baseline
2. Establish specific, measurable, attainable, relevant, and time-bound goals for energy transformation
3. Put the goals into a plan for action.

Implement

The implementation phase includes these steps:

1. Develop, finance, and implement projects
2. Create early successes
3. Evaluate effectiveness and revise as needed

The goals of this phase are to:

1. Implement projects that can build community support for ongoing and future energy projects
2. Measure the progress and effectiveness of the plan and its projects

A.2 Framework for Project Standardization

Reduce investor uncertainty by adopting a project development framework such as NLR's SROPTTC™[48] to examine the key issues and identify next steps towards resolving them. The following methodology outlines SROPTTC™:

1. **S**ite: Identify the physical location for the physical assets of a project, including property rights, length of tenure, terms and conditions, etc.
2. **R**esource: Characterize and understand the renewable resource being considered.
3. **O**ff-take: Establish and secure by contract the buyer of both the energy and any other characteristics of output (e.g., renewable energy credits).
4. **P**ermits: Identify and obtain all permits necessary for project construction and operation
5. **T**echnology: Invest in engineering design, equipment selection, and procurement activities of the chosen technology.
6. **T**eam: Assemble a fully qualified team that addresses all business, technical, financial, legal, and operational aspects.
7. **C**apital: Attract financial resources necessary for final development, construction, commissioning, and initial operations.

[48] https://www.nrel.gov/state-local-tribal/project-development-model

A. 3 Annual Population

Census data are available for 2010, the baseline year, and will be available for 2045, the target year for achieving the 100% reduction in fossil fuel consumption. For all other years during which census data is unavailable, population growth will be estimated based on GPA customer growth. GPA customer information obtained via GPA annual reports.

Calculations

$$\text{Estimated Population}_{\text{Year}} = \frac{\text{Population}_{2010} \times \text{GPA Customers}_{\text{Year}}}{\text{GPA Customer}_{2010}}$$

Example:

YEAR 2015:
Population (2010, base year): 159,358
GPA Customer 2010: 47,826.00
GPA Customer 2015:49,629.00

Estimated Population 2015 = (159,358 x 49,530) / 47,826

est. population 2015 =165,575.58

ANNUAL POPULATION TOTAL	
2010*	159,358.00
2011	159,844.48
2012	161,670.43
2013	161,930.33
2014	163,016.58
2015	165,575.58
2016	169,597.35
2017	169,410.76
2018	171,173.40
2019	172,409.59
2020*	153,836.00
2021	174,145.58
2022	176,174.79
2023	176,631.28
2024	178,460.57

A. 4 GPA Fuel Consumption

Table 5. Guam Power Authority Historic Fuel Consumption

GPA Historic Fuel Consumption Data (YEAR)	TOTAL BARRELS	CONVERSION TO GALLONS
2010	2,856,573.00	119,976,066.00
2011	2,732,040.00	114,745,680.00
2012	2,718,901.00	114,193,842.00
2013	2,596,682.72	109,060,674.24
2014	2,523,511.00	105,987,462.00
2015	2,597,449.00	109,092,858.00
2016	2,720,701.00	114,269,442.00
2017	2,825,640.00	118,676,880.00
2018	2,741,450.50	115,140,921.00
2019	2,763,360.00	116,061,120.00
2020	2,674,086.50	112,311,633.00
2021	2,810,659.00	118,047,678.00
2022	2,830,981.00	118,901,202.00
2023	2,717,788.00	114,147,096.00
2024	2,816,581.00	118,296,402.00

Data source: San Nicolas (2025), GPA Strategic Planning & Operations Research Division

A.5 Fuel Sales (minus Jet Fuel)

Table 6. Total Fuel Sales (Minus Jet Fuel)

YEAR	TOTAL FUEL SALES (minus jet fuel) (Thousands of Gallons)
2010	64673.20
2011	63927.70
2012	64315.78
2013	65620.80
2014	70368.62
2015	80397.50
2016	98447.00
2017	104609.90
2018	107324.00
2019	138538.20
2020	146350.30
2021	98703.00
2022	120567.00
2023	152520.00
2024	103515.00

Data source: Guam Energy Office (2025)

A.6 Progress Towards FF Reduction Equation

Under the Metric for Evaluation Section. Progress towards Guam's energy goal will need to be measured to determine if it has been met. The following calculations were used to establish the Reduction Percentage Relative to 2010.

After establishing the annual population from 2010-2024. Per Capita consumption must be calculated. This was done with the following equation:

$$\text{Annual Fossil Fuel Use per Capita}_{year} = \frac{\text{Total Fossil Fuel Consumption}_{year}}{\text{Estimated Population}_{year}}$$

Example 2015:
Total FF Consumption: 109,173,225.50
Estimated 2015 Pop: 165,035.79

Annual FF Use per Capita 2015= 109,173,225.50 / 165,575.58

= 659.36 gallons/person

Then compare to the baseline averages. Use 2010 as the baseline. For every later year, the equation is as follows to show the Reduction percentage relative to the 2010 baseline, highlighting the progress towards Guam's 100% energy goal.

Reduction % = (1- (Gallons per Capita$_{Year}$ / Gallons per capita$_{2010}$)) x 100

Example 2015:

Reduction % = (1- (659.36 / 753.28)) x 100

= 12%

A.7 Proposed Transportation Projects

The original Table 5. Transportation Projects by Rank[49] found in the 2013 Strategic Energy Plan references the Guam Transportation Petroleum-Use Reduction Plan, NREL Report No. TP-7A30-57191. The proposed transportation projects in the NLR report are listed in the table below, ranked first by cost (low to high), then by anticipated impact on petroleum reduction (high to low), then by popularity (high to low), then by speed of implementation (fast to slow).

Since the publication of the 2013 Strategic Energy Plan, significant changes have occurred in the island's transportation systems, mobility technologies, and clean-energy priorities. New data from NLR, GPA, the Port Authority, Guam Regional Transit Authority (GRTA), and the DoD show that transportation planning has to shift to reflect modern realities and the 100% RPS goal.

New mobility technologies (ride-hailing apps, GRTA transit tools, and early EV charging networks) now offer more practical and scalable solutions than the standalone rideshare website envisioned in 2013. At the same time, safety, equity, and resilience challenges, including limited sidewalks, the absence of bike lanes, and growing paratransit needs, require elevating bike/pedestrian networks and ADA-accessible infrastructure to a higher priority.

Decarbonization laws and recent EV investments further shift the focus toward fleet electrification, electric transit, and modern charging infrastructure, reflecting their growing role in reducing petroleum dependence and aligning transportation with Guam's 100% RPS goal.

These updates introduce modern ranking criteria, *equity, resilience, and clean energy alignment*, and reframe transportation projects to better reflect today's technologies, community needs, and climate priorities. The revised Table 7 incorporates these changes to guide Guam toward a safer, more efficient, and low-carbon transportation system.

[49] Conrad, M. D. (2013). *Guam Strategic Energy Plan.* Guam: National Renewable Energy Laboratory. Retrieved July 23, 2025

A.8 Transportation Projects by Rank

Table 7. Transportation Projects by Rank

Rank	Updated Project Title	Description	Lead / Key Agencies	Updated Status (2025)
1	**Integrated Mobility & Carpooling Apps**	Integrated mobility tools (GRTA app, ride-hailing apps such as Stroll/GoodToGo, carpool matching, tourism travel apps, multimodal trip planning).	GRTA, GEO, Private Mobility Apps	**Partially Implemented:** Ride-hail exists; There is a need for carpool and transit integration.
2	**GRTA Transit Expansion & Electrification Plan**	Modernize GRTA by increasing routes, extending hours, adding Sunday service, and transitioning to electric buses aligned with Guam's 100% clean energy targets.	GRTA, DPW, Office of the Governor, DoD	**In Progress:** Fleet is small; EV bus pilots and fleet expansion are recommended by NLR.
3	**Real-Time Transit Information Upgrades**	Enhance GRTA app with true real-time arrivals, open data feeds, mobile fare payment, paratransit integration, and ADA features.	GRTA, Office of Technology-Government of Guam (OTECH)	**Partially Implemented:** Apps exist but need real-time GPS and payment integration.
4	**Transportation Energy & Activity Data System**	Establish updated VMT counts, vehicle fuel-type registry, efficiency data, EV adoption tracking, and OD surveys. Corrects major data gaps identified by NLR.	GEO, DMV/DRT, DPW, GRTA, NLR	**Not Implemented:** Critical foundational work is needed.
5	**Island-wide Bike & Pedestrian Safety Network**	Develop protected bike lanes, shaded walkable routes, ADA-compliant sidewalks, plus safe access to schools, transit stops, and village centers.	DPW, Mayors Council, GRTA	**Not Implemented:** Guam has only ~26 miles of sidewalks; no marked bike-only lanes.[50]
6	**Employer Flex Work & Telework Programs**	Institutionalize telework/hybrid work to reduce VMT, building on post-COVID trends and digital government initiatives.	GovGuam Agencies, Private Sector, OTECH	**Partially Implemented**: Not formalized across agencies.
7	**Community Transportation Education Campaign 2.0**	Expand 2013 fuel economy education to include EV literacy, multimodal safety, Bike & Pedestrian Safety Network, active transport, ride-hailing, and public transit awareness.	GEO, GRTA, DOE (Education), Tourism Partners	**Not Implemented / Needs Expansion:** Current outreach is limited.
8	**Sustainable Tourism Mobility Program**	Integrate airport taxis, hotel shuttles, GRTA, and ride-hailing into a unified mobility network; add EV taxis and tourism-focused mobility hubs.	GVB, GIAA, GRTA	**Not Implemented:** Fragmented services.

[50] National Renewable Energy Laboratory. 2024. Guam: 2023 Energy Baseline Report. Retrieved October 20, 2025, from https://docs.nrel.gov/docs/fy24osti/88454.pdf

9	**Multimodal Mobility Hubs (Village Centers & Tourism Districts)**	Install co-located transit stops, EV chargers, micro-mobility docks[51], and shaded pedestrian areas at key areas.	GRTA, GEDA, Mayors Council, Private Sector	**Not Implemented:** Requires infrastructure investment.
10	**Government Fleet Electrification Program**	Phased electrification of GovGuam light-duty vehicles with charging at agencies; integrate procurement with GPA IRP and federal EV incentives.	DOA, US DPS, GPA, GEO	**In Progress:** Limited EV acquisition; needs an island-wide plan.
11	**Port & Airport Fleet Electrification & Charging Infrastructure**	Electrify cargo-handling equipment, shuttle vehicles, and operational fleets at the Port Authority and the Airport; expand workplace charging.	Port Authority, GIAA, GPA, DoD	**In Progress**: Camp Blaz is installing 233 chargers; Port modernization is underway.
12	**GRTA Paratransit Modernization**	Expand ADA paratransit service, app integration, real-time notifications, and guarantee accessible vehicles.	GRTA	**Partially Implemented:** The Amble app exists; it needs expansion.
13	**Micro-Mobility (Bike/E-Bike/Scooter Share) System**	Deploy public or private micro-mobility fleets connected to transit stops and tourist areas.	Private Sector, GRTA, GVB	**Not Implemented:** No active system.
14	**Idle-Reduction & Fleet Efficiency Program**	Combine idle-reduction programs for buses, taxis, delivery fleets, and government vehicles into a single coordinated program.	GRTA, DPS, Private Fleets	**Not Implemented:** No systematic program.
15	**Vehicle Efficiency Incentives (Updated Feebate Concept)**	Build a feebate design with modern incentives for hybrid/EV adoption; integrate with DMV fees or import duties.	GDRT, Legislature, GEDA	**Not Implemented:** Policy reform required.
16	**Emission & Safety Compliance Program (Modernized)**	Update 2013 “mobile emissions testing” into a modern inspection program emphasizing safety, efficiency, and EV readiness (no tailpipe testing for EVs).	GDRT, Guam EPA, Legislature, Office of the Governor	**Not Implemented:** No island-wide emissions system.
17	**Alternative Fuels R&D (Waste Grease/Coconut Biodiesel)**	Re-evaluate the feasibility of locally produced biodiesel blends (B5/B20) based on feedstock availability and lifecycle carbon analysis.	UOG, GEDA, Private Sector	**Long-Term Research Only:** Limited feedstock; low near-term impact.
18	**Transportation Fuel Logistics & Port Efficiency Upgrades**	Incorporate 2013 “pipeline improvements” into broader Port modernization: safer fuel transfer points, resilient infrastructure, reduced spillage, and congestion.	PAG, EPA, USCG	**In Progress:** Included in Port of Guam Sustainability Plan (if not already included)

[51] Duvall, A. (2020). Micro-Mobility Energy Bounding Analysis.

A.9 Reduction Scenarios

The Following Analysis and Scenarios were done in the 2013 Energy Action Plan.
It is important to note that GEO and UOG CIS and SG are working with stakeholders to develop updated modeling and energy scenarios. They will include existing mandates and technologies. These updates will be included at a later time.

Fossil Fuel Consumption Scenarios: Wedge Analysis

The purpose of this "wedge" analysis is to show, in graphical form, the likely impact of measures taken to reduce the use of fossil fuels. After an alternative technology or policy is implemented, it creates an irregular-looking wedge on the graph, hence the name given to this type of analysis.

General Methodology and Assumptions

The wedge analysis for Guam was performed by NLR using information provided by the Guam Power Authority and other official sources. The first wedge analysis was developed for Guam's strategic energy plan using 2010 data. That analysis established a business-as-usual (BAU) or base case against which the impact of any actual and proposed changes to Guam's energy consumption patterns can be compared. Those changes could be the result of energy efficiency measures, energy conservation, or expanded use of alternative power-generation technologies.

Energy can be measured using a variety of units, such as kilowatt-hours or kWh (for electricity) and British thermal units or Btu's (for heat energy). Units of energy can readily be converted into each other.

As this action plan focuses on fossil-fuel reduction, the analysis illustrates the consumption of electricity in barrels of oil equivalent (BOE) through 2020, a unit of measure that indicates how many barrels of oil would need to be consumed to meet the demand for energy. The number of Btu's in a barrel of oil is calculated for each year from data supplied by GPA and varies depending on the particular mix of fuel oil consumed by GPA that year.

Base Case

In the base case (figure 12), it is assumed that no significant steps are taken to curb fossil fuel use. In this scenario, energy consumption is projected to grow at a linear rate of 0.119% per year from 2010 onwards. That growth rate is calculated from utility data on actual consumption patterns from 2000 to 2010. This BAU scenario also assumes no major fluctuations in fuel prices by incorporating the average fuel cost for the period from 2000 to 2010.

The base case graph is a solid blue color, reflecting the fact that Guam’s electricity is generated mainly from fossil fuels.

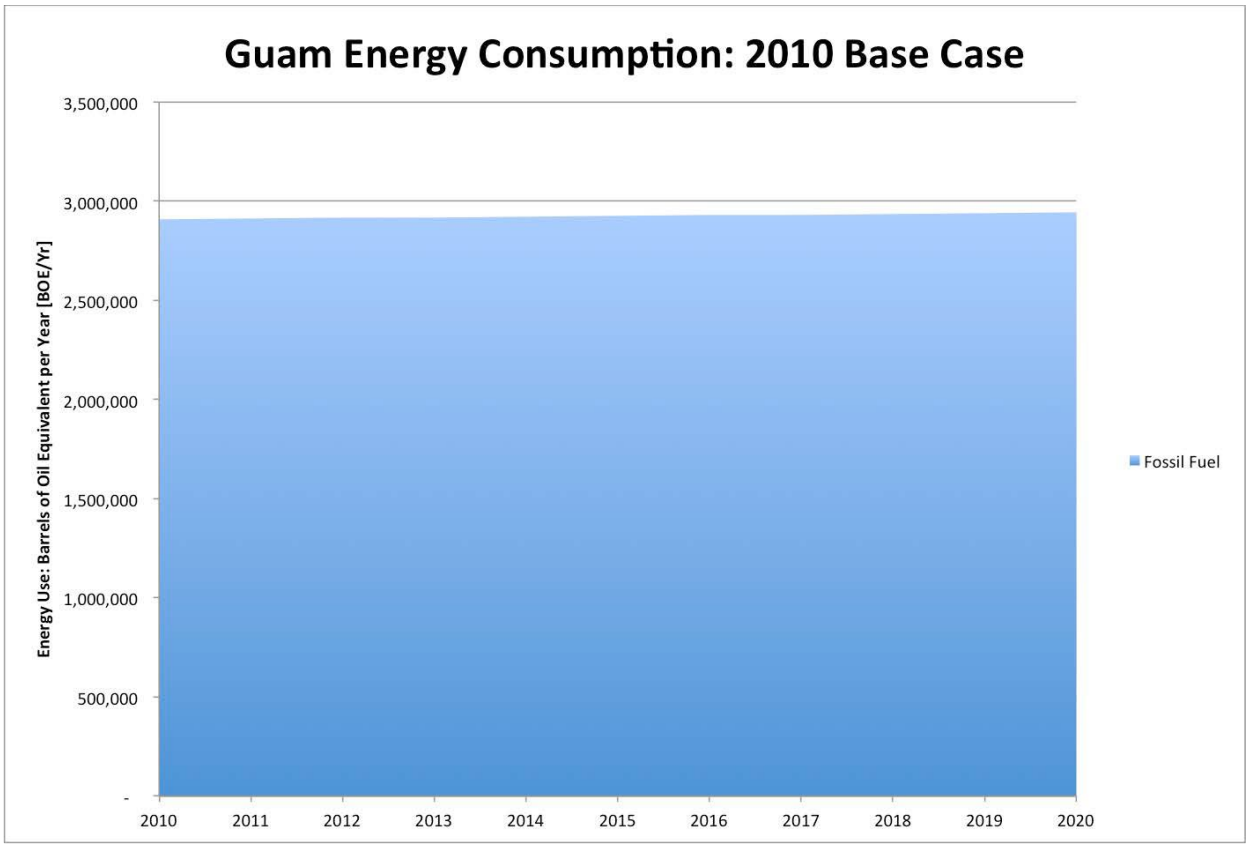


Figure 12. Energy Consumed to Generate Electricity: 2010 Base Case

20% Reduction Scenario

Figure 13 illustrates one potential path to reducing fossil fuel consumption by 20%. The top of the graph represents the same linear increase as the base case. The red wedge shows the direct reduction of energy not needing to be produced due to potential efficiency improvements in generation and/or end-use consumption. The green wedge represents the potential contribution of various renewable energy technologies to the 20% reduction in fossil fuel consumption.

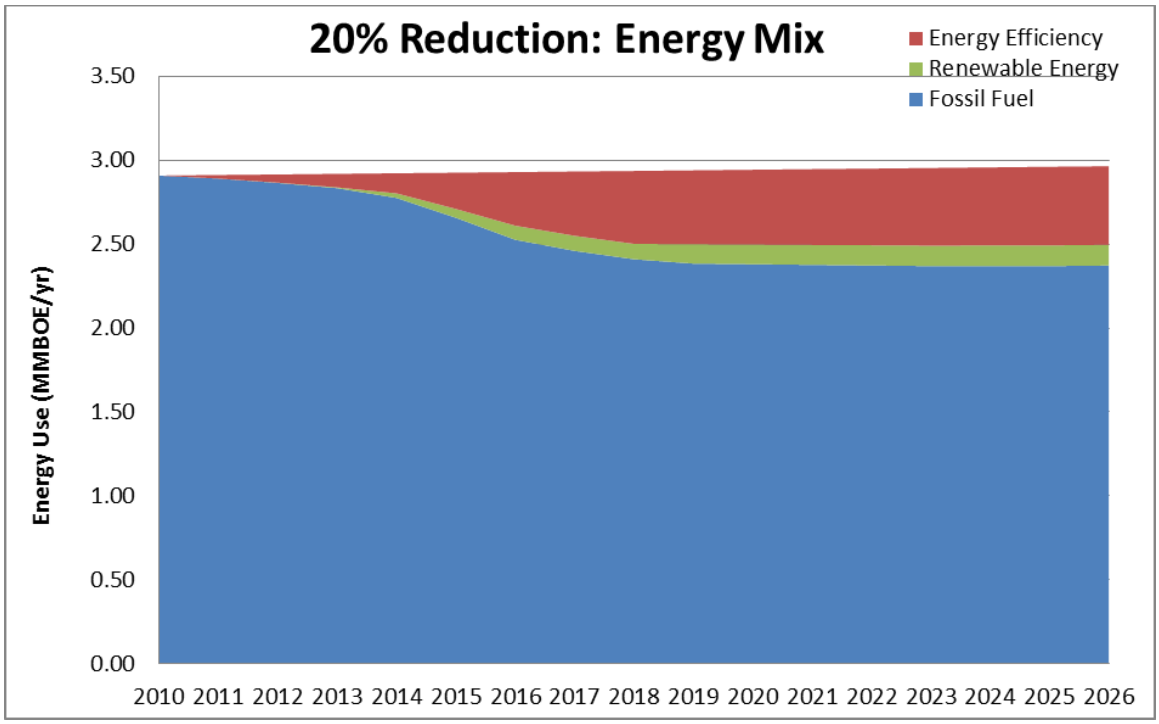


Figure 13. 20% Reduction: Energy Mix

Figure 14 represents the same information shown in figure 13 but in more detail. It shows how several renewable energy technologies, and energy efficiency actions in specific end-use sectors, could contribute to the overall reduction of fossil fuel consumption in Guam. Note that the legend is in the same order as each wedge is stacked. Similarly, the area cut out by energy efficiency improvements matches that of the red wedge in figure 13; additionally, the renewable energy wedge matches the same area in both charts.

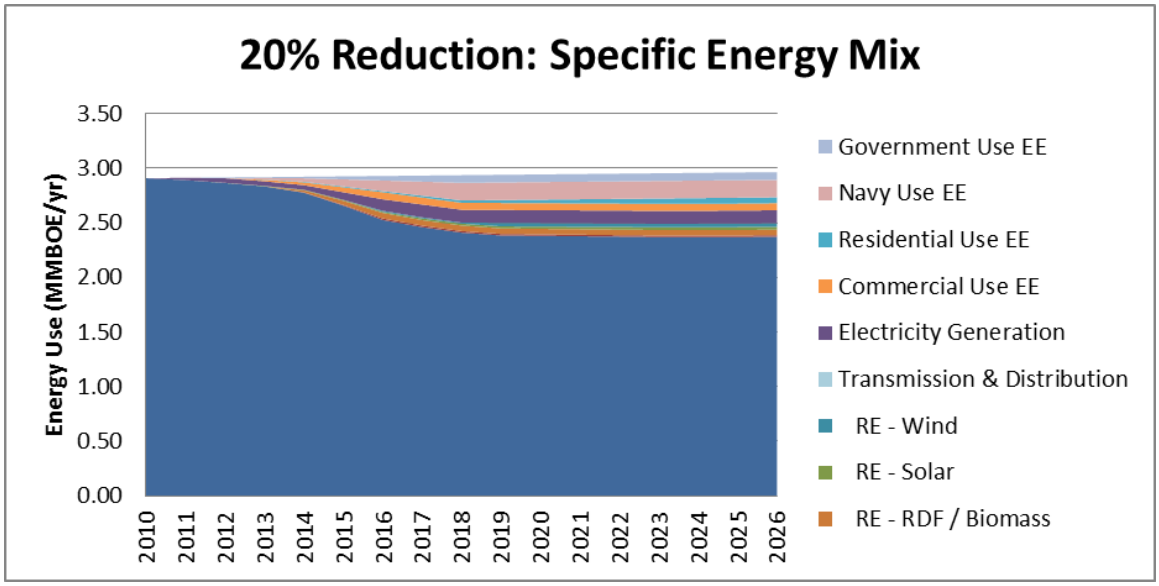


Figure 14. 20% Reduction: Specific Energy Mix

53% Reduction Scenario

The high-impact scenario (Figure 15) was determined by considering strategies that could meet a 53% fossil fuel reduction goal. The top of the graph again assumes the linear increase as the base case. The red wedge shows the direct reduction of energy not needing to be produced due to efficiency improvements in generation or end-use consumption while the green wedge represents the contribution of various renewable energy technologies to the reduction in fossil fuel consumption.

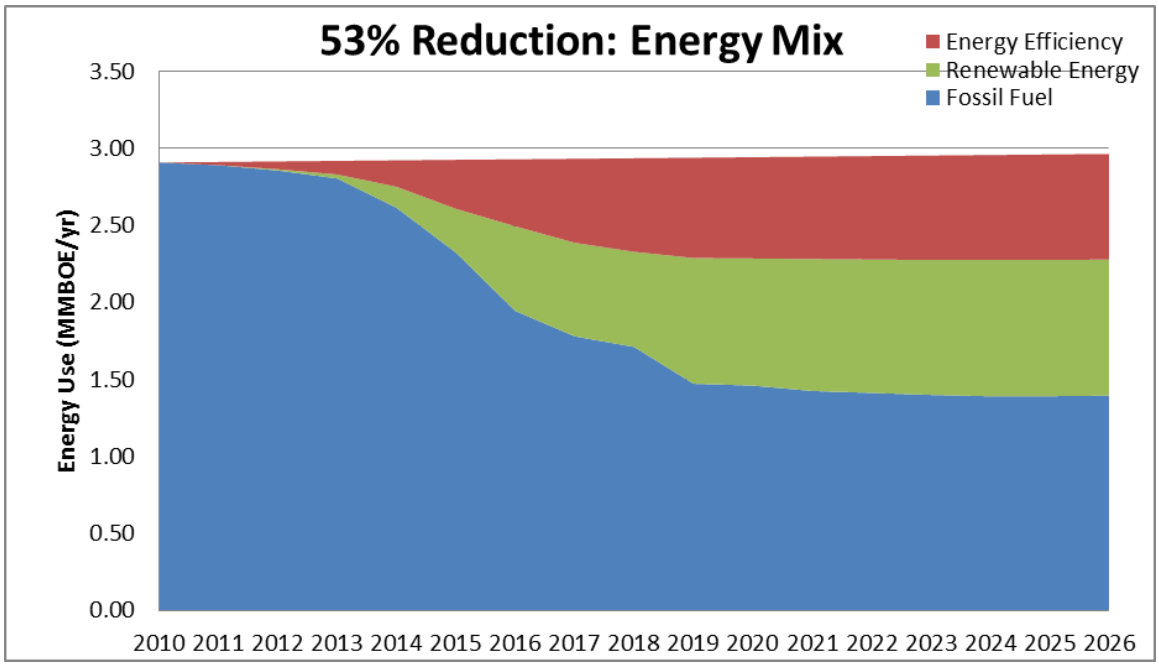
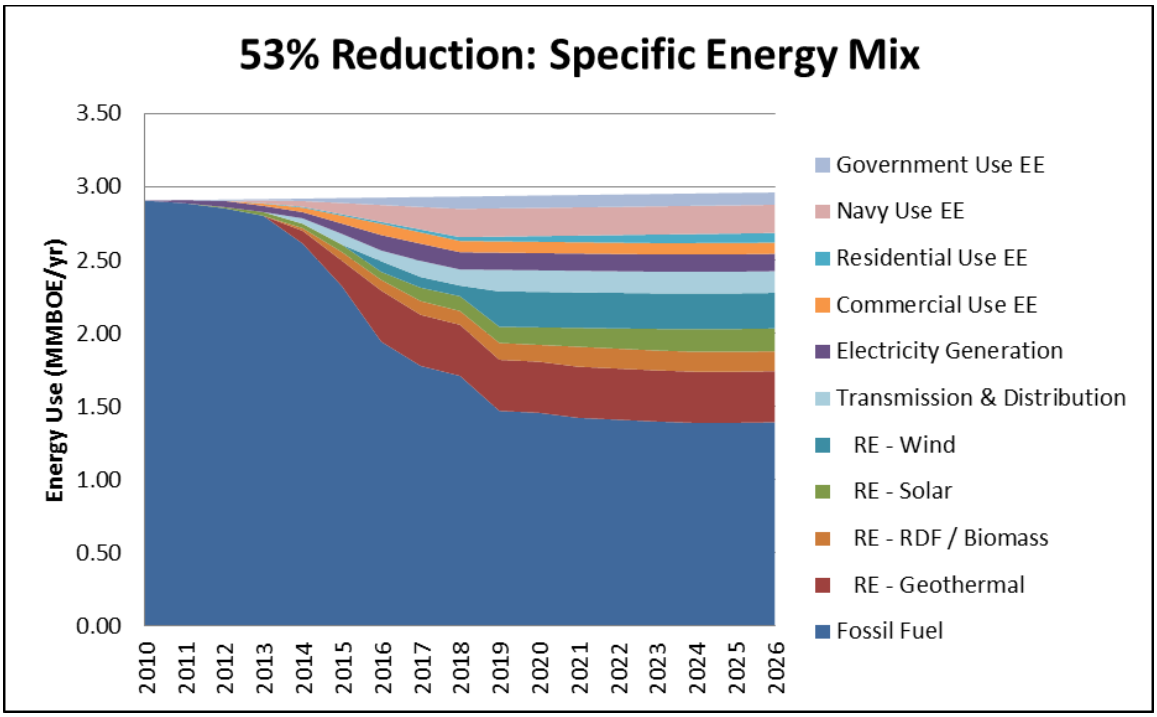


Figure 15. 53% Reduction: Energy Mix

Figure 16 represents the same information shown in figure 15 but in more detail. It shows how several renewable energy technologies, and energy efficiency actions in specific end-use sectors, would contribute to the overall reduction of the fossil fuel consumption in the energy portfolio for Guam. Note that the legend is in the same order as each wedge is stacked. Similarly, the area cut out by energy efficiency improvements matches that of the red wedge in the low impact energy mix chart above; additionally, the renewable energy wedge matches the same area in both charts.



Comparing all scenarios, one can see how implementing a wide range of energy efficiency and renewable energy technologies over time can reduce fossil fuel consumption and begin to paint a picture of sustainability. Strategy implementation takes time and so does project development. Change does not happen overnight, but with decisive goals and clear action steps, change will be incremental.

Future Scenario

In the future scenario (figure 16), the overall shape of the graph reflects the same growth in total energy consumption (0.119% per year) as the base case. The graph has been updated with actual energy consumption and generation data from 2010 to 2012. The purple area at the top of the graph shows the drop in energy demand during those two years.

Projected data is used for the period from 2012 to 2020. Future projections can derive from communication and published information from GPA and other official sources regarding planned conversion of electricity generators to LNG, legally binding contracts or laws governing additions of renewable energy generation to the electricity grid, the anticipated impact on energy demand of energy efficiency and conservation measures stemming from this action plan, and the latest information on the likely impact of military personnel on Guam's energy consumption.

The actual criteria included in the future projection are described in the methodology and assumptions section below the graph. The actual energy demand in 2012 is projected forward to 2020 as a fixed percentage of the total BAU energy demand, which means that the thickness of the "demand reduction" wedge is a fixed proportion of BAU demand.

Both actual and projected data can be updated each year as more information becomes available.

The future scenario graph shows an expanding wedge of renewable energy generation replacing fossil fuel generation starting shortly after 2012. This wedge is primarily the result of Public Law 29-62, which requires that 5% of net electricity sales come from renewable sources by the end of 2015. The scenario does not currently include any energy efficiency actions.

Because of inefficiencies in the process of power generation and transmission as well as other system losses, approximately 1.136 MWh of electricity must be produced for every 1 MWh of electricity that is sold.

Replacing 5% of electricity sales from fossil-fueled generators with electricity from renewable resources would lead to a 136,146 bbl[52] reduction in fossil fuel consumption in Guam, saving approximately $15 million per year in fuel costs.

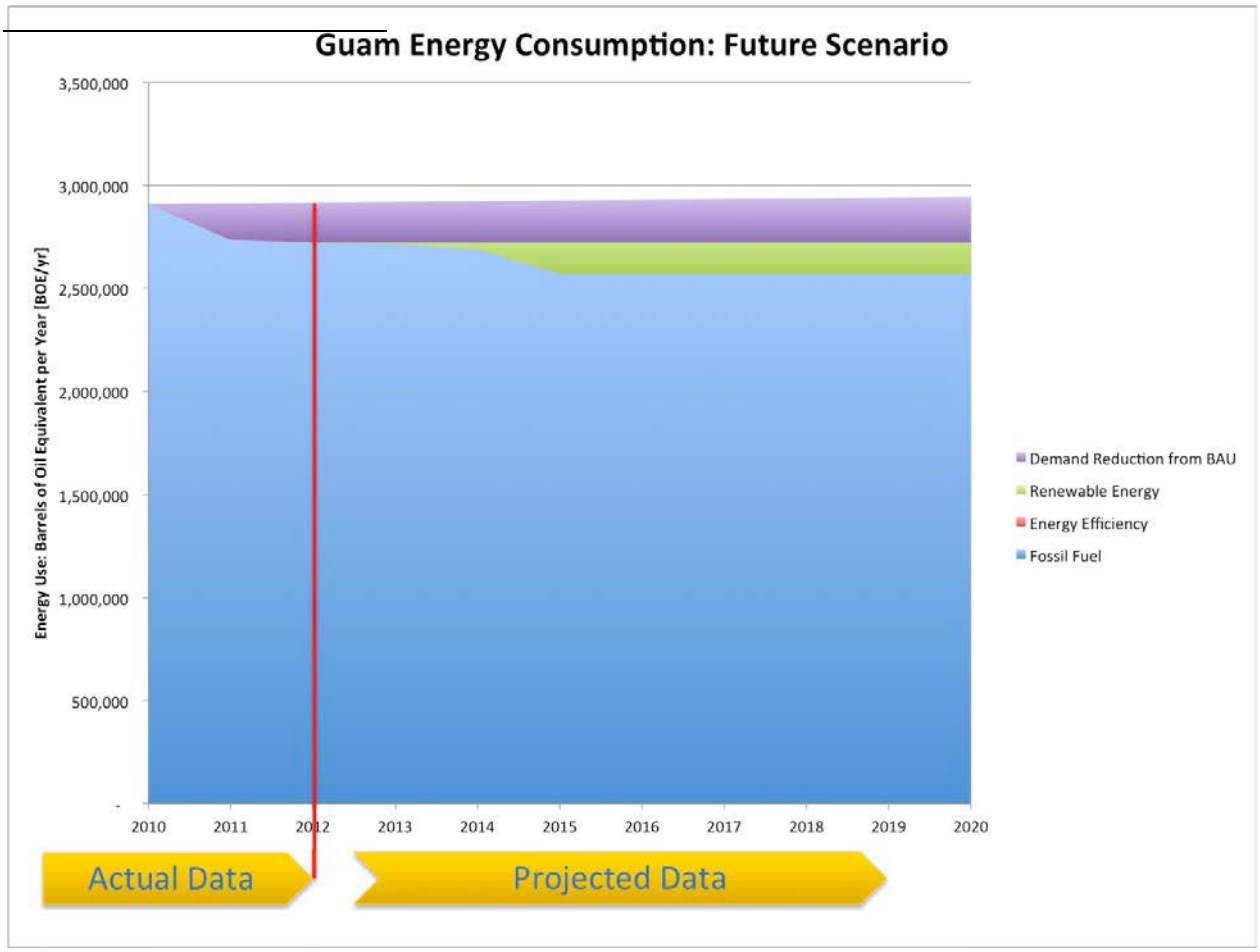


Figure 16. Energy Consumed to Generate Electricity: Actual and Projected

[52] barrels

Methodology and Assumptions for the Future Scenario

This section walks through the key calculations used to develop the graph in Figure 16.

Assumptions Included in the Future Scenario

- According to Public Law 29-62, 5% of net electricity sales must come from renewable sources by December 31, 2015[53]
- These sales are assumed to derive from the following:
  - 429 kWh from net-metered wind and PV systems[54]
  - 9.35 MW of wind generating capacity from Pacific Green Resources LLC projects
  - Additional unspecified projects required to reach the goal of 5% of net electricity sales generated by 2015.

Included in the 2013 GPA integrated resource plan, but not included in wedge analysis due to the absence of an accepted RFP or a firm implementation plan (may be included in the wedge analysis at a future date):

8. 10 MW geothermal plant planned for 2019
9. 60 MW - 120 MW combined-cycle gas power plant

Calculation of Fuel Savings from Renewable Energy

Calculations begin with the assumption that 5% of net electricity sales come from renewable energy by 2015 and use 2012 as the baseline year.

The following data was provided by the utility:

2012 Fuel Consumption Data			
Fuel	**Units (bbl[55])**	**Costs**	**Million Btu (MMBtu)**
High Sulfur RFO	1,928,688	$212,876,225	12,150,734
Low Sulfur RFO	734,015	$78,093,042	4,624,295
Ultra Low Sulfur Diesel	60,208	$9,095,427	351,494
TOTALS	2,722,911	300,064,694	17,126,523

2012 Fuel Cost Data	
Fuel Type	**Cost [$/bbl]**
High Sulfur RFO	110.37

[53] http://www.guampdn.com/article/20130423/NEWS01/304230310/Wind-turbine-added-University-Guam, accessed April 24, 2013
[54] Email to NREL from GPA
[55] barrels

Low Sulfur RFO	106.39
Ultra Low Sulfur Diesel	151.07

2012 Fuel Generation Data	
Total Electricity Generation [MWh]	1,784,446
Total Net Electric Sales [MWh]	1,570,396
Generation Efficiency (Heat Rate) [MMBtu/MWh]	10.145

Calculations

In 2012, GPA generated 1,784,446 MWh of electricity, of which 1,570,396 MWh was sold.

The ratio of generated power to net sales can be used to derive a single number that summarizes the approximate transmission and distribution system losses, losses in the electricity generating process and other losses associated with the avoided energy generation:

1,784,446 generated MWh/1,570,396 sold MWh

= 1.1363 generated MWh/sold MWh

In other words, 1.1363 MWh is generated for every 1 MWh sold. To calculate 5% of net electricity sales:

1,570,396 MWh * 0.05 = 78,520 MWh

To calculate the fuel savings from a 5% reduction in electricity consumption:

It seems reasonable to assume a linear relationship between electricity consumed and electricity generated. It also seems reasonable to assume a linear relationship between electricity generated and the fuel used to generate that electricity. The model is evaluating electricity generation (and fuel savings) at the margin, and there is no reason to assume that power plant efficiency will be impacted significantly by an incremental reduction in power plant output.

Thus a 5% reduction in electricity sales results in a 5% reduction in electricity generation and a 5% reduction in fossil fuel consumption for power generation.

Total fuel consumed by GPA for electricity production in 2012 was 2,722,911 bbl. The projected fuel savings from a 5% reduction in electricity consumption is thus:

2,722,911 bbl * 0.05 = 136,146 bbl

To calculate the dollar value of the fuel savings:

The weighted average cost of fuel is calculated using the following information provided by GPA. The weighting of each fuel is calculated as the percentage of individual fuel type relative to the total barrels of oil purchased.

High Sulfur RFO: 70.83%

Low Sulfur RFO: 26.96%

Ultra Low Sulfur Diesel: 2.21%

The weighted average cost (C_w) is then calculated as:

C_w = ($110.37*0.7083) + ($106.39*0.2696) + ($151.07*0.0221)

= $110.20/bbl

The fuel cost savings (rounded to the nearest dollar) is calculated using the projected fuel savings and the weighted average cost of fuel for 2012:

136,146 bbl * $110.20/bbl = $15,003,289

Glossary of Energy Management and Energy Efficiency Concepts

Demand-side management (DSM) — Actions undertaken by a utility to change the level or timing of energy use on the customer side of the electricity meter, generally with the intention of optimizing existing and planned generation and transmission assets on the utility side of the meter. It encompasses utility-initiated actions to improve energy efficiency, increase energy conservation, and reduce peak electricity demand. Examples include rebates, incentives and utility investments that improve building shell insulation and the efficiency of heating and cooling systems, and rate structures that shift demand from times of peak energy use to off-peak hours.

DSM includes other load management approaches, such as direct load control systems that enable the grid operator to regulate the electricity used by individual appliances or equipment on customer premises (usually residences), and contractual arrangements that allow the utility to reduce demand by specific customers (usually businesses) through direct action by the grid operator (remote tripping) or by the customer voluntarily taking action to reduce demand when requested by the grid operator.

DSM is sometimes defined to include utility incentives to encourage electricity generation by customers, because it reduces the need for the utility to invest in power plants or transmission and distribution networks. This definition of DSM includes solar photovoltaic (PV) or other distributed generation systems installed on a customer's property, but does not include PV or other distributed generators installed on the transmission or distribution grid.

DSM refers only to energy and load-shape modifying activities that are undertaken in response to utility- administered programs, such as a utility incentive to customers, encouraging them to buy more energy- efficient light bulbs. It does not refer to changes arising from normal operation of the market (such as the independent decision by a customer to buy such light bulbs because electricity is expensive) or from government-mandated energy efficiency standards.

Energy conservation — The process of using less energy by reducing or going without a service. Energy conservation typically requires a change in behavior or not using an existing technology, e.g., turning off a light, using the stairs instead of taking the elevator, or turning up the thermostat on an air conditioner. Popular approaches to accomplishing energy conservation goals include: (1) educating people about how to conserve energy, and (2) implementing non-energy-consuming technologies such as cool roofs, which reduce the need for air conditioning.

Energy efficiency — The process of using less energy to provide the same service, or using the same amount of energy to provide more services. Energy efficiency typically requires the use of a different energy technology or using existing technology in a different way. For example, a compact fluorescent light (CFL) or light-emitting diode (LED) bulb is more energy efficient than a traditional tungsten incandescent light bulb because it produces the same amount of light (measured in lumens) using significantly less electrical energy.

Energy Saving Performance Contacts — An agreement between a building or facility owner or occupant and a performance contractor. The contractor identifies, designs, and installs energy conservation measures (ECMs) and guarantees their performance.

Under performance contracts, financing is often arranged by the contractor. As an option, the building owner or a third party may provide financing. Performance contracts also can incorporate utility incentives or government subsidies that may reduce the total cost of the project.

The term of a performance contract commonly ranges from 5 to 10 years for a simple project. The term can extend to 20 years or more for larger projects. The term should not exceed the expected useful life of any of the upgraded systems. Contracts normally have buyout provisions should the facility owner wish to terminate the agreement early.

Supply-side management — Refers to the practice of electric utilities building generating plants to serve whatever demand customers require. This practice was the norm until the 1970s.

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2023 UPDATE

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