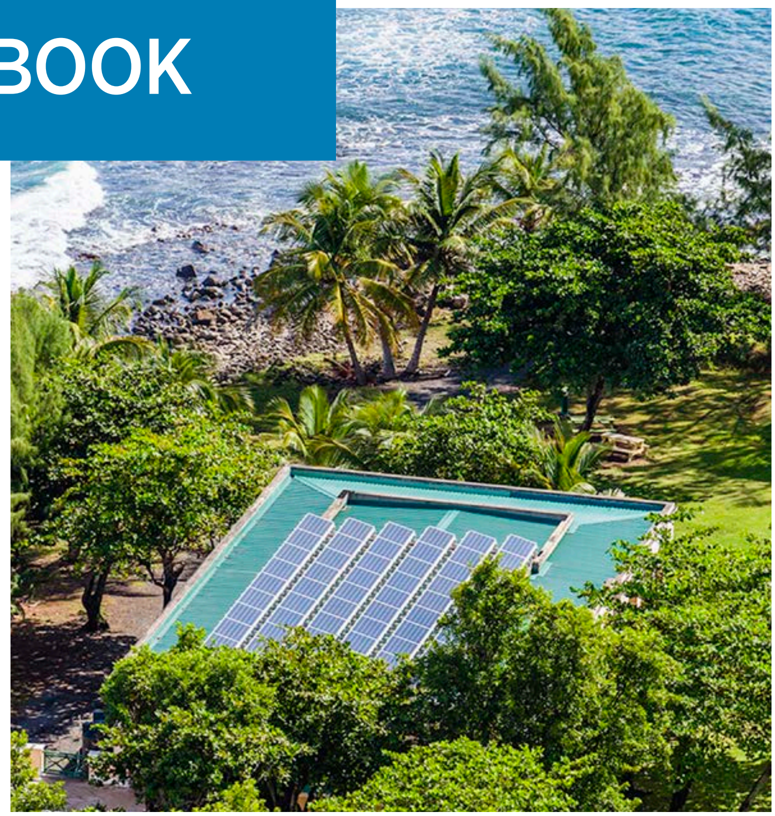
ENERGY TRANSITION INITIATIVE

Islands

PLAYBOOK



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ACRONYMS AND ABBREVIATIONS

APEC	Asia-Pacific Economic Corporation
CDC	U.S. Centers for Disease Control and Prevention
DBEDT	Department of Business, Economic Development, and Tourism
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
EDIN	Energy Development in Island Nations
EERE	Office of Energy Efficiency and Renewable Energy
EM&V	efficiency monitoring and verification
ESPC	energy savings performance contract
GAO	U.S. Government Accountability Office
GP	government procedure
HCEI	Hawai'i Clean Energy Initiative
HECO	Hawai'ian Electric Company
HSIS	Hawai'i Solar Integration Study
ICLEI	International Council for Local Environmental Initiatives
IRP	integrated resource plan
ISO	International Organization for Standardization
KIUC	Kaua'i Island Utility Cooperative
kW	kilowatt
kWh	kilowatt-hour
LEED	Leadership in Energy & Environmental Design
MTR	minimum technical requirement
MW	megawatt
NREL	National Renewable Energy Laboratory
O&M	operations and maintenance
OECD	Organization for Economic Co-Operation and Development
OPM	U.S. Office of Personnel Management
PPA	power purchase agreement
PREPA	Puerto Rico Electric Power Authority
PV	photovoltaic
RACI	Responsible-Accountable-Consulted-Informed
RFP	request for proposals
SWH	solar water heater, solar water heating
SWOT	Strengths-Weaknesses-Opportunities-Threats
UDS	U.S. dollars
USVI	U.S. Virgin Islands
TRC	technical review committee
VIEO	Virgin Islands Energy Office
WAPA	Virgin Islands Water and Power Authority
WTE	waste-to-energy

INTRODUCTION

The Islands Playbook (the Playbook) provides an action-oriented guide to successfully initiating, planning, and completing a transition to an energy system that primarily relies on local resources to eliminate a dependence on one or two imported fuels. It is intended to serve as a readily available framework that any community can adapt to organize its own energy transition effort.

Along with describing the steps on the path toward a comprehensive energy transition, the Playbook includes lessons learned from efforts undertaken by Hawai‘i, the U.S. Virgin Islands, and other—primarily island—communities who recognized that single sources of fuel unnecessarily constrained their ability to realize sustainability, economic development, and other goals. These lessons learned underscore that success is attainable, and hopefully provide others with the confidence to act to set and achieve their own goals.

The Playbook also includes templates and blank worksheets for some of the activities described, which can be copied or distributed electronically when needed. These are designed, as is much of the Playbook, to organize an ongoing, constructive dialogue about a community's energy future and how to make that future a reality. Because these efforts will evolve over time, more resources and more lessons learned will be added to support the long-term pursuit of local, sustainable resources to diversify a community's energy portfolio.

We anticipate that the first additions will result from joint efforts undertaken by the U.S. Department of Energy,[1] the Rocky Mountain Institute, and the Carbon War Room,[2] to support energy transition efforts in the Caribbean.

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[1] This document was made possible through the leadership and support of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.

[2] The Carbon War Room will also be using the Playbook as the implementation strategy for its *Ten Island Challenge*.

PHASE 0: COMMITTING TO AN ENERGY TRANSITION

Transitioning away from a dependence on imported fossil fuels will require leadership and commitment by various parts of the community. To begin, a group of community leaders—such as utility managers and local officials—must express their commitment to the public and to potential investors. With an expression of commitment, the challenge then becomes selecting a path, rather than whether the transition is possible at all.

Phase 0 Describes How To:

- ☐ 0.1 Compile a List of Energy Opportunities
- ☐ 0.2 Identify Decision Makers and Resources
- ☐ 0.3 Convene Decision Makers for Initial Discussions
- ☐ 0.4 Record the Transition Commitment in a Written Document

0.1 Compile a List of Energy Opportunities

There may be many compelling reasons to transition from reliance on imported fuels. Clearly articulating them will facilitate initial conversations and inspire community leaders to commit to the change. Energy opportunities will evolve over time—and as more people join the conversation—so they should resonate with key decision makers and should be informed by readily available energy data, such as prices, fuel mixes, and current analyses of the energy system.

Possible Energy Opportunities (illustrative, not comprehensive)

Reduce wasted energy	Lower greenhouse gas emissions
Increase predictability of energy costs	Minimize water use in energy
Diversify fuel mix	Enhance use of local resources
Lower residential energy bills	Improve customer participation in markets
Attract private investment	

0.2 Identify Decision Makers and Resources

The entire community stands to benefit from the transition, and success will require input and participation from many stakeholders—individuals, private and public sector organizations, and utilities. At this early stage, an initial stakeholder list should focus on decision makers who are key to launching the transition, and the resources they may have or need to do so.

As the stakeholder list grows to identify all parties active in the local energy market—including consultants and international organizations—possible teams and available resources that may help implement the transition will take shape. With broader participation come more talent and resources, which facilitate success.

Sample Stakeholder Matrix

Name	Role in Transition	Impact on Transition	Interest in Transition	Engagement Required

Illustrative only. The full worksheet on page 0-7 can be adapted to suit different needs.

0.3 Convene Decision Makers for Initial Discussion

After identifying which energy opportunities to pursue and which stakeholders will be involved at the beginning of the transition, it is time to start the dialogue about leading it. It can be beneficial to have a credible third party—such as a nongovernmental organization that does not stand to gain financially or politically—assist in convening meetings because its representatives may be perceived as neutral experts.

The result of early conversations should be obtaining support from key stakeholders to begin Phase 1, and identifying parties willing to demonstrate their leadership in the transition. These conversations can also begin to identify aspects of the vision that will take shape in Phase 1.

0.4 Record Commitment in a Written Document

Because an energy transition is a significant undertaking, it may be beneficial for key stakeholders to demonstrate their commitment to the effort in a written document such as a memorandum of understanding or partnership agreement. This document can describe the level of commitment necessary to undertake the transition, expectations about roles and responsibilities, and broader participation in the effort.

0.5 Phase 0 Resources

Lessons Learned

- U.S. Virgin Islands Leadership Embraces Inclusiveness to Ensure Community Ownership of Clean Energy Vision

Worksheet

- Stakeholder Engagement Register

Template

- Donor Coordination Matrix
- Memorandum of Understanding

Information Resources

LESSONS LEARNED

U.S. Virgin Islands Leadership Embraces Inclusiveness to Ensure Community Ownership of Clean Energy Vision

More than 25 government leaders, energy office officials, and utility company executives from the USVI attended a workshop at NREL in Golden, Colorado, in February 2010. *Photo by Adam Warren, NREL*

Getting the Right People in the Room at the Outset

Getting the right people in the room is critical to ensuring buy-in from key stakeholders when setting the vision for an energy project or initiative. Like many island communities, the U.S. Virgin Islands (USVI) was almost 100% dependent on imported oil for electricity, water desalinization, and transportation in 2009. USVI electricity costs were nearly four times the U.S. national average.

Part of the Energy Development in Island Nations (EDIN) initiative, the USVI pilot project launched in late 2009 as a collaborative effort led by the U.S. Department of Energy (DOE), the U.S. Department of Interior (DOI), the USVI government, the Virgin Islands Energy Office (VIEO), and the Virgin Islands Water and Power Authority (WAPA).

At the inaugural EDIN-USVI workshop in February 2010, USVI Gov. John P. de Jongh Jr. announced his goal to reduce the territory's dependence on fossil fuel 60% by 2025. The next step was to form the project's leadership team and bring together key stakeholders to establish a vision for the USVI's clean energy future.

Challenge

After Gov. de Jongh announced the USVI's clean energy goal, the first challenge—and critical first step—was to charter and empower an effective leadership team for the project. The partners and stakeholders had different priorities and agendas, but each needed to be represented on the leadership team because each had expertise, resources, capacities, and capabilities that were essential to advancing the governor's goals. The leadership team also needed to include a local energy champion with the influence, charisma, and insights to achieve buy-in for the project.

Gov. John P. de Jongh Jr. at the EDIN-USVI Energy Workshop held at NREL in February 2010. *Photo by Rebecca Ottaway, NREL 18597*

Once the leadership team was in place, the next challenge was organizing the first locally held EDIN-USVI planning workshop to get the right people in the room to set the vision. Because the territory had a history of unsuccessful government initiatives and poorly planned and executed renewable energy projects, the leadership team faced a fair amount of skepticism and apathy in engaging key stakeholders and persuading them to participate in the workshop.

> "We must—together—embrace the challenge of transforming our community and the underpinnings of our economy to build the future that we need and must reach, not just for ourselves, but, more importantly, for our children."
>
> —Gov. John P. de Jongh Jr.

Although the leadership team agreed in principle about inclusiveness as an ideal, it wrestled with how many people to invite to the workshop—and whom. The first day would be geared toward teeing up the project, whereas the second day would be highly interactive, with its primary goals to form steering committees and set the vision. Because energy was a major pain point in the territory, the leadership team expected strong voices of opposition among the key stakeholders, and knew this would pose challenges to doing the work and controlling the public message.

The leadership team needed to strike a balance between including a broad set of public and private stakeholders with diverse interests and perspectives, and maintaining a manageable number of participants to allow work to be accomplished.

Solution

The governor's office appointed VIEO Director Bevan Smith and WAPA Chief Executive Officer Hugo Hodge Jr. to co-lead the project with the support of a steering committee composed of DOE and National Renewable Energy Laboratory (NREL) representatives and Basil Ottley with DOI. Despite representing diverse interests and agendas related to energy transformation, this core group was tasked with developing and implementing a plan for achieving the governor's goal.

Ottley, a former USVI senator, was well-positioned to serve as the project's local energy champion because of his deep roots and strong connections in the territory, lack of ties to any political administration, and keen understanding of the issues, needs, and challenges. These attributes, combined with his infectious enthusiasm for the project, made Ottley a valuable asset in identifying and engaging key stakeholders to participate in the early planning process. Along with other locally based members of the leadership team, he reached out to the various stakeholders to rally their support and motivate them to participate in the first USVI planning workshop.

While Ottley was key to gaining local support, DOE brought to the table unbiased technical expertise in renewable energy and energy efficiency. DOE would be critical to ensuring that the proposed technical solutions best used USVI's natural resources while meeting the goal.

The steering committee members tapped in to their organizations' public affairs and communications staffs to assist with the stakeholder engagement effort. In the end, the committee invited a diverse mix of public and private stakeholders—potential opponents included—ranging from legislators and government administrators to activists, educators, and local business leaders. Among the individuals and groups represented were:

- The USVI senate
- Government agencies (regulatory and permitting, housing, transportation, tourism)
- Chambers of Commerce
- Local tourism groups and hotel owners
- Community activists and advocacy groups (St. Croix Environmental Association, AARP, etc.)
- Local solar installers
- Real estate developers
- Energy service companies
- University students and staff.

USVI Organization Chart

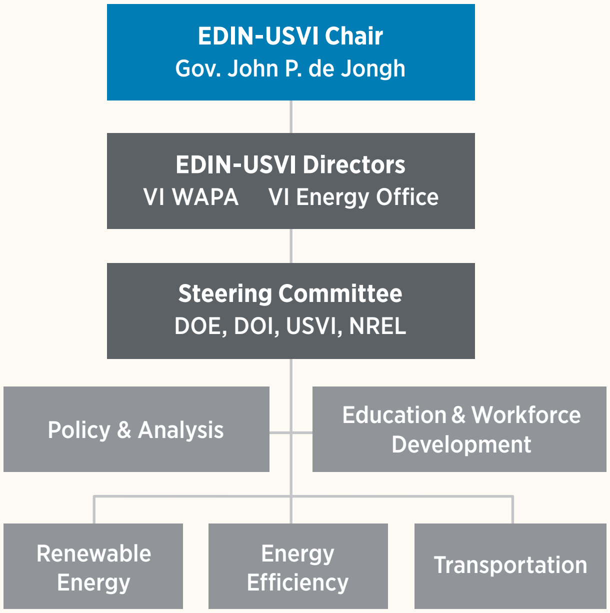


Illustration by NREL

Leadership Roles and Responsibilities

To achieve a clean energy vision goal, it is important to determine who will lead the effort and clearly define roles and responsibilities. In the USVI, three groups led the effort:

- Leadership team
- Steering committee
- Working groups.

Leadership Team

The USVI leadership team included executives from the governor's energy office and the utility.

Steering Committee

Representatives from partner organizations DOE, DOI, and NREL comprised the USVI steering committee. The group was tasked with developing and implementing a plan for achieving the goal, which it achieved by organizing the inaugural strategic energy planning workshop that led to the development of the USVI Energy Road Map.[1]

Working Groups

The USVI working groups were composed of many public and private stakeholders, who focused on five key areas: energy efficiency, renewable energy, transportation, education and workforce development, and policy and analysis. They began in the planning phase by developing a set of task-related initiatives to be considered. Next, they performed detailed analyses to identify the mix of energy efficiency and renewable energy that would enable the USVI to achieve its goal. They used the data gathered during the assessment phase to develop the USVI Energy Road Map.

To allow for open discussion, the workshop was closed to the media but a press conference immediately followed the event.

The initial planning workshop was held at the University of the Virgin Islands St. Thomas campus in June 2010. Of the 100 people invited to participate in the two-day workshop, approximately 60 attended. The USVI vision-setting exercise benefited from input from attendees who were essential or highly motivated, as well as from public and private stakeholders who were eager to do the work. It led to the development of five working groups to execute data gathering and to identify the necessary tactics and strategies to achieve the vision.

Key Takeaways

The USVI project demonstrates that an inclusive approach at the outset, with champions from the community and in the executive level of government, is important because successful energy transformation requires buy-in—not just from the local government, but from the entire community.

Identifying whom to include, inviting them to participate, and motivating them to contribute to the process are common challenges for those leading a community energy planning process, because energy transformation involves overcoming apathy and skepticism, and changing the status quo. It also involves

[1] Available at *http://energy.gov/eere/downloads/usvi-energy-road-map-charting-course-clean-energy-future-brochure-edin-energy*.

stakeholders—with vastly different viewpoints and agendas—coming together to reach a consensus about a vision for the project or initiative.

Overcoming apathy is challenging because it involves changing deep-seated attitudes and beliefs that are often rooted in cultural and societal norms and/or spawned by community experience. Likewise, changing the status quo is a significant barrier to success. Any threat to the established order carries with it an element of social, political, and economic risk, and thus there are bound to be people who resist change for a variety of reasons.

Finally, bringing together people with divergent perspectives and agendas—social, political, and economic—to shape a common vision is always an uphill climb. At this stage, it is important to recognize that although some individuals and groups will already have an understanding of and a vested interest in defining a sustainable energy future, others may not yet be engaged in the conversation or moved to action.

Key lessons learned for setting the USVI clean energy vision include:

- Obtain executive sponsorship of the vision from public and private leadership.
- Form a public-private partnership to achieve aspirational goals. The public sector cannot establish a vision for energy transformation in a vacuum.
- Engage a broad cross-section of local stakeholders—even naysayers—to reach a consensus and secure community buy-in on the project.
- Identify and involve local energy champions throughout the process to pinpoint challenges and gather successes.

In the USVI, involving a broad cross-section of public and private stakeholders—potential opponents included—in setting the vision created an opportunity for civil discourse that was critical to the project's long-term success. Although inclusiveness was not necessarily the easiest path, it proved an effective strategy for securing a sense of community ownership and brought all the benefits of transparency to the process. Involving detractors in the early planning stages gave project proponents a chance to understand and assess barriers to project success, address opposing views, assuage objections through thoughtful and reasoned arguments backed by hard data, and ultimately reach a consensus.

Finally, identifying a local energy champion was a critical piece of the puzzle. Involving a respected and well-connected community leader helped establish credibility for the project locally. Furthermore, the right person in this role can generate excitement and optimism, motivate key stakeholders, and rally grassroots support throughout the project.

Worksheet: Stakeholder Engagement Register

Name	Role in Transition	Impact on Transition	Interest in Transition	Engagement Required

Template: Donor Coordination Matrix

Donor Name	Project Scope and Name	Project Partners and Consultants	Timeline (Start & End)	Funding Amount	Point(s) of Contact

Template: Memorandum of Understanding

MEMORANDUM OF UNDERSTANDING

BETWEEN

[NATION]

AND

[COUNTERPARTY]

I. Background

The [INSERT ISLAND NATION] recognizes that reducing its dependence on imported oil is a primary pathway toward achieving energy independence and a cleaner environment. [NATION] is now embarking on the next phase of its clean energy future to drive economic vitality and growth through building the innovation sector and providing sustaining opportunities for job growth.

By taking action to transition from oil imports to use of local, indigenous renewable resources and efficient technologies, the [NATION] and the [COUNTERPARTY] are developing pathways for job creation, industrial transformation, environmental compliance, and technological innovation.

In [YEAR], [NATION] took the first steps to transitioning its energy system away from a dependence on imported oil. [NATION] recognizes the value of setting a long-term vision, and recognizes the role of [COUNTERPARTY] in convening the broad set of stakeholders necessary to set that vision and assess the pathways to realize that vision. [NATION] also recognizes the value of leveraging resources, knowledge, and experience of [COUNTERPARTY] in a shared commitment for the deployment of renewable energy, energy efficiency, and alternative transportation technologies, and promoting various opportunities to pursue innovative, tailored energy solutions.

II. Purpose

[NATION] and [COUNTERPARTY] (collectively referred to as “the Parties”) will enter into this Memorandum of Understanding (“MOU”) to set a vision, articulate pathways to realize that vision, promote effective collaboration, and prepare [NATION] to successfully complete the transition of its energy system. This includes jointly pursuing innovative policies, technologies, deployment strategies, and financing approaches relating to, without limitation: energy efficiency; renewable energy; alternate fuels; electric transmission and distribution systems; energy storage; alternative fuel vehicles; and other forms of clean transportation.

The successful execution of the purpose of the MOU will position [NATION] to focus on local energy resources, including efficiency, ensure continued long-term investment in its energy sector and achieve energy autonomy and sustainability.

III. Roles of the Parties

The Parties hereby agree that they will undertake, subject to Section IV and to the extent permitted by applicable law, the following activities under the MOU:

A. Parties Collectively

The Parties will endeavor to:

1. Agree on near- and medium-term opportunities for collaboration to achieve the [NATION] goal of [INSERT ONE TO THREE GOALS], in order to eliminate the State's reliance on imported oil;
2. Act, in support of one another and in concert when appropriate, to realize the benefits of the opportunities identified in (A)(1);
3. Designate Points of Contact ("POCs") for undertaking activities in concert and for consultation regarding activities relevant to the MOU undertaken individually; and
4. Support and promote communications and awareness campaigns to inform consumers, businesses, and major stakeholders in [NATION] of the goals and benefits of this Partnership.

B. [COUNTERPARTY]

The [COUNTERPARTY] will endeavor to:

1. Identify available resources that could further the purpose of the MOU, and work with the State to make appropriate use of those resources;
2. Provide technical assistance relevant to achieving the purpose of the MOU;
3. Assist in convening the national stakeholders that may help achieve the purpose of the MOU, realize the benefits of opportunities identified in (A)(1), and successfully complete the actions contemplated in (A)(2);
4. Ensure that the POCs identified under (A)(3), supra, employ effective communication relating to MOU activities in performance plans or other relevant planning structure; and
5. Designate a lead for each opportunity identified under (A)(1), supra, responsible for working with the POCs to coordinate activities under (A)(2).

C. [NATION]

[NATION] will endeavor to:

1. Develop the technical, workforce and academic tools necessary to realize the purpose of the MOU;
2. Identify, coordinate and maintain collaborative working relationships with key local stakeholders for implementation of the MOU;
3. Identify and lead processes required to fulfill the MOU, including drafting and implementing state and local policies necessary to demonstrate and foster the leadership contemplated by the [YEAR] MOU;
4. Designate a lead for each opportunity identified under (A)(1), supra, responsible for working with the POCs to coordinate activities under (A)(2); and

5. Involve the public, academic community, private sector, and state and local officials in the following:
    a. Shaping and executing the projects, programs and policies under the [YEAR] MOU;
    b. Realizing the benefits of opportunities identified in (A)(1); and
    c. Successfully completing the actions contemplated in (A)(2).

IV. Miscellaneous

A. Termination

1. As a document whose sole and primary purpose is the internal management of the Parties, the MOU may be terminated through written notice by either of the Parties at any time; and
2. Nothing in the MOU can in any way restrict either of the Parties from participating in any activity with any individual or organization, public or private.

B. Fiscal Disclaimers

The MOU shall not:

1. Be construed to impact the procurement or financial activities of the Parties;
2. Be construed to be either a fiscal or a funds obligation document; nor
3. Be construed to intend to obligate the Parties to receive or transfer anything of value, including, without limitation, to expend, exchange, or reimburse funds, services, or supplies.

C. Cause of Action Disclaimers

The MOU shall not:

1. Create a legal obligation of the Parties; nor
2. Create a private right or cause of action for or by any person or entity.

Signatory	Signatory
Print Name	Print Name
Title	Title
Date	Date

Information Resources for Phase 0

These information resources and useful links are illustrative, not comprehensive.

Solar Powering Your Community: A Guide for Local Governments (U.S. Department of Energy [DOE] 2011). DOE developed this comprehensive resource to provide a framework for a comprehensive solar plan for a community by introducing a range of policy and program options.

Sustainability Planning Toolkit (International Council for Local Environmental Initiatives [ICLEI] 2009). This publication provides a starting point to understand the key steps involved in developing or updating a sustainability plan.

The **Communications and Outreach Web Resource** (*http://www.icleiusa.org/action-center/engaging-your-community/outreach-and-communications-guide*) from ICLEI contains an array of steps and methodologies for communication and outreach efforts.

The **Planning Tool Exchange** (*http://www.planningtoolexchange.org*) is an online hub for tools, resources, and organizations in community planning.

PHASE 1:
SETTING THE VISION

The purpose of Phase 1 is to identify the major characteristics of the energy system to which the community will transition. In other words, Phase 1 will establish the principles—such as fuel diversity and price stability—to motivate stakeholders and lay the groundwork for analysis and deployment in Phases 2, 3, and 4.

To accomplish this, the Phase 1 leadership team will collect input from the stakeholders identified in Phase 0, and draft a statement that reflects the shared understanding of the community. In Phase 2, the vision will frame analysis to determine specific pathways to realize this future state.

Phase 1 Describes How To:

- ☐ 1.1 Establish a Leadership Team
- ☐ 1.2 Develop a Vision Statement
- ☐ 1.3 Set a Transition Timeline
- ☐ 1.4 Engage Stakeholders

1.1 Establish a Leadership Team

The Phase 1 leadership team is responsible for convening stakeholders from around the community and compiling their input for the vision. Given the task at hand, a leadership team of three to six energy champions is appropriate, with representation from government, utilities, and the private sector. The team should be empowered to make the necessary decisions to execute the vision.

1.1.1 Draft a Leadership Team Charter

A charter may help the leadership team achieve its purpose in a timely fashion and minimize misunderstandings. The charter should establish general operational criteria, such as a commitment to participate in all meetings and a willingness to listen to each other and consider new ideas. It sets expectations for the team's interactions and responsibilities, and describes how the team will reach decisions. The charter should also outline the process for bringing on new members and replacing departing ones.

1.1.2 Consider a Stakeholder Advisory Board

A stakeholder advisory board can serve a coordinating role for many members of the community with similar interests. During Phase 1, the chair of the advisory board can sit on the leadership team and channel input from the business community and the public.

The stakeholder advisory board can continue to operate in later phases as well, with rotating membership to ensure that different stakeholder groups provide input to the process. Because of its constituencies, the stakeholder advisory board can also be a stabilizing force when there is a change in government administration or utility management.

1.2 Develop a Vision Statement

The vision statement should describe major characteristics of the future energy system and reflect the input from the stakeholders identified in Phase 0. The focus now should be qualitative; quantitative elements come later, in Phase 2. The vision should be aspirational and articulate organizing principles for continued efforts in later phases.

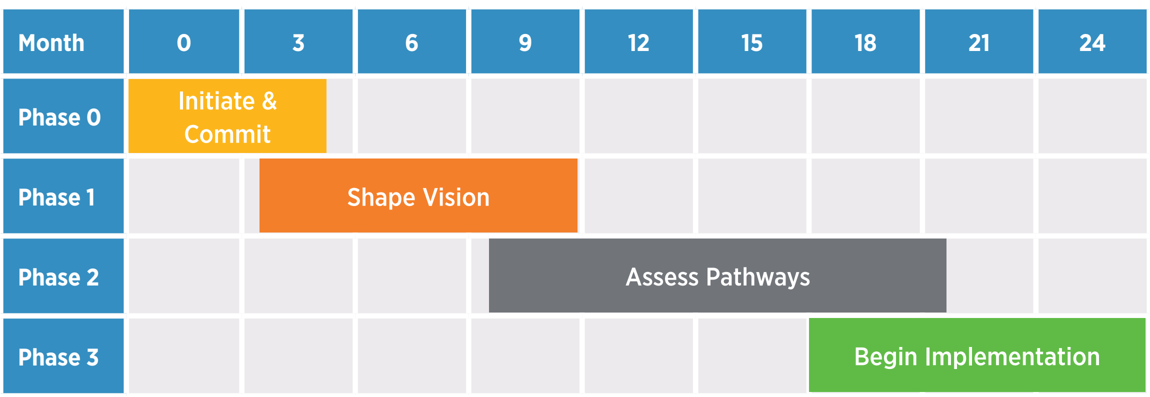
"The energy transition will result in an energy system that prioritizes local resources, such as solar power and energy efficiency, to displace as much imported fuel as possible while lowering costs to consumers and stabilizing prices for businesses."

Sample vision statement

1.3 Set a Transition Timeline

The leadership team should also produce a general timeline for Phases 2 and 3 to accompany the vision statement. The timeline also helps stakeholders manage their participation and their expectations. The time-line should be realistic, but reaffirm a commitment to a concerted effort to realize the vision and transition to a more sustainable energy system.

Illustrative Timeline



1.4 Engage Stakeholders

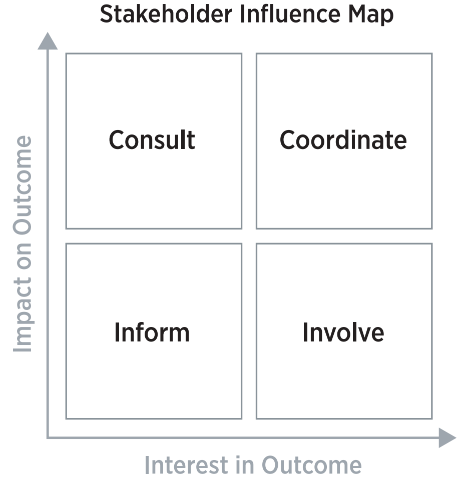
With an articulated vision and a timeline, it is important to engage a broader set of stakeholders to generate interest in the transition and obtain support for the vision. Ultimately, the community will take ownership of the transition, so the team should solicit and incorporate community feedback in Phase 1. Transition projects will have neighbors and customers who may or may not be the same members of the community, and project success or failure may hinge on whether their interests align with the vision. It is equally important for these stakeholders to understand their fundamental role in shaping and realizing the vision.

1.4.1 Identify and Map Stakeholders

The leadership team should build on the stakeholder list from Phase 0 to develop a more complete roster during Phase 1. Based on a stakeholder's impact on and interest in the outcome under consideration, the stakeholder identification process should indicate the type of engagement required, such as:

- **Inform.** Keep the stakeholder apprised of developments and progress.
- **Involve.** Invite the stakeholder to participate in certain activities, such as meetings or outreach that touch on the stakeholder's interest in the outcome.

Stakeholder Influence Map



- **Consult.** Regularly and actively seek support for and feedback on how best to achieve upcoming goals.
- **Closely coordinate.** Establish an ongoing relationship regarding all aspects of the transition, ranging from day-to-day operations to timing significant milestones.

In addition to compiling a list, the leadership team may find it helpful to visualize it with a stakeholder map. This visualization can allow the leadership team and others to more easily evaluate the stakeholder "landscape" within the entire community, individual sectors, or for specific issues.

1.4.2 Shape a Communications Plan

As part of setting the vision, the leadership team should integrate a communications strategy to keep the community informed of the progress toward realizing the vision. Communications about the transition help prevent misunderstandings about its purpose, build momentum in the community toward a successful outcome, and can maintain morale among participants by recognizing their contributions.

The communications strategy can be based on milestones, such as finalizing the vision statement, ribbon cuttings, and issuing requests for proposals. To reach different segments of the community, communications should make use of a variety of media and messengers, such as the traditional press, social media from the government, or endorsements from well-regarded individuals.

1.5 Phase 1 Resources

Lessons Learned

- Hawai‘i Establishes Goal of Achieving 70% Clean Energy by 2030
- Working Groups Collaborate on U.S. Virgin Islands' Clean Energy Vision and Road Map

Worksheet

- Stakeholder Matrix

Information Resources

LESSONS LEARNED

Hawaiʻi Establishes Goal of Achieving 70% Clean Energy by 2030

Hawaiʻi's clean energy goal—70% by 2030—can be considered the most aggressive state goal in the United States, setting a bold example for other states and other islands around the world. Since 2008, when the state entered into a partnership with the U.S. Department of Energy (DOE) to launch the Hawaiʻi Clean Energy Initiative (HCEI), Hawaiʻi has been a leader in the demonstration of renewable energy technologies and integrating a large amount of renewable capacity into the grid.

Challenge

Recognizing that one of the barriers to success is lack of stakeholder engagement and community buy-in, a series of working groups were formed two months after the HCEI agreement was signed between the state of Hawaiʻi and DOE. Their purpose was to examine various energy scenarios and develop a roadmap for meeting the clean energy goal. The working groups were composed of a variety of stakeholders, including federal and local governments, not-for-profit organizations, private sector companies, trade associations, and academic organizations.

> "We need every Hawaiʻi citizen to be personally energy aware and feel responsible for contributing in some way to solving our energy problems. Many of the best contributions are low or no cost, involving changes in behavior and attitudes."
>
> —Ray Starling, Program Director, Hawaiʻi Energy

The working groups assumed responsibility for assessing pathways in four energy sectors: electricity (generation and delivery), end-use efficiency, transportation, and fuels. Each working group gathered information from multiple perspectives across the state. Each group then analyzed and refined that information, commonly focusing on policy and regulatory change, project development, outreach and education, and overall planning and management.

Solution

An HCEI steering committee was formed to coordinate interactions between the four working groups and to ensure that they formulated a comprehensive strategy. The information gathered by the working groups was shared with a wider audience throughout the state and feedback was incorporated into the process for use in improving decision-making and developing the HCEI Road Map.

One of the major outputs from the working group process was a scenario or "wedge" analysis—delivered in partnership with Booz Allen Hamilton—that described how 70% clean energy could be achieved by activities in sectors covered by the four working groups. The wedge analysis formed the basis of much of the additional follow-on work assessing pathways, and was the first of many studies on behalf of the working groups.

The overall vision adopted by the state of Hawaiʻi in moving its energy infrastructure to a more sustainable path was based on a three-part planning process:

- Identify key sectors of the energy economy.
- Set clean energy goals in each sector.
- Create multifaceted critical strategies to attain sector goals.

HCEI Energy Sectors and Goals

Energy Sector	Strategies	2030 Goals
Electricity (Generation and Delivery)	• Align electricity regulatory and policy framework with clean energy goals • Increase certainty in the process for developing new renewable energy • Deploy renewable generation and grid infrastructure • Explore next generation technologies/new applications of existing technologies	Renewable Portfolio Standard: 40% of delivered MWh renewable energy
End Use Efficiency	• Align efficiency regulatory and policy framework with clean energy goals • Retrofit residential and commercial existing buildings • Strengthen new construction policies/building codes • Identify non-building related energy efficiency measures	Energy Efficiency Portfolio Standard: 4,300 MWh reduced
Transportation	• Improve standard vehicle efficiency of fleet • Reduce vehicle miles traveled • Incorporate renewable fuels into transportation sector • Accelerate the deployment of electric vehicles and related infrastructure	Reduce petroleum used for ground transportation by 70%*
Fuels	• Evaluate local agricultural industry and support its development • Invest in key infrastructure at scale • Evaluate and develop renewable fuel processing infrastructure • Match potential fuels supply to sources of in-state demand	Meet as much of in-state demand for renewable fuels as is feasible

*HCEI will develop an expanded understanding of the needs of the large buyers in the aviation and defense sector. In the future, marine and aviation biofuel alternatives may be substituted to help meet the goal by displacing the equivalent of 70% of ground transportation demand with non-fossil fuels.

Key Takeaways

HCEI's process is a useful example for others to follow because it engaged from the onset a wide variety of key stakeholders through focused working groups, involved the public in the planning and decision making process, and laid the foundation to make informed decisions about the path to success. With multifaceted analysis, HCEI provided the necessary information to help increase the state's economic and energy security, demonstrate innovations, and develop the workforce of the future.

Governing Frameworks Encourage Active Stakeholder Engagement in HCEI

The Hawai‘i Department of Business, Economic Development, and Tourism (DBEDT), with the input of DOE, has shaped two different “governing” frameworks for HCEI. In the beginning of HCEI and early in Hawai‘i’s energy transition, DOE was positioned to act more as a co-lead to establish momentum behind the initiative, but critical roles for other stakeholders developed as HCEI evolved over five years.

The second HCEI structure involves four elements: (1) a management team; (2) an advisory board; (3) ad hoc issue-oriented teams, called ‘strike teams’ by HCEI; and (4) external stakeholders. The core management team involves primarily government agencies that address different aspects of energy policy, representing economic development, regulation, and consumer issues. The advisory board gives key stakeholders a very strong leadership role in HCEI, and includes, but is not limited to utilities, project developers, nonprofits, and the university. These two groups will convene external stakeholders at least twice a year, in addition to regular meetings. This consultative process will maintain momentum for HCEI, and allow the management team to address the priorities of stakeholders in a timely fashion.

In order to provide the analysis and solutions to address those priorities, ‘strike teams’ will be formed as needed and disbanded when its results are reported to the management team and advisory board. Each strike team may include a member of the DBEDT State Energy Office, or other relevant agency, to facilitate coordination and accountability back to achieving Hawai‘i’s clean energy goals.

By introducing a degree of formality to the process, Hawai‘i can focus on action while ensuring that expectations are clear, roles and responsibilities are defined, and that all of Hawai‘i can actively participate in the transition.

LESSONS LEARNED

Working Groups Collaborate on U.S. Virgin Islands Clean Energy Vision and Road Map

The Energy Development in Islands Nations (EDIN)-U.S. Virgin Islands (USVI) pilot project offers a valuable example of how to approach vision and goal setting for an energy project or initiative.

At the inaugural EDIN-USVI workshop in February 2010, USVI Gov. John P. de Jongh Jr. announced his goal to reduce the territory's dependence on fossil fuel 60% by 2025. To define and realize the vision for a clean energy future, the governor put in place a leadership team and steering committee with specific roles and responsibilities. Their first duty was to engage key stakeholders in a series of local energy planning workshops.

A diverse set of stakeholders brainstorming on the vision for the EDIN-USVI project at the first community energy planning meeting, June 2010, University of the Virgin Islands, St. Thomas, USVI. *Photo from Aldeth Lewin, Virgin Islands Daily News*

Challenge

In the first workshop in June 2010, the leadership team and steering committee needed to inform diverse public and private stakeholders about key aspects of the project. Workshop attendees had varying levels of technical knowledge about the USVI's energy profile, clean energy technologies, and potential pathways for achieving the governor's goal of 60% clean energy by 2025. The organizers needed to engage their stakeholders in the process of refining the territory's clean energy vision, setting goals for achieving it, forming consensus about the path forward, and securing community buy-in.

The first challenge the leadership team faced was finding a balance between engaging the community in identifying technology and programmatic pathways to achieving the vision, and not getting so technical that participants became disengaged. The next was in giving the participants insights into the opportunities for achieving the fossil fuel reduction goal, as well as the difficulties and barriers.

In order to facilitate an effective conversation among the diverse stakeholders who represented a broad spectrum of knowledge and perspectives, the leadership team needed to begin with information sharing to help stakeholders with primarily social concerns understand more technical elements, and vice versa. The team needed to present information objectively and examine the issues from all sides, and also needed to create an open environment that invited dialogue and brainstorming. The biggest challenge was securing buy-in and establishing the necessary level of consensus to establish a shared vision and mutually agreed-upon goals for moving the project forward.

Solution

1. Present technical information about USVI energy profile, clean energy technologies, policies, and barriers and opportunities based on initial assessments.
2. Facilitate dialogue that helps stakeholders understand the project opportunities and barriers from the leadership team's perspective, and gives the leadership team insight into the barriers and opportunities from the community's perspective.
3. Form consensus on a shared vision and establish broad goals.
4. Organize an interactive group exercise to lay the groundwork for communicating project vision and goals to the public and generating grassroots support.
5. Task working groups with identifying and implementing specific solutions for achieving energy goals, and assign local stakeholders to co-lead the working group, with technical support from U.S. Department of Energy and National Renewable Energy Laboratory experts.

Key Takeaways

The USVI project demonstrates the importance of sharing key information in a transparent and objective way, facilitating open dialogue between key stakeholders, and exploring project barriers and opportunities from all sides when setting the vision and goals for a clean energy project or initiative. By employing these tactics, the USVI leadership team and steering committee succeeded in bringing together stakeholders with vastly different viewpoints and agendas to form a shared vision and set mutually agreed-upon goals that established a path for achieving energy transformation in the territory.

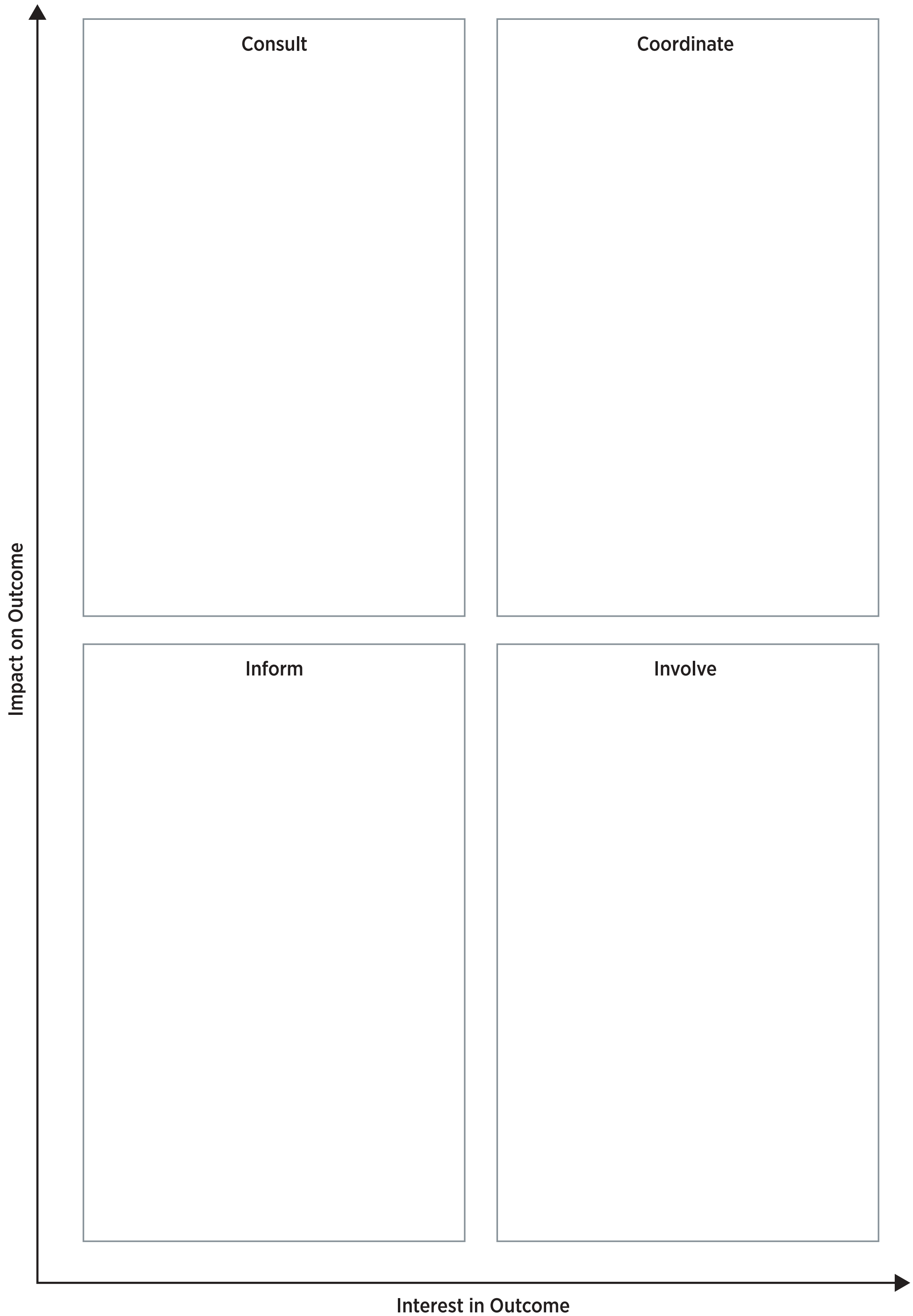
Bringing together people with disparate perspectives and agendas—social, political, and economic—to shape a common vision is always an uphill climb. At this stage, it is important to recognize that although some individuals and groups will already have an understanding of—and a vested interest in—the effort of defining a sustainable energy future, others may not yet be engaged in the conversation or moved to action.

In the USVI, involving a broad cross-section of public and private stakeholders—potential opponents included—in setting the vision created an opportunity for civil discourse that was critical to the project's long-term success. Inclusiveness was not necessarily the easiest path; however, it proved an effective strategy for securing a sense of community ownership. Involving detractors in the early planning stages improved transparency, gave project proponents a chance to understand and assess barriers to project success, addressed opposing views, assuaged objections through thoughtful and reasoned arguments backed by hard data, and ultimately achieved consensus.

Key lessons learned for engaging USVI stakeholders include:

- Obtaining input from stakeholders helps prioritize recommendations based on the community's aspirations.
- Providing objective information about clean energy technologies and hard data about the community's energy landscape, available resources, barriers, and opportunities helps strike a balance between stretching the goal and doing what's technically feasible.
- Developing a communications strategy that conveys the vision, goals, and ways for stakeholders to be engaged lays the groundwork for building grassroots support.

Worksheet: Stakeholder Matrix



Information Resources for Phase 1

These information resources and useful links are illustrative, not comprehensive.

Low-Emission Development Strategies: Technical, Institutional and Policy Lessons (Organization for Economic Co-Operation and Development and International Energy Association 2010). This publication provides country case studies to examine the technical, institutional and policy challenges associated with preparing national climate change strategies.

Reforming Power Markets in Developing Countries: What Have We Learned? (World Bank 2006). This publication uses case studies to assess the suitability of available options for public-private collaboration in the comprehensive reform of energy markets.

The **Community Energy Strategic Planning** Web resource (*http://www1.eere.energy.gov/wip/solutioncenter/strategic_energy_planning_guide.html*) from the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy offers tools and tips on creating a robust strategic energy plan.

The **Dialogue and Deliberation Resource Center** (*http://ncdd.org/rc/beginners-guide*) from the National Coalition on Dialogue and Deliberation collects information on how to organize ongoing conversations to facilitate a shared understanding of change.

The **Energy Literacy Framework** (*http://www1.eere.energy.gov/education/energy_literacy.html*) is an interdisciplinary approach to teaching and learning about energy.

PHASE 2: ASSESSING OPPORTUNITY PATHWAYS

In Phase 2, the leadership team will coordinate analysis of energy solutions to realize the vision from Phase 1. Depending on the vision, the solution sets may go beyond electricity to include transportation energy use, water use, and land use planning.

The purpose of this analysis is to provide the community with options and flexibility. The energy transition cannot be accomplished all at once, and circumstances will develop that will change what constitutes the best next step in the transition. At the end of Phase 2, the community will have assessed possible solutions and refined a few practical pathways to realizing the vision laid out in Phase 1.

Phase 2 Describes How To:

- ☐ 2.1 Detail the Current Energy System
- ☐ 2.2 Compare the Current System with the Vision Statement to Reveal Pathways
- ☐ 2.3 Develop Energy System Plans
- ☐ 2.4 Specify Policy, Market, and Operational Barriers and Enablers to Realizing the Vision

2.1 Detail Current Energy System

To ascertain which changes need to be made to realize the vision, the leadership team must establish an accurate description of the current energy system, relying on technical experts to collect and analyze the best available data. This includes a baseline of supply and demand, the state of energy infrastructure, current energy activities and relationships, and energy resource assessments.

2.1.1 Establish an Energy Baseline

An energy baseline is established by collecting information on energy consumption—by sector and time of year—and energy production, including fuel sources and heat rates. It also includes information about line losses, remaining useful life of assets, common end-use behaviors, and peak loads. Essentially, a baseline includes all the information that explains the current energy system production levels and costs. Compiling and analyzing this information may take some time depending on how much information is available.

2.1.2 Catalogue Current Energy Activities and Institutional Relationships, Including Public-Private Partnerships

With the stakeholder analysis from Phases 0 and 1, the leadership team, or working groups if available, should build a catalogue of current energy activities and institutional relationships. This should include incentive programs, policies, and regulations; bilateral or multilateral development partners; and agencies responsible for permitting new energy projects, including building energy efficiency equipment. The catalogue will be a useful reference for shaping opportunity pathways, and as the resulting new programs and policies are defined.

2.1.3 Conduct Energy Resource Assessments, Including Demand-Side Resources

Resource assessments estimate the technical and economic potential of various energy sources, including energy efficiency. These studies can indicate the relative importance of energy sources and where the most promising initial site-specific analysis could take place, which is useful to shaping opportunity pathways. For example, a resource assessment will provide data necessary for estimating how much wind energy could be incorporated into a given pathway.

2.2 Compare the Current System With the Vision Statement to Reveal Pathways

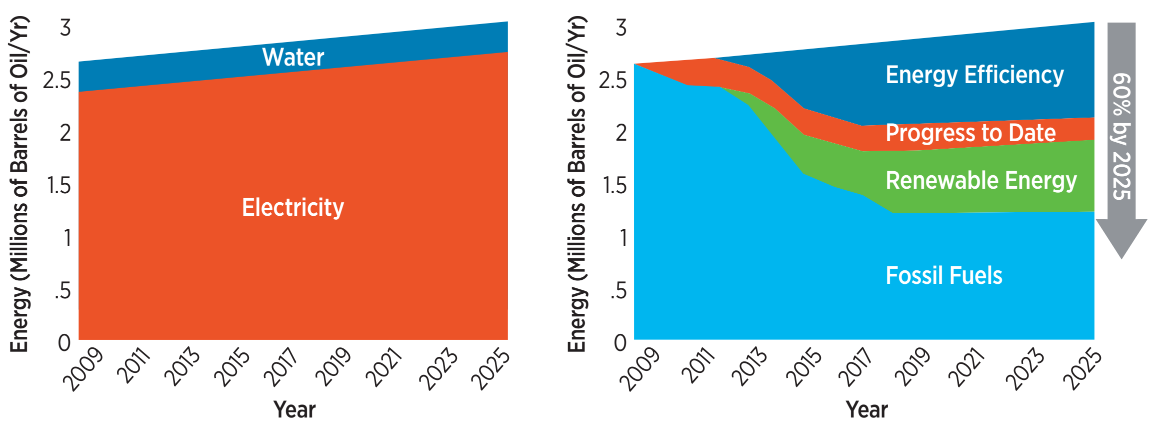
With an accurate profile of the current state of the energy system, the community can measure and quantify the changes that need to be made to realize the vision. This quantification informs overarching numerical targets—such as a 70% reduction in fossil fuel use or deploying clean energy to meet 75% of energy needs—which may add detail to the Phase 1 vision.

A comparison to the baseline also allows the community to identify specific, practical opportunity pathways to realize the vision. For example, if the vision calls for fuel diversity, a comparison with the baseline can show different mixes of fuel conversion, new renewable generation, and efficiency that would eliminate dependency on any one fuel.

2.2.1 Wedge Analysis

A wedge analysis breaks down the total amount of change needed or expected from "business as usual" into the sectors or activities that will drive that change. When shown as a graph similar to the figure below, the different components of change look like wedges. The wedge analysis describes how change will be achieved, and facilitates communication of pathways to stakeholders.

Business As Usual Versus 60% By 2025



2.2.2 Strengths-Weaknesses-Opportunities-Threats Analysis

A Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis is a tool that can help the group explore the factors that will impact the success or failure in meeting the outlined objectives. Typically, the SWOT is compiled into a 2×2 matrix, with strengths and weaknesses describing the characteristics of the people involved and resources at hand, and opportunities and threats describing the external or environmental factors. Beyond simply thinking through these factors, completing a SWOT analysis makes it easier to pair strengths with opportunities, as well as weaknesses with threats, to evaluate the relative merits of pathways from the current energy system to the energy system described in the vision statement. The SWOT framework can also provide structure to stakeholder engagement, with one intended outcome to collect SWOT information from stakeholders for the leadership team to compile.

SWOT Matrix

Strengths	Weaknesses
Opportunities	**Threats**

2.2.3 Critical Path Analysis

Another analytical tool that may aid in the evaluation of pathways between the current system and the vision statement is critical path analysis. While a formal critical path analysis connects all tasks in a given project by their sequence and duration, the basic framework may be applied in Phase 2 to specify the changes and activities that must take place along a given pathway to realize the vision statement.

For example, before building energy use can be reduced, measurements need to be made via an energy audit, and before an audit can be done, a building owner must want an audit and a trained auditor must be available. Also, capable installers and energy-saving equipment must be available. Each of these activities takes time and some must be done in a specific sequence before the objective of reducing building energy use is attained.

2.3 Develop Energy System Plans

No single planning strategy fits all energy transition visions, but all are based on articulating pathways from the baseline to the future energy system as described in the vision statement. Plans that include energy system elements serve to link the Phase 1 vision to the project selection in Phase 3, and inform decisions about near-term investments in human or financial capital. Depending on the planning components, various stakeholders may take ownership of plans or aspects of plans; thus, integrating stakeholder engagement can facilitate timely, comprehensive planning.

2.3.1 Draft an Integrated Resource Plan

The key plan to assessing opportunity pathways is the Integrated Resource Plan (IRP) for the electricity system. The purpose of an IRP is to specify a portfolio of supply and demand resources that balances risks with anticipated costs and benefits, including environmental and social considerations, over the next 15–20 years. The IRP is typically developed by a utility (or utilities) with public input, and guides near-term investment decisions to develop the portfolio.

IRPs are created by comparing the anticipated electricity system needs, costs, and risks in future energy scenarios. The comparisons are made by changing assumptions about costs, benefits, and risks over the next 15–20 years. The government's role is to approve the assumptions, data quality, and the conclusions drawn from them, following thorough review.

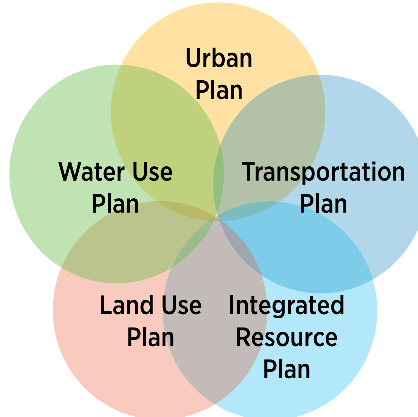
The IRP process involves extensive public participation, data collection, and analysis. IRPs consider all critical components of supply and demand. Some examples include:

- Market segments (e.g., residential, commercial, industrial) and size
- Fuel costs and reliability of supply
- Supply generation and delivery options
- Maintenance and capital investment schedule
- Energy efficiency and demand-side resources
- Legal or regulatory requirements
- Environmental and social objectives.

Although the planning horizon for an IRP is typically 15–20 years, utilities often update an IRP every two to three years to account for changing circumstances.

2.3.2 Complete Other Planning Components as Needed

Similar in principle to integrated resource planning, other planning components that involve energy are intended to estimate the benefits and costs of other courses of action. For transportation, elements related to energy include fueling infrastructure, public transportation, and fleet purchase policies. Land use policies impact siting of new generation assets, and water use plans influence the relative merits of generation technologies. Communities may want to integrate other planning elements into the assessments of energy opportunity pathways in Phase 2.



An energy transition may involve several interrelated plans.

2.4 Specify Policy, Market, and Operational Barriers and Enablers to Realizing the Vision

Now that pathways to realizing the vision have been assessed, the leadership team should identify specific barriers and enablers along those pathways. Barriers are policy, operational, and demand challenges that would prevent or inhibit progress along a particular pathway, such as:

- Initial capital costs
- Unclear permitting requirements
- Utility rate structures
- Lack of consumer awareness
- Inadequate credit or project repayment history
- Misaligned electricity production incentives
- Overlapping governmental responsibilities over energy
- Access to land
- Lack of necessary skills in the workforce.

Enablers, by contrast, facilitate progress along a particular pathway, and can include:

- Political commitment
- Transparent planning and resource allocation decisions
- Support from community leaders
- Public interest
- Experience with public-private partnerships
- Well-trained construction and/or utility workforce
- Capital investments that have been recouped and are ready for replacement
- Specialized university training courses and expertise
- Advanced utility metering and billing infrastructure.

Workers install a 10-kilowatt wind turbine at the St. Croix Reformed Church and Kindshill School in St. Croix. *Photo from Don Buchanan, VIEO, NREL 20418*

It is impossible to accurately describe barriers and enablers to realizing the vision without knowing what changes need to be made.

With possible pathways in mind, these barriers can be assessed for their true impact on a successful transition, and resources can be devoted to addressing these barriers as necessary. Specifying barriers and enablers to pathways is the final step in assessing the relative costs, benefits, and risks between them. The community is ready to begin allocating resources in Phase 3.

The optimal mix of policy and operational changes will depend on local conditions. While it is extremely helpful to examine the policy components of success in other jurisdictions, the combination of policy and operational changes needed in any one place must be tailored to local needs and institutions in order to be most effective. Stakeholders will have valuable input on how to minimize barriers and make use of enablers in order to arrive at the right mix of policy and operational changes.

2.5 Phase 2 Resources

Lessons Learned

- Assessing Pathways in the U.S. Virgin Islands and Hawaiʻi
- High Penetration Solar Distributed Generation Study on Oahu
- Assessing Pathways in Aruba

Worksheet

- Strengths-Weaknesses-Opportunities-Threats Matrix

Sample

- Integrated Resource Plan Objectives

Information Resources

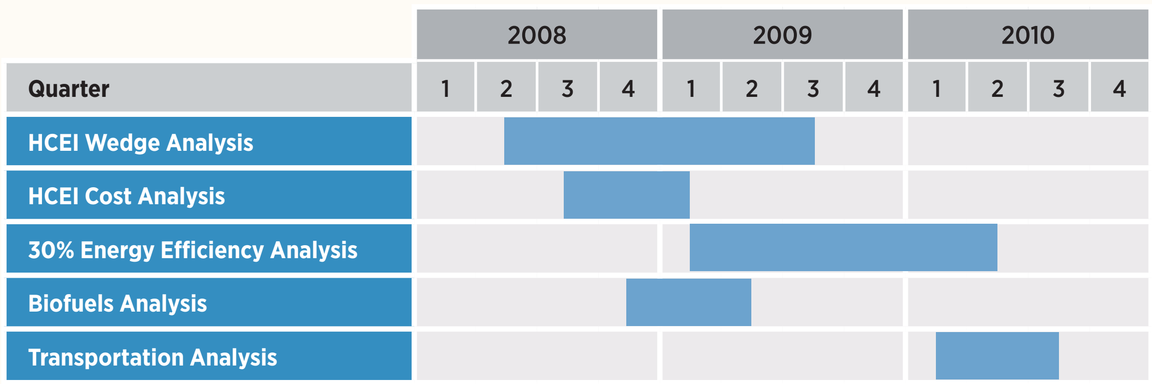
LESSONS LEARNED

Assessing Pathways in the U.S. Virgin Islands and Hawai‘i

Challenge

When setting energy goals, a common challenge is measuring success toward meeting those goals. Establishing an energy baseline enables more informed energy decision-making and provides a way to measure progress toward meeting goals. A key step in developing a road map to meet clean energy goals is determining which energy efficiency and renewable energy technologies the market will support and best use available resources.

Hawai‘i Clean Energy Initiative Scenario Analysis Timeline



Solution

Scenario analyses in the U.S. Virgin Islands (USVI) examined factors such as comparing business as usual versus deploying an aggressive mix of energy efficiency and renewable energy to achieve the territory’s goal of 60% clean energy by 2025. In Hawai‘i, the U.S. Department of Energy (DOE) assisted with various scenarios to achieve the state’s goal of 70% clean energy by 2030. In both instances, the work:

- Facilitated discussion among key stakeholders
- Identified potential policy options and evaluated their impacts on reaching the goal
- Presented possible pathways to attain the goal based on available technologies
- Evaluated capital costs
- Provided technology and market information to help key stakeholders make more informed decisions about next steps
- Conducted feasibility studies to determine which energy efficiency and renewable energy technologies to deploy to meet the goals
- As part of the USVI Energy Road Map, DOE evaluated the cost and energy savings that would be achieved through end-use, residential, and government and business energy efficiency actions. Various renewable energy resources and costs, including solar, wind, biomass, landfill gas, and waste-to-energy were also assessed.

Additional factors that were included in the scenario analysis for the USVI included:

- Grid integration
- Land constraints
- Policy considerations (regulatory processes and building codes)
- Financing issues (up-front versus long-term project development costs)
- Cultural sensitivities (aesthetic concerns and resistance to change).

As in the USVI and Hawai‘i, the data and analyses in Phase 2 are key to charting realistic pathways to transition from the current energy system.

The Energy Mix Needed to Meet USVI’s 60% Clean Energy By 2025 Goal

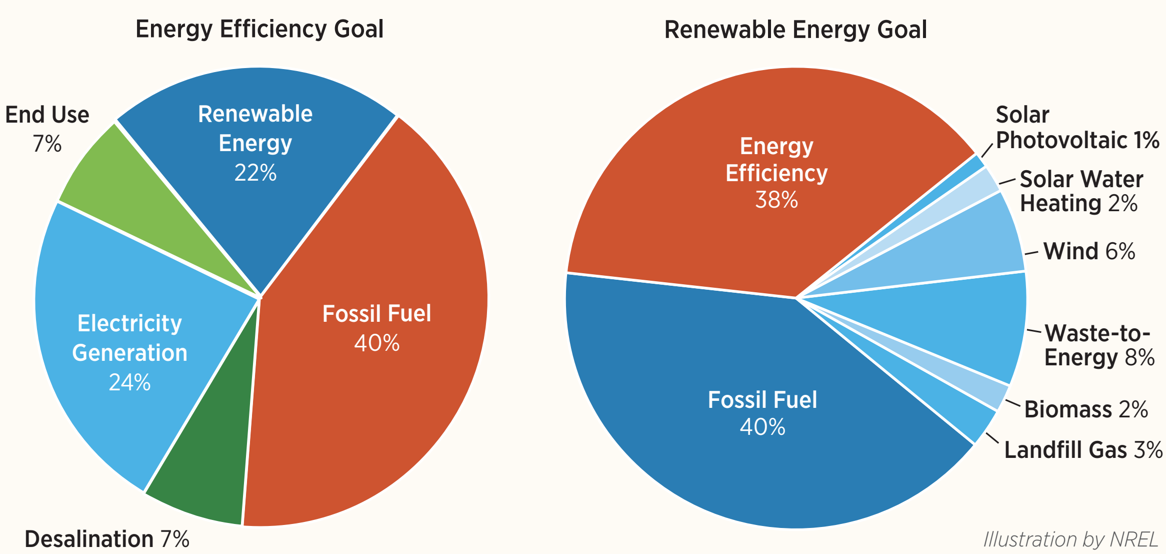


Illustration by NREL

LESSONS LEARNED

High Penetration Solar Distributed Generation Study on Oahu

In 2008, the Hawai‘i Clean Energy Initiative (HCEI) set a goal of reaching 70% clean energy by 2030. In order to complement energy efficiency targets, the state of Hawai‘i developed requirements to generate 40% of its energy from renewable resources by 2030.

In support of HCEI and the 40% renewable resource goal, the U.S. Department of Energy (DOE) and the Hawai‘ian Electric Company (HECO) focused on developing strategies to allow increased photovoltaic (PV) penetration levels on distribution systems, laying the foundation for integrating high levels of distributed PV. These studies relied on the expertise of the National Renewable Energy Laboratory, General Electric, BEW Engineering, and others.

The rooftop solar PV on Hawai‘i's Mauna Lani Bay Hotel generates 75 kW of electricity. *Photo from SunPower, NREL 06430*

Challenge

The main objective of the project was to construct, calibrate, and validate one high penetration renewable generator distribution feeder circuit on Oahu's electricity grid to understand the impact on the entire electric power system.

Solution

To start the effort, the team developed a low-voltage electricity distribution circuit model incorporating high penetration levels (more than 15% of the annual peak load) of PV, including data from the substation to the end-use load as well as PV inverter characteristics. The study expanded upon a previous one by enhancing the model's ability to identify the impact on technical performance and operations on Oahu's electricity grid.

During the course of the study, the team evaluated critical issues and mitigation strategies for achieving increased penetration of PV on the HECO electricity grid, including:

- Levels of PV installation protection schemes and how they were impacted
- Reverse power flow impacts on feeder circuits
- Capacitor operations, load tap changers, and voltage regulation on feeders.

At the conclusion of the study, systems planning improvements and modifications, as well as strategic options for mitigation, were presented to HECO. The identified solutions were also coupled as potential reasons to make changes to interconnection rules such as *HECO–Hawai‘ian Electric Rule No. 14H–Interconnection of Distributed Generating Facilities Operating in Parallel with The Company's Electric System*.

Although the results of the study and final recommendations were valid only for the particular feeder analyzed, the methodology was replicable on other feeders. Thanks to a standardized process detailing the considerations the utility should review—whether at a single site level or a cluster level—future studies can employ the same methodology.

Key Takeaway: Studies Find High Levels of Wind and Solar Attainable

The project discussed here was part of a larger, more comprehensive effort by DOE and the Hawai'ian utilities to identify ways to increase wind and solar penetration across the islands. Two studies were conducted over the course of several years, each reviewing various scenarios.

The Oahu Wind Integration and Transmission Study was meant to help stakeholders, especially the utility and the State, understand the costs and operating impacts of significant amounts of wind power on their island grids, and plan for future transmission to accommodate this power. The Hawai'i Solar Integration Study detailed the effects of high penetrations of solar and wind energy on the technical operations of the Maui and Oahu grids. Because those two islands already had significant wind and solar power feeding their electricity grids, the utilities on each island wanted to understand how to better operate their systems with more renewable and distributed energy. Both studies found that although renewable generation changes grid dynamics, these resources can be successfully integrated with the right approach.

The studies described here helped decision makers anticipate and plan for this high-penetration solar reality. Today, Hawai'i has one of the highest penetrations of distributed solar in the United States with 1 in 10 homes using solar.

Engaging Stakeholders Leads to Better Studies, Integrated Planning

As part of several studies conducted in 2009 that looked at ways to integrate more solar and wind on the Hawai'ian Islands (including the high penetration solar study mentioned here), the HCEI leadership team convened key stakeholders from the beginning of the project. For two studies in particular, the Oahu Wind Integration Study and the Hawai'i Solar Integration Study, a technical review committee (TRC) was developed. TRC members were regional, national, and international technical experts with substantial experience in power systems, renewable energy, direct-current cable systems, island grids, and wind and solar integration. TRC members provided a technical review of each study's methods, assumptions, preliminary results, gaps, overlaps, data needs, and timelines at in-person meetings during each project. Each TRC reviewed the studies and made recommendations, but the Hawai'ian utilities had final decision-making authority for their projects and next steps.

LESSONS LEARNED

Assessing Pathways in Aruba

In 2010, Prime Minister Eman of Aruba expressed an ambitious goal: to transition Aruba to 100% renewable energy by 2020. Aruba offers a valuable example of how to approach vision and goal setting for an energy project or initiative.

Challenge

Strong tourism and growth in the hospitality industry are boosting economic development for the island of Aruba. However, like many islands and remote locations, Aruba must import thousands of barrels of fuel oil per day to sustain its economy. In 2012, Aruba consumed more than 4,000 barrels of oil per day for electricity and water production.

To meet the prime minister's vision of transitioning off fossil fuels by 2020, the Aruban government and the local utility, WEB Aruba, developed an integrated strategy for sustainable, affordable, and reliable energy.

Solution

The first step was to develop an integrated, multisector, sustainable development strategy in collaboration with the private sector, nongovernmental and government organizations, and individuals. Partners that have committed to the project and are helping Aruba realize its vision include the Carbon War Room, Harvard University, former Vice President Al Gore, and Delft University of Technology.

Through the Green Aruba Forum, the Government of Aruba assembled sector-specific teams of technical experts to examine the current status of Aruba's economic sectors responsible for most of the island's fuel consumption, and to offer a range of possible strategies for addressing the key challenges to sustainable growth in those sectors.

The technical teams focused on three sectors—energy, transportation, and the built environment—to identify pressing challenges and potential opportunities. This work included assessments of renewable energy and energy efficiency opportunities, and wind, solar, and storage options.

The teams also pinpointed possible actions that Aruba might take in the near term to realize its vision, and highlighted some opportunities, which include sectors that require long-term planning, as well as an analysis of technologies still under development.

"Our goal is an ambitious one: to increase the social, environmental, and economic resilience of Aruba through an efficient use of natural resources and an implementation of projects that will create and sustain high-quality local jobs for current and future generations. Ultimately, we hope that Aruba will become the model for a low-carbon, sustainable, and prosperous economy that can be replicated in other island nations."

—Aruba Prime Minister Mike Eman

The findings are summarized in the research report, *Smart Growth Pathways: Building a Green Platform for Sustainable Aruba,*[1] which provides an overview of the work that has been done to date by these technical teams to translate Aruba's goals into tangible plans of action.

Aruba has already made significant progress on the path to sustainability. The island's 30-megawatt (MW) Vader Piet wind farm generates approximately 18%[2] of Aruba's annual electricity, and another 24-MW Urirama wind farm is in development. Other planned projects include a 3.5-MW grid-tied solar PV installation at the airport, a waste-to-energy plant, grid storage, and demand response options. Aruba is also electrifying its public transportation sector, with the first electric bus put into service in 2013.

Key Takeaways

An actionable plan is critical to achieving the vision of a sustainable future. For Aruba, and other similar locations, this involves reducing carbon dioxide emissions to open new channels for environmentally sustainable economic growth, creating local job opportunities, and enhancing the health and well-being of the island's residents and visitors.

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[1] Carbon War Room. *http://www.carbonwarroom.com/sites/default/files/reports/CWR_SGP_Download_singless.pdf*.

[2] Source: NuCapital. Accessed Aug. 7, 2014. *http://nucapitalsvcs.com/index.php/projects/27-nuvader-piet-beheer-nv-aruba*.

Worksheet: Strengths-Weaknesses-Opportunities-Threats Matrix

Strengths	Weaknesses

Opportunities	Threats

Sample: Integrated Resource Plan Objectives

Objective	Nature of the Objective
Reliable Electric Service	Serving consumers with minimal disruptions in electric service
Electrification	Providing electric service to those without convenient access to electricity is a common objective in developing countries
Minimize Environmental Impacts	Reducing the impacts of electricity generation (and energy use in general) is a goal that has received increasing attention in recent years. Environmental impacts on the global, regional, and local scales can be considered
Energy Security	Reducing the vulnerability of electricity generation (and the energy sector in general) to disruptions in supply caused by events outside the country
Use of Local Resources	Using more local resources to provide electricity services—including both domestic fuels and domestically manufactured technologies—is of interest in many countries. This objective may overlap with energy security objectives
Diversify Supply	Diversification may entail using several types of generation facilities, different types of fuels and resources, or using fuels from different suppliers
Increase Efficiency	Increasing the efficiency of electricity generation, transmission, distribution and use may be an objective in and of itself
Minimize Costs	Cost minimization is a key impetus for pursuing IRP, and a key objective in planning. The costs to be minimized can be costs to the utility, costs to society as a whole (which may include environmental costs), costs to customers, capital costs, foreign exchange costs, or other costs
Provide Social Benefits	Providing the social benefits of electrification to more people (for example, refrigeration and light for rural health clinics and schools, or light, radio, and television for domestic use). Conversely, social harms, as from relocation of households impacted by power project development, are to be prevented or minimized
Provide Local Employment	Resource choices have different effects upon local employment. IRP objectives can include increasing local employment related to the electricity sector, and increasing employment in the economy at large
Acquire Technology and Expertise	A utility (or country) may wish to use certain types of supply project development in order to acquire expertise in building and using the technologies involved
Retain Flexibility	Developing plans that are flexible enough to be modified when costs, political situations, economic outlook, or other conditions change

Source: *Best Practices Guide: Integrated Resource Planning For Electricity*, U.S. Agency for International Development (2009)

Information Resources for Phase 2

These information resources and useful links are illustrative, not comprehensive.

Baseline Energy Performance of New York State Government Buildings (NY 2013). This report demonstrates how energy baseline information can be collected, analyzed, and presented.

Best Practices Guide: Integrated Resource Planning For Electricity (United States Agency for International Development 2009). This publication provides the analytical framework and methods to execute integrated resource planning.

Best Practices in Electric Utility Integrated Resource Planning (Regulatory Assistance Project 2013). This guide uses case studies to examine different approaches to Integrated Resource Plans (IRPs).

Caribbean Sustainable Energy Roadmap (Caribbean Community Secretariat 2013). This publication provides a comprehensive overview of the regional energy situation, in light of regional priorities on sustainable energy.

Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Intergovernmental Panel on Climate Change 2007). This report describes mitigation options in energy supply, transport, buildings, industry, agriculture, forestry and waste management, with one additional chapter dealing with the cross-sectoral issues.

Encouraging Renewable Energy Development: A Handbook for International Energy Regulators (National Association of Regulatory Utility Commissioners 2011). This guide seeks to help international regulators navigate the policy landscape for large scale renewable deployment.

Energy Baseline Methodologies for Industrial Facilities (Northwest Energy Efficiency Alliance 2013). This publication covers how to establish and document an energy baseline.

Evaluating Policies in Support of the Deployment of Renewable Power (International Renewable Energy Agency 2012). This brief at examines criteria to evaluate the performance of a number of renewable energy policies.

Hawai'i Clean Energy Initiative (HCEI) Scenario Analysis: Quantitative Estimates Used to Facilitate Working Group Discussions (2008–2010). This analysis provided Hawai'i with the foundation to describe and assess pathways to realize its clean energy vision.

The Body of Knowledge on Infrastructure Regulation (*http://regulationbodyofknowledge.org/*) from the Public Utilities Research Center provides links to a large library addressing the regulatory treatment of infrastructure, an extensive glossary, and self-testing features to facilitate learning.

The Competition Reform Web Resource (*http://www.oecd.org/daf/competition/reforms/*) from the Organization for Economic Co-Operation and Development provides governments information to assess their own policies for opportunities to enhance competition.

The Context Sensitive Solutions Resource Center (*http://contextsensitivesolutions.org/*) from the U.S. Department of Transportation offers insights on infrastructure planning, in the context of transportation planning.

The Cost of Renewable Energy Spreadsheet Tool (CREST) is an economic cash flow model designed to assess project economics under various policy support structures.

The Developing a Greenhouse Gas Inventory Web resource (*http://www.epa.gov/statelocalclimate/local/activities/ghg-inventory.html*) from the U.S. Environmental Protection Agency includes steps on completing a greenhouse gas inventory.

The Energy Regulators Regional Association (ERRA) E-Library (*http://www.erranet.org/Library*) provides information and data related to energy regulation.

The Energy System and Scenario Analysis Toolkit (*http://en.openei.org/wiki/Energy_System_and_Scenario_Analysis_Toolkit*) collects a variety of different tools to assist with modeling and analyzing an energy system.

The Hawai'i Clean Energy Initiative website (*http://www.Hawai'icleanenergyinitiative.org*) contains the latest information and analysis on many clean energy efforts in Hawai'i.

The International Council for Local Environmental Initiatives Toolkit (*http://www.icleiusa.org/action-center/tools*) provides tools to help complete an emissions inventory.

The **RETScreen website** (*http://www.retscreen.net*) and software provide a decision support tool to evaluate distributed energy project feasibility and performance.

The State and Local Energy Efficiency Action Network (*https://www4.eere.energy.gov/seeaction/*) offers resources, discussion forums, and technical assistance to state and local decision makers as they provide low-cost, reliable energy to their communities through energy efficiency.

The **Sustainable Energy Regulation and Policymaking for Africa** website (*http://africa-toolkit.reeep.org/*) from the United Nations Industrial Development Organization contains a variety of information on shaping energy policy.

Using Integrated Resource Planning to Encourage Investment in Cost-Effective Energy Efficiency Measures (U.S. Department of Energy 2011). This publication covers the planning issues of particular relevance to including demand-side resources in IRPs.

PHASE 3: PROJECT PREPARATION

3.1 Involve Stakeholders in Policy and Operational Reform Efforts

At the end of the opportunity road map process in Phase 2, a Strengths-Weakenesses-Opportunities-Threats analysis identified potential near-term projects to begin making the energy vision from Phase 1 a reality.

When selecting which near-term actions to take, the leadership team and working groups need to consult subject matter experts and other stakeholders, many of whom may be affected by project implementation. Many of these stakeholders will have participated in Phase 2, and based on the priorities they identified at that time, will also have input about which projects to pursue first. Without limiting their input, the project preparation consultations with stakeholders should identify actions that address specific problems with practicable solutions that can be accomplished within a reasonable timeframe and defined budget. Also, after projects are identified, the team members must be ready and willing to explain why they were selected and others were not. This transparency can help maintain interest in supporting the overall effort.

Phase 3 Describes How To:

- ☐ 3.1 Involve Stakeholders in Policy and Operational Reform Efforts
- ☐ 3.2 Identify the Staff Resources Needed to Complete Near-Term Projects
- ☐ 3.3 Set a Budget and Analyze Risks
- ☐ 3.4 Identify Financing Options for Near-Term Project(s)
- ☐ 3.5 Develop Performance, Measurement, and Reporting Plans

3.2 Identify the Staff Resources Needed to Complete Near-Term Projects

Near-term projects can focus on a variety of actions, such as overhauling policies, designing utility-led programs for ratepayers, assessing renewable resources, conducting feasibility studies, updating the electricity grid, and developing a workforce to invest in human capital. The team should use stakeholder input about priorities to select projects that will accomplish specific objectives, rely on or build the strengths of those who will be implementing the projects, are central to realizing the Phase 1 vision, and create value for those impacted by the project.

Project selection must balance the level of effort with the expected benefit, taking into account resources and team strengths. Poor decisions can divert resources from more beneficial efforts, erode the confidence of the project team, and reduce momentum among external stakeholders.

3.2.1 Establish a Project Team

Having identified where project priorities match the Phase 2 road map, stakeholder interests, and the Phase 1 vision, assemble a team that can complete the project. Project teams will vary in size, but each team must have someone to fill the following roles and responsibilities (even if one person has more than one role):

- **Project lead.** The person who ultimately bears responsibility for the success or failure of the project, the project lead oversees plans, budget, and schedules; delegates responsibilities; and closes out the project.

- **Champion.** The person who initially proposed the project, or obtained approval for it. This person will seek out additional resources as needed to ensure project success, and can positively impact decision makers. The champion is not necessarily a chief executive or agency head, but is typically in a senior supervisory role for the initiative.
- **Subject matter expert(s).** People who understand the process, policy, technology, or service that is the focus of the project.
- **Project execution staff.** Project staff members are responsible for undertaking the actions set out in the project plan. These may include data collection, reporting, construction, and equipment management.

3.2.2 Select at Least One "Quick Win" Project in the Initial Round of Projects

Among the near-term actions identified in Phase 2, it is important to select at least one "quick win" project that will produce a demonstrable benefit in a short timeframe. Quick wins are important to build morale among project teams, demonstrate success to potential investors, and maintain community support for medium- and long-term projects.

Quick win projects generally have some or all of the following features:

- Low financial cost
- Deliverable in less than a year
- Established ability to act according to law and institutional authority
- High likelihood of energy cost savings or community investment
- Prominent locations, such as a large public building, airport, school, or church
- Prominent project partners, such as well-respected politicians, businesspeople, and community leaders.

Examples of quick win projects in the Caribbean include:

- **Solar water heating (SWH).** SWH can save electricity costs and interior square footage with a minimal capital outlay.
- **Streamlined interconnection policies and procedures.** A streamlined, well-documented process will support and encourage the development of a thriving solar distributed generation industry.
- **Distributed generation.** A modest distributed generation installation (e.g., wind or solar) can serve as a pilot project and learning opportunity.
- **Workforce development program.** This project can adapt educational or utility training resources to invest in the labor force needed to implement medium- and long-term projects. Topics can include energy retrofit training, building energy management, and solar PV installation.
- **Energy operations and maintenance (O&M).** Organizing a group of public and private stakeholders to implement energy O&M best practices can save money from day one and creates lead-by-example opportunities.

3.2.3 Define Clear Roles and Responsibilities for Different Governmental Entities Involved in Near-Term Projects

Project teams do not operate in a vacuum. It is important to manage expectations and ensure the adequate participation of everyone involved in a project, both directly and indirectly. One useful analytical tool to aid in this process is a responsibility assignment matrix—Responsible-Accountable-Consulted-Informed (RACI) matrix.

A RACI analysis describes who is responsible for doing work (R), who is accountable for work being completed (A), who must be consulted during the course of work (C), and who must be informed of the progress being made (I).

Responsibility Assignment Matrix

PROJECT: Issue RFP*		DEPARTMENT: Public Utility			UPDATED: Jan. 20XX		
Step/ Action	Description	Project Lead	Subject Matter Expert	Utility Leadership	Energy Ministry	Public Works Ministry	Governor
1	Define project size and eligible technology	R	C	A	C/I	I	I
2	Draft RFP	A	C	I	I		
3	Publish RFP			R	A	I	C

* Request for proposals

Completing a RACI matrix like the example in this table can guide decision-making and communications through each step of the project, helping the right people contribute to a project in a timely fashion on the way to project success.

Building Momentum: U.S. Virgin Islands School Retrofits Deliver Solid Return on Investment, Validating Ongoing Investments in Energy Efficiency

The Energy Development in Islands Nations (EDIN)-U.S. Virgin Islands (USVI) project provides an example of how achieving significant success early in the project execution phase addresses the common challenge of building support and momentum for a clean energy project or initiative.

As an EDIN project partner, USVI was able to tap into a broad spectrum of technical assistance and project development support from the U.S. Department of Energy and the National Renewable Energy Laboratory (NREL), which included identifying optimal energy efficiency and renewable energy solutions and a roadmap for achieving the territory's goal of reducing fossil fuel use 60% by 2025. NREL's initial USVI resource assessments identified energy efficiency measures as "low-hanging fruit"—projects with potential to achieve the greatest energy savings for the least cost.

In October 2011, the USVI achieved what would become one of its most visible and impactful successes toward the 60% goal when building energy efficiency upgrades were completed in 11 USVI schools. The energy services company that performed the retrofits guaranteed the USVI government a cost savings of $1.2 million annually, and the results exceeded expectations. Ongoing monitoring by the Virgin Islands Energy Office showed the retrofits saved $1.3 million in energy costs in the first year and $1.7 million in the second year, which helped offset operational costs for the Department of Education.

To build on this success, the USVI government authorized $35 million in funding in 2013 to install lighting and water retrofits in 34 more schools and other Department of Education facilities. Pointing to the very aggressive energy efficiency goals that have been established for the USVI government, EDIN-USVI Director Karl Knight said, "This project demonstrates what is possible—what the potential return on our investment can be."

Energy efficiency measures offer significant savings with minimal upfront cost and therefore present a prime opportunity to build momentum during the execution phase of a project. By producing cost savings that exceeded projections, the school retrofits built credibility for the EDIN-USVI project by providing a highly visible example of progress toward the territory's clean energy goal. They also validated ongoing government investments in energy efficiency by yielding strong returns over the first 2 years. This, in turn, helped build momentum for the EDIN-USVI project by motivating stakeholders and inspiring the community as a whole to become engaged in the effort.

3.3 Set a Budget and Analyze Risks

Once priority projects have been chosen and the team identified, setting a budget is next in project preparation. The budget accounts for project costs, described in hours of time and dollars spent on material, adjusted for project risks. The project lead should consult with subject matter experts and other project participants, and look at costs for similar projects, even projects in other jurisdictions; experience may save the project team from repeating mistakes and missing opportunities.

Common cost items include:

- Staff time
- Travel and meetings
- Data collection and reporting
- Information technology license fees
- Insurance
- Site acquisition and preparation
- Capital expenses, training, and specialized equipment
- Consultant services.

As often as possible, base these cost estimates on experience and information from suppliers. Contingency costs are typically expressed as a percentage of total cost, and should be included to allow for impacts from risk.

3.3.1 Analyze Project Risk

Effectively mitigating risk begins with an analysis of a project's known risks and response options, which include changes to the schedule, budget, and staffing. Phases 1 and 2 will have laid the foundation for determining risk. The goal in Phase 3 is to articulate root causes of specific risks, and assign them a probability value—such as low, medium, or high. Analyzing and addressing a project's risks can be critical to its "bankability" and attracting the right vendors.

Identified risks can be entered into a matrix that plots the severity of impact and likelihood of occurrence to visually represent which ones justify advance planning. Also, risks can be entered into a "risk register" that can be updated for the life of the project.

3.3.2 Common Types of Risk

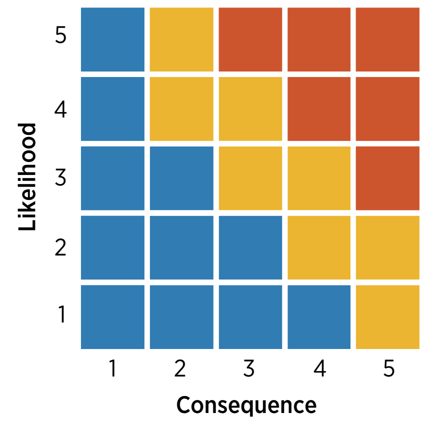
Project risks can be dealt with in several ways. One is changing the project plan to avoid risks. Another is changing the project structure to transfer risks to the party that can most effectively bear them. Certain kinds of risk may require addressing the root cause before it arises. This is known as mitigation or contingency planning, and can be critical to shaping "bankable" agreements. Common types of risk and approaches to addressing them are described below:

- **Technology risk.** This risk arises from the main technology's failure to meet output specifications despite proper design, manufacturing, and installation. Root causes can be addressed as follows:
  - Complete assessments to match the technology to the project location and needs
  - Rely on previously demonstrated or commercial technologies
  - Train the workforce in the proper use and maintenance of the technology
  - Identify alternative technologies that may be used in a contingency plan.

Risk Reporting Matrix

Likelihood

Level	Likelihood	Probability
1	Not Likely	~10%
2	Low Likelihood	~30%
3	Likely	~50%
4	Highly Likely	~70%
5	Near Certainty	~90%



Consequences

Level	Technical Performance	Schedule	Cost
1	Minimal or no impact	Minimal or no impact	Minimal or no impact
2	Minor reduction in performance	< 1 month schedule slip	< 1% cost increase
3	Moderate reduction in performance	1-2 months schedule slip	< 1-4% cost increase
4	Significant degradation in performance	3-5 months schedule slip	< 5-9% cost increase
5	Severe degradation in performance; will not meet key technical thresholds	≥ 6 months schedule slip	≥ 10% cost increase

Source: DOD, Risk Management Guide for DOD Acquisition

Once a technology has been chosen, adequate warranties from a vendor that can honor them addresses this risk.

- **Legal risk.** Legal risk stems primarily from changes in law, or the application of law, that would negatively impact the project. Through the collaborative efforts of diverse stakeholders in Phases 1 and 2, many legal risks will be mitigated. Contract provisions, such as indemnity, conditions present, and warranties can also address legal risk.
- **Performance risk.** Many performance risks can be controlled by drafting suitable project specifications and by selecting of capable and experienced vendors. The latter depends in part on transparency in the selection process. In negotiations with vendors, risk can be addressed through adequate warranties and liquidated damages provisions, as well as construction bonding requirements. Other performance risks have operational barriers as root causes, such as interconnection and dispatch requirements. In some instances, changing these root causes is its own project, but they can be addressed independently through relationship management and facilitated meetings. Even with the best project partners, unexpected equipment delivery delays or labor unavailability can arise, so it is important to account for performance risks in the budget.
- **Payment risk.** Payment risk is addressed through a combination of creditworthy customers and suppliers, credit enhancements, firm obligations to pay for performance, and credit insurance, as appropriate.

- **Cooperation problems.** For specific projects, cooperation problems can be reduced by setting up joint trainings between the project team and the implementing government agencies. These trainings or other facilitated meetings can help establish realistic expectations to avoid serious disagreements that would impact project schedule or budgets. An independent alternative dispute resolution or mediation facility may be appropriate as a last resort.

3.4 Identify Financing Options for Near-Term Project(s)

Many potential financing sources, including private debt and equity and public international or multilateral funds, are available to energy infrastructure projects. Financing solutions and partners will vary by project size, technology, partners, and other project- and location-specific factors. The sources and options described below can be combined or adapted to suit the needs of a particular project.

3.4.1 Sources of Funding and Capital

- **Organization for Economic Co-Operation and Development (OECD) officially supported export credits.** Under the Sector Understanding on Export Credits for Renewable Energy, Climate Change Mitigation, and Water Projects, OECD countries have agreed that any public trade finance support for renewable energy and energy efficiency projects will have interest rates at least 1.2% above 10-year OECD country debt and a maximum term of 18 years. This trade finance support often depends on a certain percentage of project value or project partner ownership originating in the OECD country providing the support.
- **Multilateral development banks and finance institutions.** These international public institutions, which include the Caribbean Development Bank and the Global Environment Facility, often have climate change mitigation or adaptation programs that could support renewable energy generation or energy efficiency projects. Unlike bilateral public support, there are not typically any domestic content requirements, but other requirements do often impact the type of project, project design, and/or repayment.
- **Private financial institutions.** Although international public financial participation in a deal can lower interest rates, private foreign direct investment is by far the largest source of possible funds and is based on the creditworthiness of project partners, not their home jurisdiction or other predefined eligibility requirements, such as additionality.
- **Private capital markets.** For large projects or a portfolio of projects—typically more than $10 million U.S. dollars (USD)—private capital markets may be willing to participate in the financing structure. Institutional investors, such as pension funds, are beginning to show an appetite for long-term clean energy infrastructure bonds, and the OECD estimates the size of this market in 2014 to be $20 billion USD.
- **Domestic policy support.** Although likely not sufficient to finance a project, domestic policies can lower the overall financing cost of capital and infrastructure projects. These types of policies include modified tax treatment, such as investment incentives or accelerated depreciation; government backstops, such as loan loss reserves or other interest rate buy-downs; and dispatch incentives, such as feed-in-tariffs or loading orders.
- **Repurposing public funds.** For smaller projects, public funds may be eligible for repurposing to support a project, such as relying on educational resources for the bulk of a workforce development program. Additionally, energy use reduction equipment could receive priority treatment in the commitment of facilities maintenance funds.
- **Refining legislative authority.** Some public finance support structures can be built through amendments to the legislative authority of existing institutions. This approach can sometimes take longer, but can also be very effective as part of a package to implement the Phase 1 vision.

Avoiding Excessive Solar Curtailment on Kaua‘i

Because island grids are small, the impact of adding variable generation—either at the sub-transmission or the distribution level—can have a negative impact on the central generating plants and the quality of power delivered to the customers.

In anticipation of these challenges, the Kaua‘i Island Utility Cooperative (KIUC) reached out to the U.S. Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL) in 2010 for more information on ways to overcome integration challenges and for potential solutions. One of KIUC's primary concerns for meeting its commitment to generate at least 50% of its electricity using renewable energy by 2023 by integrating higher levels of variable renewable energy into the island's electricity system was coordination with its under-frequency load-shedding schemes.

To address these concerns, the DOE and NREL team performed an economic and technical analysis, discussing specifically how to model photovoltaic (PV) inverters in the electricity grid (which were the key components to modeling high penetration of PV on the Kaua‘i grid), and modeling an initial base case of electricity production and use on Kaua‘i. Different types of PV inverter models were analyzed to ensure the stability of the electrical system during disturbances.

Additionally, the team conducted power system modeling and simulations to accurately plan for overall grid quality. At the time of the study, KIUC derived the majority of its power from diesel and naphtha (96%) and had about 7% renewable energy installed on its system. Because so much diesel power was used, the study reviewed potential renewable-diesel hybrid electrical power systems to supply required loads. Because these types of systems may include fossil fueled generators, along with renewable energy, the components have to be combined with storage devices, inverters, and charge controllers to meet load demands. However, adding variable generation such as PV can create potential high ramping rates on the diesel generators.

Given this additional challenge, the team then analyzed electrical power system models to better understand the impacts of high penetrations of PV on the power system, finding that the planned projects by KIUC had a balanced mix of renewable energy and would have a low impact on the generation system.

Following the completion of the studies, KIUC installed a 1.2-megwatt (MW) solar PV system on one of its electrical distribution feeders demonstrating high penetration levels of solar. According to KIUC, during sunny days the PV system can supply 90% of the demand required by the distribution circuit to which it is connected. The preliminary results from monitoring the circuit indicated that overall power quality had not been compromised, helping Kaua‘i meet its goal of 50% renewable electricity generation by 2023.

1.2-MW PV array on Kaua‘i. *Photo by Jamie L. Keller, NREL 21774*

3.4.2 Finance Structures

The simplest finance structure is a private financial institution making an unsecured loan directly to a consumer. More complex financing structures are justified when banks perceive undue risk, whether due to consumer credit history or technology, or where consumers perceive high transactions costs, such as identifying reliable service providers or products. Public financial participation in projects can serve as credit enhancements to reduce these transaction costs for both private financial institutions and consumers, as well as eliminate the financial and administrative resources needed for direct public funding. Some credit enhancements are described below.

- **Loss reserve (partial sovereign guarantee).** A loss reserve uses a pool of public resources to reduce repayment risk on loans made by private lenders in support of projects imbued with a public purpose. In exchange for active participation of private lenders at lower interest rates, the reserve will disburse funds on non-performing debt in a given portfolio, up to the amount of the reserve. This approach improves the credit evaluation of loans that are negatively impacted by a lack of borrower credit history or technology performance, such as the lack of loan performance history in the residential energy efficiency retrofit market. Loss reserves can partially wrap a portfolio of loans or a bond series, depending on the need of the project. Loss reserves, compared to direct subsidies, consume fewer public administrative resources and rely on the ability of private lenders to minimize transaction costs. Property Assessed Clean Energy programs, in which consumers repay loans for distributed generation or energy efficiency retrofits through their property tax bill, typically include a loss reserve.
- **Sovereign guarantee (full wrap).** In contrast to loan loss reserves, which partially wrap a portfolio of smaller projects, this form of contingent explicit liability is capped at the amount of the total project. Sovereign guarantees are sometimes sought for large infrastructure projects when lenders or vendors perceive disproportionate legal, foreign exchange, or political risks.
- **Utility-led energy services and on-bill repayment.** Increasingly, electric utilities are offering nontraditional services, such as distributed generation or efficiency retrofit financing. Because the utility often has access to lower cost capital than does the individual consumer, this structure can allow the utility to broaden its energy business while lowering transaction costs, in part because the consumers repay through their utility bills.

3.5 Develop Performance, Measurement, and Reporting Plans

With an idea about the project focus and its financing structure, the project team can begin to shape performance and reporting plans. Regular communication throughout the project term increases the chances of success by identifying potential problems in time to develop effective solutions. To ensure value in this communication, the project team should determine the actions and metrics it requires vendors and other participants to prioritize.

Performance plans are often organized around milestones, or key actions that need to take place in sequence to successfully proceed toward project completion. Performance plans should include schedules, anticipated approval pathways, and risk and change management strategies, particularly for longer projects.

Milestones depend on project type and project participants, but can include:

- Equipment delivery and acceptance from procurement schedules
- Percentage of workers trained
- Number of installations, such as homes retrofitted or SWHs
- Attaining financing or completing RFP awards
- Passing key risks into new project stages, such as obtaining all permits and beginning construction
- Communications for performance recognition, such as dollars raised or spent.

Reporting plans should provide a uniform, simplified way to gather the key information needed for the project team and other stakeholders to determine progress. Report information, the timing of reports, and the report approval process should be consistent, and reflect who needs what information and by when. The specific information required varies based on project size and type, but should generally include:

- Project name, any identifying number, and date of submission and period covered by report
- Status summary
- Performance and milestone updates
- Progress toward reaching metrics
- Issues that have arisen or have a reasonable likelihood of arising and mitigation strategies
- Budget status and expenditures.

3.6 Phase 3 Resources

Lessons Learned

- Solar Hot Water Heater Industry in Barbados
- Greensburg Implements High-Efficiency Building Codes to Achieve Long-Term Energy Savings
- U.S. Virgin Islands Establishes Interconnection Standards to Clear the Way for Grid Interconnection

Sample

- 10 Important Features of Bankable Power Purchase Agreements for Renewable Energy Power Projects

Worksheet

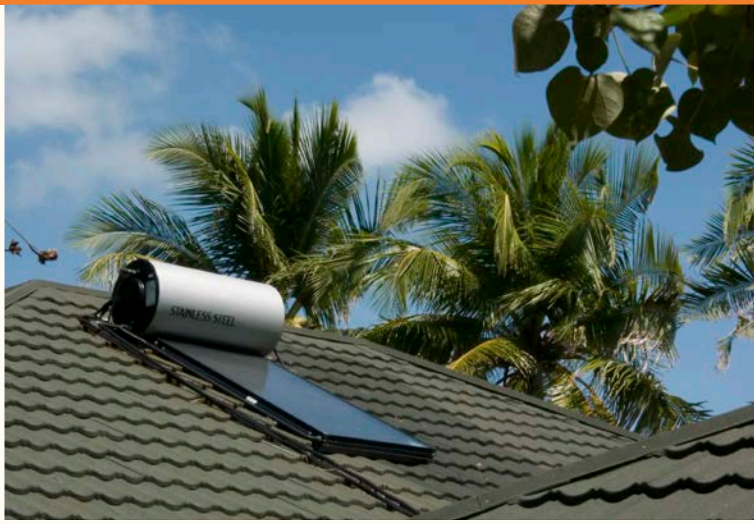
- Responsible-Accountable-Consulted-Informed Matrix
- Risk Register Matrix

Information Resources

LESSONS LEARNED

Solar Hot Water Heater Industry in Barbados

Barbados is addressing the challenge of offsetting high fossil fuel costs by using its abundant solar resources to power solar water heaters (SWHs) across the island. Barbados offers a valuable example of how to successfully execute market implementation of a commercialized renewable energy technology.



Rooftop SWHs are being successfully used in Barbados as a result of effective financial incentives and government support. *Photo from iStock 6923507*

Challenge

Before realizing the SWH success, Barbados had to overcome several other challenges according to the Climate and Development Knowledge Network publication "Seizing the sunshine – Barbados' thriving solar water heater industry,"[1] including:

- **Access to startup capital.** Despite having secured government contracts for SWH installations, banks were unwilling to invest in SWH commercial and residential installations.
- **Lack of consumer awareness and confidence in solar technology.** Developing an effective product and ensuring that the size of the SWH was appropriate for each household were crucial for maintaining sufficient water temperature.
- **High upfront cost and inconsistent financial incentives to encourage consumers to invest in a new system.** There is a history of fluctuating tax credits for SWHs in Barbados, including a complete removal of incentives from 1992 to 1996, resulting in suppression of industry growth.

Solution

The factors that led to Barbados successfully overcoming the market barriers to widespread implementation of SWHs were local high-level government champions, financial support, regulatory certainty, and consumer acceptance.

The SWH industry first emerged in Barbados in the early 1970s in response to oil prices increasing threefold in one year. At the time, fossil fuels supplied 95% of the country's energy needs. In 1973, Canon Andrew Hatch of Christian Action for Development made a SWH out of an old oil drum and fixed it to the roof of his church.

Recognizing the potential of the technology, in 1973 James Husbands founded Solar Dynamics, the first SWH company on the island, and soon had the opportunity to demonstrate the technology to Prime Minister Tom Adams in his own home. Adams saw the benefit of the SWH when his annual gas consumption was reduced by 70%. With Husbands and Adams as local champions for SWH, momentum and public engagement around the initiative grew.

[1] "Seizing the sunshine – Barbados' thriving solar water heater industry." Climate and Development Knowledge Network. Accessed Aug. 7, 2014. *http://cdkn.org/resource/cdkn-inside-story-seizing-the-sunshine-barbados-thriving-solar-water-heater-industry/.*

Next, government incentives brought competition to the business of manufacturing and supplying SWHs. Starting in the 1970s, the Barbados government introduced a series of measures to support the fledgling SWH industry.

By 2009 there were around 45,000 installed SWH systems in Barbados, or two in every five households. The government introduced further measures to support the industry by mandating SWHs for all new government housing developments. However, there were still challenges to getting early-stage funding from banks for commercial installation. To overcome this problem, the Barbados Institute of Management and Productivity provided a loan that could be quickly repaid after the project was completed.

Consumer acceptance was also key to SWH industry growth in Barbados. Once consumers saw that the technology was sized for their households and worked well, their confidence grew. This was important because other countries such as Jamaica had tried to establish a SWH industry to meet energy needs and reduce costs, but customers were dissatisfied because the installed SWHs were too small, resulting in water that was too cold.

High upfront costs were another barrier encountered by the SWH industry. To help address this issue, credit unions and distributors offered financial support, allowing consumers to spread the cost of the units over 3 years. Matching the credit term to the 3-year payback time of the SWH units meant that some consumers spent less money than if they had continued heating their water with gas.

Financial Incentives to Stimulate SWH Growth in Barbados

1974 – Fiscal Incentives Act

Just as the SWH industry was beginning to emerge, the government of Barbados introduced a tax exemption for the materials used to produce SWHs, saving 20% of the cost. The government also levied a 30% tax on electric water heaters, significantly increasing their price.

1977 – Government Purchase of SWH for State Housing

The government supported the growing SWH industry by mandating the installation of SWHs in new-build government housing developments.

1980–1992 – Homeowner Tax Benefit

In 1980, the government made the full cost of a SWH installation tax deductible to a maximum of $1,750 U.S. dollars (USD). This led to a peak in SWH installations in 1989 of more than 2,800 units. However, this incentive was stopped in 1992 as part of economic restructuring following the economic recession in the late 1980s.

1996 – Amended Homeowner Tax Benefit

In 1996, the Homeowner Tax Benefit was reinstated. In its amended form, Barbadians were allowed an annual tax deduction of $1,750 USD for home improvements, including mortgage interest, repairs, renovation, energy- and water-saving measures, and SWHs.

Key Elements of the Support Framework for the SWH Industry in Barbados

Direction of Influence	Factors That Helped Stimulate Growth of SWH Industry
Private Sector to Consumers	• High-quality products • Consumer guarantee • Finance to spread upfront cost of SWH • Community engagement and job creation • Clear quality of life benefits • Strong marketing and communications
Private Sector to Government	• Demonstrated the potential of the technology • Cost-effective technology that saves millions of dollars
Government to Consumers	• Involvement and participation through communications • Fiscal incentives (the Homeowner Tax Benefit) • Increased duty on gas and electric heaters
Government to Private Sector	• Fiscal Incentives Act 1974 • Government purchase of SWH for new-build developments • Created an environment of regulatory certainty and gave continuous support

Source: Climate and Development Knowledge Network

Key Takeaways

Today, the SWHs designed in Barbados are sold throughout the region, and Barbados is recognized as a leader in the SWH field. One company alone, Solar Dynamics, has installed more than 30,000 units on homes and businesses across the Caribbean.

Although challenges may vary by location, Barbados offers an example of why energy champions, financial incentives, and consumer confidence and acceptance are key to ensuring widespread adoption of a renewable energy technology such as SWHs to help offset high energy costs.

Key lessons for countries wishing to replicate Barbados' achievement include:

- Local finance partners can establish channels of funding for pioneering companies that are struggling to access credit.
- Financial incentives, such as tax credits, can help manufacturers and consumers adopt new technology.
- A stable regulatory framework can provide confidence for investors and consumers.
- High-quality products supported by an enthusiastic, locally sensitive marketing strategy will build consumer awareness of the benefits of new technology.
- Manufacturer or supplier performance guarantees reduce consumer risk and facilitate deployment.
- Consumer credit schemes from manufacturers, distributors, or installers can lower upfront costs to consumers.

"It was very important that successive governments were consistent in their support. … Governments need the fortitude to commit to [financial and regulatory support] for the long term."

—Leonard Nurse, Barbados Special Envoy for the Environment

LESSONS LEARNED

Greensburg Implements High-Efficiency Building Codes to Achieve Long-Term Energy Savings

On May 4, 2007, a massive tornado struck Greensburg, an agricultural community of about 1,400 people in south-central Kansas. Since then, city and community leaders and residents have been committed to rebuilding the town as a model sustainable community.

When the tornado struck, 11 people were killed, and more than 90% of the city's structures, most vehicles, and the electricity infrastructure were destroyed or damaged. Homes and businesses were leveled, displacing most of the town's residents.

The LEED Platinum K-12 school in Greensburg, Kansas.
Photo from Joah Bussert, Greensburg GreenTown, NREL 19952

Challenge

Moving forward quickly to rebuild homes and businesses after the tornado was a high priority for Greensburg. Recognizing an opportunity to not just rebuild, but to rebuild in a way that would sustain the local economy for the long term, the city began working with technical experts from a variety of organizations to identify the best ways to achieve this goal—a common challenge for communities faced with the need to rebuild from the ground up in the wake of disasters.

Solution

One of the first steps the City of Greensburg took was to adopt a resolution in December 2007 that all city-owned buildings (more than 4,000 square feet) be designed to a U.S. Green Building Council Leadership in Energy & Environmental Design (LEED) Platinum level with a minimum of 42% energy cost savings compared to standard buildings built to code. With the help of energy modeling and technical expertise from NREL and others, buildings such as City Hall and a business incubator were successfully built to LEED standards. This inspired other public and commercial building leaders to elect to achieve the same goal for the Greensburg school and the Kiowa County Memorial Hospital, among others.

The city also explored the possibility of formalizing green building codes, but lack of knowledge about building codes was a major challenge for Greensburg. City leaders expressed concerns about how residents, business owners, and builders would respond to perceived higher building costs for green buildings, and about how the city staff would learn the new energy codes or program requirements.

To date, Greensburg's per-capita ratio of U.S. Green Building Council LEED-certified buildings is one per approximately every 129 citizens. In a town of 900 people, that's the highest per-capita concentration of LEED buildings in the United States.

City leaders relied on the expertise of the National Renewable Energy Laboratory (NREL)[1] and IBACOS. Both organizations analyzed and summarized the rapidly changing field of green building codes and green building programs for city leadership and offered several options for consideration, including:

- Explore a partnership with the Kansas Building Industry Association and National Association of Home Builders to conduct a voluntary pilot program applying the National Green Building Standard.
- Establish a voluntary Greensburg Green Building Program focused on encouraging use of energy-efficient and sustainable practices in homes and businesses.
- Encourage or incentivize architects and builders to use ASHRAE's Advanced Energy Design Guides, which spell out climate-specific design recommendations for achieving 30% energy use improvement when compared to ASHRAE Standard 90.1.
- Adopt 2006 International Energy Conservation Code as the basic energy code because it applies to the residential and commercial sectors and has reasonably achievable energy requirements.

> "The technical assistance provided by DOE and NREL staff assures that Greensburg's city and county governments, businesses, and other buildings will continue to save large sums of money for a long time to come."
>
> — Daniel Wallach, Executive Director and Founder, Greensburg Greentown

After many discussions, the city approved a voluntary Greensburg Green Building Program in April 2009 that included partnering with the Kansas Building Industry Association to offer training, discount some services, and support public awareness about green building while giving builders a chance to understand green building techniques gradually. By seeking unbiased, third-party expertise on rebuilding with energy efficiency, Greensburg was able to explore numerous building energy code options, educate its leaders and residents on those options, and implement programs that led to the completion of numerous new and renovated buildings that meet or exceed the city's energy goals.

LEED-Certified Buildings in Greensburg

Greensburg boasts many LEED-certified buildings, including many "firsts" for Kansas and the country:

- City of Greensburg SunChips Business Incubator—the first LEED Platinum municipal building in Kansas
- Kiowa County Memorial Hospital—the first LEED Platinum critical access hospital in the United States
- Prairie Pointe Townhomes—the first residential LEED Platinum building in Kansas
- USD 422 Greensburg K-12 School—this LEED Platinum school is built to be 60% more energy efficient than standard code and generate electricity with an on-site wind turbine
- Kiowa County Courthouse—renovated with sustainable and energy-saving technologies while maintaining the structure's original design and achieving LEED Gold certification
- BTI-John Deere dealership—LEED Platinum facility that uses two wind turbines to generate 4.2 kilowatts (kW) and 1.9 kW of electricity and is a model for other John Deere dealerships.

[1] *Rebuilding Greensburg, Kansas, as a Model Green Community: A Case Study*, National Renewable Energy Laboratory.

Key Takeaways

Greensburg's efforts to rebuild green are paying off. When measuring the energy use of 13 commercial buildings (from 2010 through 2011), Greensburg buildings are saving a combined total of $200,000 in energy costs per year compared with average energy use of similar buildings. In addition, several major housing projects were built with energy efficiency features, including the Prairie Point Townhomes, which earned the first residential LEED Platinum rating in Kansas. Completed in July 2008 by Kiowa County, this low-income rental development was evaluated by NREL and IBACOS using the Home Energy Rating System Index, which projected that the homes would use 41% less energy than a standard home built to the 2003 International Energy Conservation Code. In addition, the complex, like the entire town of Greensburg, is powered by a community wind farm.

Faced with the daunting challenge of recovering and rebuilding sustainably after disaster, Greensburg provides an example—not only for communities recovering from disaster, but for any community striving to build a more sustainable future. Kaupuni Village, an affordable housing complex for low-income families in Oahu, Hawaiʻi, offers another example of building sustainably from the ground up on a much smaller scale. These examples provide lessons learned and may help others to avoid common pitfalls and barriers as they strive to integrate sustainable building practices into their strategic energy planning.

Lessons Learned

- Determine gaps and opportunities by comparing current local codes with the latest international standards.
- Educate key stakeholders, including city and business leaders and residents, about the benefits of the proposed changes and why updated codes should be used to meet the community's goals.
- Explore partnerships with reputable building organizations to leverage their expertise and resources.
- Demonstrate success with highly visible public buildings that can serve as living laboratories for incorporating energy efficiency and renewable energy into building designs.

Another LEED Example: Hawaiʻi's Kaupuni Village

Kaupuni Village is another example of the successful execution of a LEED-certified affordable housing community. Located on Oahu, Kaupuni Village comprises 19 single-family homes and a community center. Not only are the structures built to achieve net-zero energy and use 40% less energy than a standard home, but the entire community was built as a fully self-sufficient and sustainable environment in keeping with traditional Hawaiʻian cultural values.

Set in the Waianae Valley of Oahu, Kaupuni Village is the first net-zero energy affordable housing community in Hawaiʻi.
Photo by Kenneth Kelly, NREL 20154

LESSONS LEARNED

U.S. Virgin Islands Establishes Interconnection Standards to Clear the Way for Grid Interconnection

A 448-kW PV system installed at the Cyril E. King Airport on St. Thomas in April 2011. *Photo by Adam Warren, NREL 18953*

The Energy Development in Island Nations (EDIN)-U.S. Virgin Islands (USVI) pilot project offers a valuable example of how to translate technical analysis to an effective, efficient regulatory and policy environment that facilitates the integration of renewable energy into the existing electricity system.

Faced with electricity prices more than four times higher than the U.S. average, USVI Gov. John P. de Jongh Jr. set an aggressive goal in February 2010 to reduce the territory's almost total dependence on fossil fuel 60% by 2025. To achieve that goal, the governor and the EDIN-USVI project partners, including the U.S. Department of Energy and the U.S. Department of the Interior, the USVI government, Virgin Islands Energy Office (VIEO), and the Virgin Islands Water and Power Authority (WAPA), were committed to developing the territory's renewable energy resources and increasing its energy security. But there were a variety of hurdles to overcome.

Challenge

According to the VIEO, a lack of clearly defined interconnection procedures was among the most significant challenges for those working to install renewable energy systems in the territory. This is a challenge many communities face as they begin implementing long-term clean energy strategies and initiatives. In the USVI, the ad-hoc policies and standards that were in place were confusing and cumbersome, resulting in a high level of frustration that discouraged individuals and businesses from investing in renewable energy systems and projects.

To address this issue, the EDIN-USVI project team sought assistance from an objective party with the technical expertise needed to inform the development of transparent provisions and standard agreements designed to facilitate the timely, predictable, and cost-effective interconnection of renewable energy systems. To increase the speed and scale of renewable energy adoption, the USVI needed to clear the way for the integration of renewable energy generation onto the grid while maintaining the safety, reliability, and power quality of the electricity distribution system.

Solution

The EDIN-USVI team turned to Keyes, Fox & Wiedman, a law firm with deep expertise in renewable energy regulatory policy and interconnection standards, to perform an in-depth analysis of the territory's interconnection procedures and make recommendations. To inform its work, the firm worked closely with a renewable energy working group composed of private citizens, VIEO employees, WAPA employees and board members, private solar developers, and National Renewable Energy Laboratory technical advisors. It also leveraged the experience of others, including California and Hawai'i, drawing upon their lessons learned and the procedural models they have developed (specifically the Federal Energy Regulatory Commission's Small Generator Interconnection Procedure, California's Rule 21, and Hawai'i's Rule 14H) for grid interconnection.

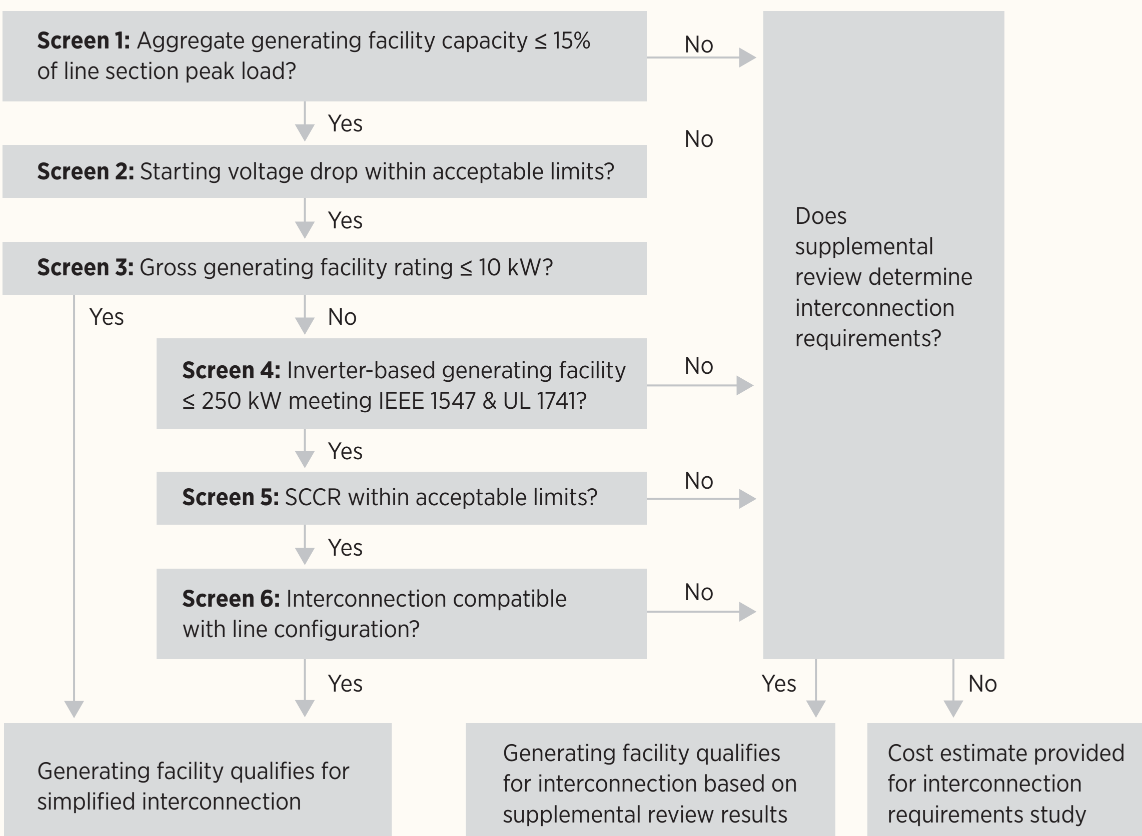
In April 2010, the firm presented the working group with a draft interconnection policy and interconnection agreement along with justification and examples supporting its recommended policies and rules, including:

- Provide multiple review levels for different system sizes and types
- Establish timelines
- Remove unnecessary technical requirements
- Provide interconnection rules that apply to all system types and fuel sources
- Include a simple dispute resolution procedure

Among the specific components of the draft interconnection procedures were:

- Timelines for each step
- Review screens
- Supplemental review requirements
- Study process
- Standard applications and agreements.

Proposed USVI Screen Criteria Process Flow



The working group shared the report's findings with a diverse set of stakeholders at a public meeting to ensure balance between the needs of the utilities, developers, and renewable energy offtakers. This collaborative process resulted in the establishment of a clear, well-defined, and streamlined interconnection process that contributed significantly to increasing the speed and scale of renewable energy deployment in the USVI. By August 2014, the territory had reduced its fossil fuel use by 20%, and St. Croix was on track to produce 25% of its power from solar and wind.

"In 2014, renewable energy projects for residential and commercial customers tied into the electric grid reached 5 megawatts on St. Croix and 10 megawatts in the St. Thomas/St. John District," said VIEO spokesperson Don Buchanan. "The utility has almost completed a 4 megawatt solar installation on St. Croix. It is expected to be online by November. The peak megawatt usage on St. Croix, population 50,000, is now about 39 megawatts."

Key Takeaways

Clean energy policies and regulatory measures play a key role in advancing island clean energy goals. The establishment of a clear and well-defined interconnection policies and procedures has been a significant factor in the success USVI has achieved in pursuit of its 2025 goal. The USVI tapped into outside technical expertise and leveraged model interconnection standards developed by similar communities to develop a draft interconnection procedure, and then it worked collaboratively with local stakeholders and project partners to ensure that the procedure it ultimately adopted would encourage and promote renewable energy development without compromising the safety and reliability of the electricity distribution system.

Key lessons learned for USVI interconnection standards include:

- Seek assistance from legal and technical experts with experience in grid interconnection issues to inform the development of interconnection standards.
- Leverage the experience of communities pursuing similar clean energy goals, drawing upon the lessons they have learned and the models they have developed.
- Work collaboratively with key stakeholders to incorporate their insights and ideas, and strive to achieve balance in addressing their diverse interests and needs.
- Develop a website that clearly communicates essential information about interconnection standards and streamlines the process for users.

> "What we're attempting to do is integrate a very large portion of renewable energy into our system. Think of it as a pilot for how to integrate renewables as a large proportion of the grid."
>
> —Karl Knight, Director, VIEO; WAPA board member

Sample: 10 Important Features of Bankable Power Purchase Agreements for Renewable Energy Power Projects

From Overseas Private Investment Corporation, U.S. Department of Commerce, U.S. Agency for International Development, and the U.S. Trade and Development Agency (*http://www.opic.gov/sites/default/files/files/10%20Elements%20of%20a%20Bankable%20PPA.pdf*)

A bankable power purchase agreement (PPA) is essentially a long term offtake agreement executed with a creditworthy offtaker and having a sufficient tenor to enable repayment of debt by providing an adequate and predictable revenue stream.

1. Dispatch Risk

There are two structures generally accepted by lenders for mitigating the risk that the offtaker may not dispatch the generating facility.

> **Take or Pay:** The offtaker pays a fixed tariff comprising a capacity charge (a fixed amount that is paid for available capacity - no dispatch required) and an output charge (an amount paid in respect of energy actually delivered). This permits the power producer to cover its fixed costs with the capacity charge, including debt service, fixed operating costs, and an agreed equity return.
>
> **Take and Pay:** The offtaker must take and pay a fixed tariff for all energy delivered (no dispatch required). If energy cannot be physically taken by the offtaker and output is "curtailed," energy will be calculated and paid for on a "deemed" delivered basis.

2. Fixed Tariff

It is important that the revenue of any PPA, whether "take or pay" or "take and pay," be a certain amount per kilowatt-hour generated to adequately cover the cost of operating the facility, repay the debt and provide a reasonable return on equity.

3. Foreign Exchange

In order to avoid subjecting the power producer to currency risk, the PPA should be either denominated in or linked to an exchange rate of the currency of the power producer's debt, and there should be no limitation or additional approvals required to transfer funds to offshore accounts as required.

4. Change in Law or Change in Tax

The agreement should explicitly state which party takes the risk of the law or tax regime changing after the date of the agreement in such a way as to diminish the economic returns of the transaction for such party (e.g., increase in taxes on power producers reducing the producer's returns). In order for PPAs to be bankable, most lenders require the offtaker to take this risk.

5. Force Majeure

The agreement should excuse the power producer from performing its obligations if a force majeure event (an event beyond the reasonable control of such party) prevents such performance. The allocation of costs and risk of loss associated with a force majeure event will depend on the availability of insurance and in some cases the degree of political risk in the country/region.

6. Dispute Resolution

The agreement should provide for offshore arbitration, in a neutral location, under rules generally acceptable to the international community (e.g. United Nations Commission on International Trade Law, or London Court of International Arbitration, or ICC).

7. Termination and Termination Payments

The PPA should set out clearly the basis on which either party may terminate the PPA. Termination by the offtaker may leave the project with no access to the market and thus should be limited to significant events. The agreement should provide that if the PPA is terminated for any reason, then in case of transfer of the facility to the offtaker, the offtaker shall provide a termination payment at least equal to the full amount of the power producer's outstanding bank debt, and in the case of the offtaker's default, a return on equity.

8. Assignment

The PPA should allow collateral assignment of the agreement to the power producer's lenders with the right to receive notice of any default and to cure such default. Additional step-in rights are generally set forth in a separate direct agreement between the lenders and the offtaker.

9. Offtaker Payment Support

Depending upon the size of the project and the creditworthiness of the offtaker and the development of the energy sector in a certain country, short term liquidity instrument, a liquidity facility and/or a sovereign guaranty will be required to support the offtaker's payment obligations.

10. Transmission or Interconnection Risk

The PPA should indicate which party bears the risk of connecting the facility with the grid and transmitting power to the nearest substation. The more significant these risks (due to terrain, distance, populated areas), the more the lenders will require the offtaker to bear all or a significant portion thereof.

Worksheet: Responsible-Accountable-Consulted-Informed Matrix

PROJECT: **DEPARTMENT:** **UPDATED:**

Step/ Action	Description	Project Lead	Subject Matter Expert	Management	Partner Organization	Stakeholder 1	Stakeholder 2
1	Project Step						
2	Project Step						
3	Project Step						
4	Project Step						
5	Project Step						
6	Project Step						

Worksheet: Risk Register Matrix

Type of Risk	When Risk Can Occur	Response to Risk	Consequence of Risk (e.g., High/Low)	Likelihood of Occurrence	Priority
e.g., contractor goes bankrupt	e.g., most likely to occur before commercial operations begin	Assignment or re-bid of contract; Agreement requires early warning of financial trouble	Medium, significant delays could result	Low, adequate screening protocols in place	Low

Information Resources for Phase 3

These information resources and useful links are illustrative, not comprehensive.

A Guide to Community Shared Solar (U.S. Department of Energy [DOE] 2012). This publication covers the planning and implementation of a community solar program, including examples of operational projects.

A Guide to the Lessons Learned from the Clean Cities Community Electric Vehicle Readiness Projects (DOE 2014). This report describes lessons learned from series of projects that are intended to advance the deployment of plug-in electric vehicles.

A Step by Step Tool Kit for Local Governments to Go Solar (California Energy Commission 2009). This guide describes how governments can support the development of a residential solar market.

Alternative Rate Mechanisms and Their Compatibility with State Utility Commission Objectives (National Regulatory Research Institute [NRRL] 2014). This analysis identifies and reviews alternative rate mechanisms that have come to the forefront in state utility regulation the recent past.

Clean Energy Finance Through the Bond Market (Brookings 2014). This paper provides an overview of issues regarding using public debt to support clean energy deployment.

Contingent Liabilities: Issues and Practice (International Monetary Fund 2005). This paper discusses the fiscal issues raised by contingent liabilities, which include sovereign guarantees.

Developing Renewable Energy Projects Larger Than 10 MWs at Federal Facilities (Federal Energy Management Program 2013). This detailed guide contains project development checklists relevant to U.S. utility-scale projects that could be the foundation for tailored project development checklists in other jurisdictions.

Energy Project Financing: Resources and Strategies for Success (Thumann 2008). This book provides a comprehensive treatment of financing energy projects, primarily in the context of building energy retrofits.

Evaluation of the Barbados Solar Water Heating Experience (Barbados 2003). This briefing provides a history of solar water heater deployment in Barbados, with supporting data.

Finance Mechanisms for Lowering the Cost of Renewable Energy in Rapidly Developing Countries (Climate Policy Initiative 2014). This publication contains three briefs describing mechanisms that governments can use to lower capital costs.

Financing Energy Improvements on Utility Bills: Market Updates and Key Program Design Considerations for Policymakers and Administrators (State and Local Energy Efficiency Action Network 2014). This guide provides an overview of the current state of on-bill programs and provides actionable insights on key program design considerations for on-bill lending programs.

Key Principles for Effective Strategic Workforce Planning (U.S. General Accounting Office 2009). This report describes the key principles of strategic workforce planning and provides illustrative examples of these principles.

Mitigating Commercial Risks in Project Finance (International Bank for Reconstruction and Development 1996). This brief describes major tools to allocate risk in large projects.

Overview of Regulatory Incentives in the Context of Public Policy Goals (NRRL 2008). This report describes general categories of regulatory devices to meet policy goals and provides criteria for assessing their effectiveness.

Project Selection Criteria: Greece-Italy Territorial Cooperation Programme (European Regional Development Fund 2007). This policy document demonstrates one real-world method to effectively evaluate proposals, including relevant screening checklists.

Risk Management Guide for DOD Acquisition (U.S. Department of Defense 2008). This guide discusses a variety of program risks, and how to address them, during the public contracting process.

Saving Energy in Commercial Buildings Checklist (NREL 2011). This checklist provides a succinct, comprehensive overview of the variety of measures a commercial building can undertake to improve the efficiency of energy and water use.

Solar Powering Your Community: A Guide for Local Governments (DOE 2011). DOE developed this comprehensive resource to provide a framework for a comprehensive solar plan for a community by introducing a range of policy and program options.

The **Building Energy Codes Program Resource Center** (*http://www.energycodes.gov*) provided by DOE's Office of Energy Efficiency and Renewable Energy (EERE) contains a comprehensive collection of information and tools designed to support the development and enforcement of energy codes.

The **Clean Energy Group website** (*http://www.cleanegroup.org/ceg-projects/clean-energy-finance/*) contains data, reports and educational material relating to clean energy finance.

The **Energy Data Management and Evaluation** website (*http://www1.eere.energy.gov/wip/solutioncenter/data_management.html*) provided by EERE contains information below about energy data management with resources to use in designing and implementing a data management plan.

The **Free Management Library** (*http://managementhelp.org/projectmanagement*) contains a variety of resources relating to project management, including feasibility and risk management.

The **Hawai'i Guide to Renewable Energy Facility Permits** (*http://energy.Hawai'i.gov/renewable-energy-project-permitting-in-the-state-of-Hawai'i*) provides information on the federal, state, and county permits required for renewable energy facilities in Hawai'i.

The **iSixSigma** website (*http://www.isixsigma.com/*) hosts a variety of resources, including tools and blogs, on project selection and process improvement.

The **LEADER Gateway** (*http://enrd.ec.europa.eu/leader/leader/leader-tool-kit/en/index_en.cfm*) provided by the European Commission is a local development method which facilitates local actors in developing an area by focusing on its endogenous development potential.

The **PSE&G Residential Solar Program website** (*http://www.njcleanenergy.com/renewable-energy/programs/utility-financing-programs/utility-financing-programs/pseg*) describes how the private utility responded to the policy goal of increasing residential solar deployment.

The **Project Management Knowledge Center** (*http://www.pmi.org/learning.aspx/*) hosts forms and resources on project management, some of which are free.

The Role of Pension Funds in Financing Green Growth Initiatives (Organization for Economic Co-Operation and Development 2011). This paper examines policies and finance options to encourage pension funds to help finance green growth projects.

The **State Utility Regulation and Clean Energy website** (*http://www.epa.gov/cleanenergy/energy-programs/suca/resources.html*) provided by the U.S. Environmental Protection Agency provides a variety of reports on designing and implementing energy efficiency policies and programs.

The **System Advisor Model (SAM)** makes performance predictions and cost of energy estimates for grid-connected power projects based on installation and operating costs and system design parameters that you specify as inputs to the model.

PHASE 4: PROJECT EXECUTION AND QUALITY CONTROL

After a project has been selected and its components have been designed to take advantage of available human and financial resources, the project team can shift to execution. In Phase 4, the project team will implement the performance and reporting plans, coordinate project partners, and continue to engage the public regarding progress.

Phase 4 Describes How To:

- ☐ 4.1 Implement Schedules, Performance, Measurement, and Reporting Plans
- ☐ 4.2 Mitigate Adverse Environmental and Social Impacts
- ☐ 4.3 Maintain Transparency in Project and Vendor Selection Processes
- ☐ 4.4 Develop and Implement, When Appropriate, a Project Closeout Process
- ☐ 4.5 Engage Stakeholders to Keep Progress Visible

4.1 Implement Schedules, Performance, Measurement, and Reporting Plans

4.1.1 Identify All Project Permits

The application for and receipt of project permits are critical to project success, and typically are a major component of setting realistic schedules and performance plans. While an experienced project permitting partner can help minimize unforeseen costs and delays, all project partners need to set realistic expectations regarding the permitting process, and a comprehensive list of needed permits and their requirements can help. Beyond knowing what permits are required, planning for applications and collecting the relevant data in advance will avoid resubmissions and rework. Additionally, if relevant government agencies are streamlining their permitting processes, accurate information on the permitting experience will help them reduce any inefficiencies.

Example Project Permits Questionnaire

- What permits or authorizations are required from the local utility or regulating body?
- If leasing the site, what permits or authorizations are required from site owner?
- What permits or authorizations are required from local jurisdictions or agencies?
- What permits or authorizations are required from central government agencies?
- What information does each permit or authorization require in order to be processed?
- Is that information free or will cost be incurred?
- What is the cost, and when must it be expended to meet the schedule of the project?
- Who will pay the costs of any work or direct cost necessary to accomplish work necessary to achieve approvals, authorizations, or permits?
- Could the timing of permits and authorizations significantly impact the costs or economics of the project? Could that put the project in jeopardy?
- Is litigation of permitting issues expected or probable?
- Will delays in permitting impact financing?
- What if the project is not built? Are any parties in the process expecting reimbursement of some, or all, incurred costs?

Adapted from *Developing Renewable Energy Projects Larger than 10 MWs at Federal Facilities* (Federal Energy Management Program 2013).

4.1.2 Set a Realistic Project Schedule

Setting and keeping a realistic schedule is fundamental to project success, in part because it requires the project team to imagine what success looks like and articulate the time and effort required for each step along the way. When setting a schedule, it is important to include “slack time” for when resources are unavailable, and time for meetings, as regular meetings are an integral, yet time consuming, part of project execution. If schedules change, document the changes and collect correspondence to explain why the schedule required adjustment and approve the changes.

Several tools, including a Gantt chart and Critical Path Analysis, can aid in setting and monitoring schedules. Regardless of whether the project team employs a formal method, an arrow diagram may be useful to help the project team visualize the resources that will be required in what order before a desired result will be achieved. Templates for these charts are sometimes included with or available for spreadsheet software. Free online tools offer similar functionalities.

Part of keeping to a schedule requires coordinating with management and other governmental entities involved in, but not responsible for, project success. For example, permitting construction can involve nonenergy agencies, yet their review is necessary to keep the schedule. The Responsible-Accountable-Consulted-Informed (RACI) diagrams from Phase 3 can be useful in determining which other agencies will participate in project development, and working project schedules into performance plans can help ensure this coordination proceeds effectively. If a project champion was identified in Phase 3, make sure to call upon the champion if the team is faced with—and unable to overcome—a challenge after a good faith effort.

4.1.3 Performance Plans

Success will depend on many factors, including the performance of project team members. The first steps in project execution can involve Request for Proposals, technology evaluation, or data collection, but in simple terms, it starts with a phone call or an email from the project team. Setting expectations for project team members can ensure that all members understand their roles on the project and the contributions they will make to its success.

A performance plan clearly states those roles and responsibilities for team members, and can identify the training and resources they need to attain the results expected of their performance. It can also link responsibilities to the project schedule to ensure individual project team members understand when they need to complete certain tasks to achieve their results on time. Additionally, performance plans help the project team to appreciate the value of their teammates and allow for recognition of individual and team performance.

4.1.4 Using Metrics To Track Progress

Although some responsibilities are task oriented, a focus on outcomes will ensure that processes achieve desired results. Metrics do not need to count numbers, but can track results critical to project success.

Outcomes that may be useful to track are:

- Finalizing equipment specification
- Timely issue of permits
- Close of negotiation with vendors and/or finance partners
- Timely delivery of equipment
- Trainings completed
- Testing and accepting equipment
- Issuance of purchase orders
- Timely reporting with appropriate data
- Equipment in use
- Number of public engagement activities.

4.1.5 Project Reporting

Beyond ensuring the project is on track to succeed, collecting project information for project progress reporting is one of the most important tools to communicate progress throughout the government and out to partners and the public. Building on the planning in Phase 3, simple processes to collect and present progress data in a uniform way can mark successes and help maintain support for the project.

Although data requirements, the frequency of reporting, and who compiles the reports will vary by project type, risk, and partner expectations, the requirements and frequency should be a manageable way to summarize project status. The reporting process collects information from project staff for management and other stakeholders, so team leads or project managers are likely in the best position to compile and finalize these reports. Common status reporting periods are quarterly or semiannually. It is important to note that larger projects often have more comprehensive annual reporting requirements.

The RACI diagrams from Phase 3 can help identify the appropriate audience for the reports and, in turn, the appropriate information to include in them. Common information to include in quarterly or semiannual reports includes:

- Summary of activities since the last report
- Budget status and rate of expenditure (burn rate)
- Milestone and metric status
- Any upcoming challenges for management awareness.

Anticipate Public Opposition; Engage and Educate Stakeholders Early and Often

As part of the Energy Development in Island Nations initiative launched in early 2010, the U.S. Virgin Islands (USVI) began working with the U.S. Department of Energy and the National Renewable Energy Laboratory to develop a strategy for reducing the territory's 100% reliance on fossil fuels 60% by 2025.

Based on preliminary modeling and analysis, the Virgin Islands Water and Power Authority (WAPA) identified waste-to-energy (WTE) as a significant opportunity for the USVI because municipal solid waste was an abundant renewable resource—in fact, the territory's landfills were nearing capacity and were in violation of U.S. Environmental Protection Agency standards. Because WTE provided a potential solution to USVI's waste management problem and its energy challenges, it was a key component of the territory's original strategy for achieving its 60% goal, representing 8% to 12% of the envisioned 2025 energy mix. The proposed WTE project, which ultimately failed, offers a valuable lesson on the importance of proactively addressing a common barrier to successful renewable energy project deployment: lack of stakeholder buy-in.

In August 2009, WAPA and the Virgin Islands Waste Management Authority had signed agreements with a private firm to build two waste processing and generation plants—one on St. Thomas and one on St. Croix. While the project team did not attempt to keep the project a secret, they did not put a great deal of thought or effort into communicating the risks and benefits to stakeholders. Rumors spread about the environmental impacts and costs of the project. And the official announcement about the signed agreement caused an immediate public outcry.

Continued on page 4-4

Anticipate Public Opposition *from page 4-3*

Stakeholders had legitimate concerns about the legal, financial, and environmental ramifications of various aspects of the deal, including:

- Emissions from the proposed WTE power plants
- Specifics about the project, such as the wholesale cost and the amount of power to supply to WAPA
- Costs associated with disposing of the territory's waste ("tipping fees")
- Potential financial obligations of the USVI government should the Virgin Islands Waste Management Authority be unable to supply the minimum amount of waste required for conversion to refuse-derived fuel
- The project owners planned use of petroleum coke—a byproduct of the oil refining process—as a supplemental fuel source in the event that the territory's waste stream fell below the minimum requirements.

In the face of strong community opposition, the senate in 2010 rejected one of the land leases that was a lynchpin of the original plan. In response, the developer modified the plan, eliminating the use of petroleum coke and proposing a single plant on St. Croix. The project partners also conducted a series of stakeholder engagements to educate the public on their extensive pollution control measures and the state of the art in WTE technology. A well-researched technical report on WTE released in August 2011 provided project partners and proponents with the hard data they needed to address remaining concerns. By that time, however, public opposition had reached critical levels and legislators were under intense pressure to reject the revised plan. In February 2012 the USVI senate voted down a second proposed land lease agreement, effectively killing the project.

The project team failed to anticipate and address stakeholder concerns about WTE and underestimated the power of public opinion. As a result, the team missed the small window of opportunity early in the project preparation phase to address concerns proactively through a carefully managed outreach, education, and engagement strategy. Although this project did not succeed, waste management is an ongoing issue in the territory, and the Virgin Islands Waste Management Authority continues to investigate WTE as a potential solution.

Key Takeaways

- Consult with key stakeholders about issues and barriers early in the planning stages.
- "Get out in front of the story," responding directly to concerns with hard data and carefully crafted key messaging.
- Educate and inform key stakeholders about proposed technologies and project specifics early and often.
- Taking a transparent approach to information management is a key to successfully developing stakeholder buy-in and winning the public's trust.

A landfill-gas-to-energy conversion system at Bovoni Landfill on St. Thomas will bring the USVI one step closer to meeting its clean energy goal. *Photo from Don Buchanan, VIEO, NREL 20817*

4.2 Mitigate Adverse Environmental and Social Impacts

Although generally energy efficiency and small to midsize renewable energy projects will not require significant environmental mitigation, even small construction projects can have adverse impacts on neighboring communities. Although for many projects these impacts will be slight, it is important to take steps to mitigate them. Waste management, noise and vibration, land and water use, and biological, cultural, and coastal zone management are some of the key considerations when evaluating the potential environmental and social impact of a project.

For example, the noise and light pollution that can result from wind projects can be mitigated by siting these projects appropriately. Similarly, glare from solar panels can create light pollution, and site selection can mitigate that impact.

4.3 Maintain Transparency in Project and Vendor Selection Processes

Transparency in Phase 4 demonstrates deliberate and considered decision-making, which mitigates a variety of project risks, facilitates stakeholder support, and ultimately improves the chances of project success.

Transparency can be maintained by articulating a few key components of a successful project, and communicating those expectations to project partners and potential vendors. In some instances, weighting those criteria according to importance to success allows partners and vendors to shape well-rounded and comprehensive project plans. Furthermore, the process of articulating components of success and their relative importance helps set expectations for the project team and outside stakeholders, paving the way for public recognition of successful projects.

4.4 Develop and Implement, When Appropriate, a Project Closeout Process

Some projects, such as direct funding or facility construction, may benefit from a project closeout process. During closeout, the project lead accepts final delivery of the work, so this may be when warranties begin to toll and insurance needs transfer from the contractor to facility owner. It is also another opportunity to ensure that facility operators have received the appropriate training necessary to operate and maintain project assets.

Typically, closeout involves the calculation and documentation of all costs and expenses, and written statements that the work is being accepted and that the equipment was tested and meets specification. This documentation is often required to release final payments, and provides the opportunity to compare planned budget to actual expenditures.

Along with financial information, other project documentation, such as plans, correspondence, relevant meeting notes, schedules, deliverables, scope changes, and status reports, should be collected and archived. This documentation can provide a key record of project decision-making, not only for future projects or project reviews, but also warranty claims. It also allows for knowledge transfer from the project team to owners or operators of any equipment.

Closeout can involve the reassignment of project resources, including team staff time, and performance reviews for staff and contractors. Devoting time to staff transitions can help ensure that project staff members remain through closeout because they have confidence about their next position, and will minimize disruptions to staff availability at the close of a project.

4.5 Engage Stakeholders To Keep Project Successes Visible

The continued support of the public is important to individual projects and to the overall Caribbean Energy Transition vision. Major project milestones, such as permit applications and beginning of construction, provide opportunities to communicate progress to the public and to solicit feedback from key stakeholders, such as project neighbors or consumers.

Events such as groundbreakings and ribbon cuttings can raise the profile of projects, and give partners and stakeholders the opportunity to interact. Although not directly related to project success, continuing this type of communications and outreach will demonstrate the value of the project and emphasize the capability of the community to realize its energy vision.

El Hierro Wind Farm With Pumped Storage

El Hierro, one of Spain's Canary Islands without any fossil fuel resources, set a goal of energy self-sufficiency in the late 1990s, and will realize its vision in 2014. As part of its vision, the bulk of energy supplied to the system would come from a hydroelectric plant using water pumped to a reservoir by wind turbines. A partnership called Gorona del Viento El Hierro was formed between the island government, one of Spain's largest utilities, and the Canary Islands Technological Institute to oversee the project, and in 2007, this project was selected for execution.

The engineering consultant selected to support the project identified an alternative design that would improve system efficiency. By supplying electricity from the wind turbines directly to the grid—rather than feed the pumping station only—the hydroelectric facility would then provide spinning reserves and additional generating capacity when needed. In this configuration, additional electricity generated by the wind turbines is used in the energy system—not lost in the transfer at the pumping stations—thereby eliminating the need for some pumping infrastructure.[3]

The experience of El Hierro illustrates the benefits of flexibility in planning and executing projects. The new facility is expected to lower electricity costs by approximately 23%.[4]

4.6 Phase 4 Resources

Lessons Learned

- U.S. Virgin Islands Clears the Way for Unprecedented Levels of Solar Energy

Template

- Periodic Report

Sample

- Asia-Pacific Economic Corporation Government Procurement Experts Group Non-Binding Principles on Government Procurement: Transparency

Information Resources

[3] *http://www.renewableenergyworld.com/rea/news/article/2012/10/creating-a-hybrid-hydro-wind-system-on-a-spanish-island?page=all.*

[4] *http://elpais.com/m/elpais/2014/06/27/inenglish/1403882352_828317.html.*

LESSONS LEARNED

U.S. Virgin Islands Clears the Way for Unprecedented Levels of Solar Energy

In the U.S. Virgin Islands (USVI), solar energy is helping to alleviate the territory's dependence on fossil fuel while stabilizing and reducing energy costs.

Almost 1,500 solar water heating and PV systems have popped up throughout the territory since the EDIN-USVI project launched in February 2010, and 15 MW of distributed solar PV are either in place or under construction. *Photo from Don Buchanan, VIEO, NREL 20152*

Challenge

The territory's successes with solar energy started in 2010 when USVI Gov. John P. de Jongh Jr. set an aggressive goal to reduce the USVI's dependence on fossil fuel 60% by 2025. Like many island communities, USVI was almost 100% dependent on imported oil for electricity and transportation, leaving it vulnerable to global oil price fluctuations with potentially devastating economic effects.

Solution

Collaborating with the U.S. Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL), the Virgin Islands Energy Office and the Virgin Islands Water and Power Authority (WAPA) worked with a diverse set of public and private stakeholders to establish the territory's baseline energy use, assess its clean energy resources, and identify the most viable and cost-effective solutions to address its energy challenges.

The resulting strategy, while incorporating a diverse mix of renewable energy and energy efficiency technologies, identified larger and distributed scale solar resource development as an important first step on the road to meeting USVI's aggressive clean energy goal. In addition to having an excellent solar resource, USVI had established policies that provided an opportunity for developers to capitalize on this abundant source of clean, renewable energy.

In May 2011, WAPA released a Request for Proposal (RFP) to install 10 megawatts (MW) of solar photovoltaics (PV) by December 2013. In order to achieve this milestone, WAPA needed to reduce the risks associated with renewable energy development, attract quality developers, and ensure that proposed solar projects could be financed successfully.

Tapping into the technical expertise and renewable energy project development experience DOE and NREL brought to the table, WAPA was able to address these common project development challenges by:

- Helping identify optimal sites for solar PV systems
- Identifying policy and regulatory changes that would address current barriers, such as uncertainty around interconnection procedures and agreements
- Updating the USVI's solar resource assessment to more accurately gauge the potential impact of solar energy in the territory
- Modeling the WAPA grid and developing a strategy to avoid grid integration issues by distributing PV systems geographically

- Analyzing financial and resource data—including 1-minute data from a 451-kilowatt-hour (kWh) solar PV system installed at the airport on St. Thomas—to model the effects of high-penetration renewable energy on the existing WAPA generation system and grid.

These measures, which helped break down many of the common barriers to renewable energy project development, resulted in an overwhelmingly positive response to WAPA's solar RFP. On June 4, 2012, it signed six power purchase agreements for a combined 18 MW of solar energy.

As a result, three companies are investing a total of $65 million to install 18 MW of solar in the USVI—9 MW on St. Thomas and 9 MW on St. Croix.

The PV systems will generate 9 MW of solar power in each district, which WAPA will purchase at an average cost of approximately $0.18/kWh over the 25-year term of the projects. Not only is this significantly less than what it would cost the utility to produce the same amount of diesel-generated power at its plants, but it represents a groundbreaking shift in the territory's energy economy—and sets a new standard for community renewable penetration.

On St. Croix specifically, 9 MW of solar power represents nearly 20% of the island's peak demand, an unprecedented level of renewable energy penetration for a community of its size.

Key Takeaways

The USVI's successful solar projects provide a model for other islands to follow in developing their renewable resources, showcase the technical and economic viability of high-penetration renewable energy on islands, and guide other island communities in fundamentally changing the way they generate and use energy. Through its leadership on the clean energy front, the USVI is charting the course to a more secure energy future for the Caribbean region and for islands around the world.

Airport Solar System Largest in the Caribbean

- Solar energy is making its mark in USVI, as evidenced by the large-scale solar PV system installed at the Cyril E. King Airport in St. Thomas.
- In 2011, more than 1,800 PV panels were installed along the runway of the Cyril E. King Airport, totaling 451-kilowatt (kW)—one of the largest solar PV systems in the Caribbean.
- The 451-kW PV system flanking the airport's landing strip was funded by a $2.9 million DOE grant through the Recovery Act. At 1,500 feet long and 14 feet wide, the installation is the largest solar project in USVI and will produce approximately 15% of the airport's energy needs, or 600,000 kWh annually.
- The project, a joint effort between the Virgin Islands Port Authority and WAPA, received technical assistance from NREL through the EDIN initiative. The Port Authority planned to use energy produced to meet the airport's energy load and feed any excess back into WAPA's grid to receive credit toward its power bill. The Port Authority projected that this would reduce its utility bills by as much as $400,000 a year—representing an annual energy cost savings of approximately 15%.

> "I don't know of another area or jurisdiction anywhere that has that significant of a portion of their peak demand in a renewable resource such as solar, so this is not only a significant event for the territory but for solar energy everywhere."
>
> —Hugo Hodge Jr., WAPA Executive Director

Template: Periodic Report

Project Name:	
Date of Report:	**Project Start/End Dates:**
Project Location(s):	**Funds Disbursed This Period:**
	Funds Remaining:

Summary of activities since last report:
Describe purchases/expenditures, awards made, equipment installed, and any other milestones or metrics reached in this period. Explain progress or delays, or anticipated scope of work changes. Provide update on risks, whether significant risks are no longer likely, or whether any materialized and how they were addressed.

Project Task/Activities	Metric/Milestone Description	On time? On budget?	Date Completed

Task/activities expected in next report:

Attachments: Draft Press Release Concerning Milestone X

Sample: Asia-Pacific Economic Cooperation (APEC) Government Procurement Experts Group Non-Binding Principles on Government Procurement: Transparency

(September 1997, pulled from *http://www.osec.doc.gov/ogc/occic/apec.html*)

Introduction

1. Under APEC's collective action plan on government procurement (GP), a set of non-binding principles on GP will be developed in 1997–2000 for adoption by members on a voluntary basis. In pursuing this work, the Government Procurement Experts Group (GPEG) has decided to start with the principle of transparency.

2. The GPEG has identified a set of elements pertaining to the principle of transparency in GP, which are set out in the ensuing paragraphs. Examples on practices are also provided for the purpose of illustrating the possible ways to give effect to these elements, and are not intended as prescriptions of how these elements should be given effect in practice. It should also be noted that the elements of transparency in GP identified by the GPEG are non-binding and individual economies are in the best position to decide on the applicability of individual elements of transparency to them, and how best to translate these elements into practical measures, taking into account the specific characteristics of their economy and possibly the costs and benefits of adopting specific transparency measures.

Elements of Transparency

3. The general principle is that sufficient and relevant information should be made available to all interested parties consistently and in a timely manner through a readily accessible, widely available medium at no or reasonable cost. This general principle is applicable to all aspects of GP, including the general operational environment, procurement opportunities, purchase requirements, bid evaluation criteria and award of contracts, as further elaborated in paragraphs 5 to 14.

    - **Sufficiency and relevance of information:** to enable potential suppliers to make informed decisions. For example, potential suppliers must have access to information on the conditions for participation and the requirements of the intended procurement in order to decide whether to participate and to prepare a responsive offer.
    - **Timeliness:** to ensure that the information is valid and useful when available to the receiver.
    - **Availability to all interested parties:** to ensure that the procurement process is fair to all participants and seen to be fair.
    - **Through a readily accessible medium at no or reasonable cost:** to ensure that information is accessible in practice.
    - **Consistency:** the objectives of maintaining a transparent procurement system can only be achieved if the system remains consistently transparent. This also includes making information up to date and informing relevant parties of changes and additional information promptly.

4. Notwithstanding the above, the following information may be withheld: commercially sensitive information, and information the release of which would prejudice fair competition among suppliers, impede law enforcement, contrary to public interest or compromise security of the economy concerned. Where such information is withheld, the reason should be given on request.

The general operational environment

5. The laws, regulations, judicial decisions, administrative rulings, policies (including any discriminatory or preferential treatment such as prohibitions against or set aside for certain categories of suppliers), procedures and practices (including the choice of procurement method) related to GP should be transparent.

6. This is to let suppliers know the rules of the game so that they can decide whether to participate. In practice, this can include—

    - publishing these "rules" in a medium which is readily accessible to all.
    - publishing either a positive or negative list of the entities subject to these "rules".
    - publishing any changes immediately.
    - establishing contact points for enquiries.
    - wherever possible, providing a description of the above information on the APEC GP Home Page and linking APEC members' individual GP Home Pages, where available, with the APEC GP Home Page.

Procurement opportunities

7. Procurement opportunities should be transparent.

8. This would encourage wider participation leading to increased choices for the buyer and enhanced competition, contributing to achieving better value for money in procurement activities. In practice, this can include—

    - making open and competitive tendering the preferred method of tendering. Where other procurement methods are to be used, any procurement invitations issued should indicate the intended method.
    - where open tendering is adopted, publishing procurement opportunities in a medium readily accessible to suppliers (e.g. official journals/gazettes, newspapers, specialised trade journals, Internet, and through embassies and consulates.)
    - allowing adequate and reasonable time for interested suppliers to prepare and submit responsive bids.
    - publishing contact details of purchasers, and their product/service purchase interests, for suppliers wishing to register their interest in being notified of bidding opportunities which may not be publicly advertised.
    - making early advice of complex high-value procurement needs available to interested suppliers through staged procedures such as public requests for information, requests for proposals and invitations for pre-qualification, and allowing adequate time for interested suppliers to prepare and submit a response.
    - making available requirements and procedures for pre-qualification of suppliers.

Purchase requirements

9. All the information required for suppliers to prepare a responsive offer should be made available.

10. This is to facilitate effective and efficient participation by potential suppliers in the procurement exercise. Also, because potential suppliers know the specific requirements, the non-responsive offers that the buyer may have to process can be minimized, increasing the operational efficiency of the buyer. In practice, this can include—

    - including in procurement notices the following information : the nature of the product or service to be procured, specifications, quantity, time frame for delivery, closing times and dates, where to obtain tender documentation, where to submit bids, and contact details from which further information can be obtained.
    - publishing any changes to the above information immediately.
    - providing tender documentation and other information to suppliers promptly on request.
    - wherever possible, drawing up specifications in terms of performance/functional/operational requirements using international or other relevant standards.

Bid evaluation criteria

11. All criteria for evaluating bids should be transparent and bids should be evaluated and contracts awarded strictly according to these criteria.

12. This is to ensure fairness and integrity. In practice, this can include—

    - setting out in procurement notices and/or tender documentation all evaluation criteria, including any preferential arrangements.
    - maintaining proper record of decisions.

Award of contracts

13. The award of contracts should be transparent.

14. This would demonstrate government accountability to suppliers and the public. In practice, this can include—

    - publishing the outcome of the tender including the name of the successful supplier and the value of the bid.
    - as a minimum, promptly notifying unsuccessful suppliers of the outcome of their bids and where and when contract award information is published, and debriefing unsuccessful suppliers on request.

Due process

15. Due process and public accountability are essential elements of fair, open and impartial procurement procedures, and the availability of an avenue/channel for review of complaints is an element of transparency. In practice this can include—

    - designating a body/person for the purpose of reviewing supplier complaints about procurement processes which are not able to be resolved through direct consultation with the procuring agency in the first instance. This may take the form of an independent authority.
    - making information on review procedures readily available.
    - making the review process available equally to domestic and foreign suppliers.

Information Resources for Phase 4

These information resources and useful links are illustrative, not comprehensive.

A Handbook for Measuring Employee Performance: Aligning Employee Performance Plans with Organizational Goals (U.S. Office of Personnel Management [OPM] 2011). This handbook presents an eight-step process for developing employee performance plans that are aligned with and support organizational goals.

Community Wind Toolkit (Rural Energy for America Program 2011). This publication describes the tools needed to create a successful wind energy project.

Construction Project Close-Out Checklist (Alabama 2006). This checklist covers the closeout of a building construction project.

Cost Estimating and Assessment Guide (U.S. Government Accountability Office [GAO] 2009). This report guides project managers in estimating costs reliably.

DAU Program Managers Tool Kit (U.S. Department of Defense 2011). This comprehensive guide is designed as a training resource for project and contract managers.

Environmental and Social Policy Statement (Overseas Private Investment Corporation 2010). This policy provides notice of the general environmental and social requirements that the Overseas Private Investment Corporation applies in evaluating prospective projects.

Guide to Renewable Energy Facility Permits in the State of Hawaii (Hawaii 2013). The state of Hawaii provides this guidebook to reduce the uncertainty surrounding which permits are required for which activities in a given renewable energy project.

Key Considerations for Implementing Interagency Collaborative Mechanisms (GAO 2012). This report offers an overview of mechanisms to facilitate interagency collaboration.

Land-Based Wind Energy Guidelines (U.S. Fish and Wildlife Service 2012). This guidance provides a structured, scientific process for addressing wildlife conservation concerns at all stages of land-based wind energy development.

Life Cycle Asset Management: Quality Assurance (U.S. Department of Energy 1996). This guide helps project management teams develop and implement quality assurance programs for their projects.

Project Closeout Checklist (National Science Foundation 2006). This checklist provides a real-world example of the various components of a large project closeout.

Project Management Guideline: Section 5 Project Closeout (Virginia Department of Transportation 2006). This publication describes the various steps to take in an effective project closeout.

Quality Management Principles (International Organization for Standardization [ISO] 2012)ISO developed these eight principles to inform ISO 9000, the international standard on quality management and quality assurance.

Renewable Energy Permitting Barriers in Hawaii: Experience from the Field (National Renewable Energy Laboratory [NREL] 2013). This report documents the permit streamlining project undertaken by the state of Hawaii.

Review of Policies and Recommendations for Wind Turbine Setbacks (Minnesota 2011). This survey compiles rules on the siting of wind turbines from different countries.

Schedule Assessment Guide (GAO 2012). This report guides project managers in setting reliable program schedules.

Terrestrial Wind Turbine Siting Report (Rhode Island 2009). This survey compiles rules on the siting of wind turbines from a few US jurisdictions.

The Economic Partnership Agreement between the CARIFORUM States and the European Community and its Member States. Chapter 3 of Part II contains useful information on transparency in procurement.

The **Environmental, Health and Safety website** (*http://www.ifc.org/ehsguidelines*) from the International Finance Corporation hosts the most updated versions of the World Bank Group Environmental, Health, and Safety Guidelines.

The **Hawai'i Programmatic Environmental Impact Statement** (*http://Hawai'icleanenergypeis.com*) contains analysis of the potential environmental impacts of a number of energy efficiency and renewable energy activities and technologies.

The **Measuring Performance Management website** *http://www.opm.gov/policy-data-oversight/performance-management/measuring/* from OPM contains recommendations, advice and guidance on effective performance management.

The Non-Binding Principles on Government Procurement from the Asia-Pacific Economic Cooperation Government Procurement Experts Group. These principles provide helpful guidelines in structuring transparent procurement.

The **Performance Management Program Guide** (*http://www.tbs-sct.gc.ca/tou/pmc-dgr/pmpg-mpgr-eng.asp*) provided by the Treasury Board of Canada contains information on how to establish employee performance management programs.

The **Renewable Energy Contracts Library** (*https://financere.nrel.gov/finance/content/renewable-energy-contracts-library*) hosted by NREL contains a number of real-world renewable energy contracts, including Request for Proposals.

The UNCITRAL Model Law on Public Procurement. This model law lays out many international best practices on building an effective and efficient public procurement system.

The **Unified Process Project Management Guide** (*http://www2.cdc.gov/cdcup/library/practices_guides/#.U812VfldWSr*) provided by the U.S. Centers for Disease Control and Prevention hosts downloadable briefs and forms that provide guidance to project teams about key project management practices, including status reporting.

Tools and Techniques for Implementing Management Systems (Institute of Management Accounting 1998). This brief provides tools and techniques that can facilitate the development of an Integrated Project Management System, including some common key success factors.

PHASE 5: OPERATIONS AND MAINTENANCE

Phase 5 Describes:

- ☐ 5.1 Energy Efficiency Monitoring and Verification
- ☐ 5.2 End of Warranty Assessment
- ☐ 5.3 Condition Monitoring Equipment and Predictive Maintenance

Following Phase 3 and 4 project development and construction, the operations phase of energy systems is the time during which the benefits of most energy projects will be realized. Operations and maintenance (O&M) allows full use of the project assets and minimal impact from outages or unavailability. Because the equipment significantly impacts O&M budget requirements, project owners should work closely with vendors and manufacturers to shape O&M budgets, schedules, and employee training.

An O&M strategy must describe in clear terms and metrics how the equipment should normally be used and the expected performance from normal use, both of the equipment and any larger system that directly incorporates that equipment. It should also describe personnel activities, including training, and responsibilities for maintaining and repairing equipment to meet key performance indicators, as well as provide for the exchange of O&M information between operational and managerial staff. The RACI diagrams referenced in Phase 3 can also be useful for O&M strategies.

O&M involves recordkeeping to document state of equipment and any remedial action anticipated/needed/taken. As such, a comprehensive O&M strategy can be an integral part of compliance with any applicable environmental or other regulation relevant to the performance and operation of the equipment, and is sometimes required by law. Beyond regulatory reporting requirements, consistent information collection facilitates component replacement or planned outage requests, warranty claims, and documenting success. It is also critical to energy efficiency projects, such as energy savings performance contracts (ESPCs), to demonstrate energy savings.

5.1 Energy Efficiency Monitoring and Verification

Efficiency monitoring and verification (EM&V) documents the level of energy use reductions from equipment installations and behavior changes. Calculating the energy savings attributable to efficiency programs can be complex, and should be tailored to meet the data requirements in question. At a program level, EM&V provides the experiential data needed to shape future programs and understand the role of energy efficiency in load and revenue forecasting. For utilities including energy efficiency services into their business model, EM&V can provide the data needed for sales and marketing. The needs of the program administrator will shape the EM&V approach needed to gather the appropriate data.

For Energy Savings Performance Contracts (ESPCs), a project structure where an energy services company is paid for service and equipment delivery from savings that would have been spent on EM&V is critical to project success. An ESPC relies on an accurate baseline of energy use before services are provided in order to calculate the money saved. Savings are calculated based on a mix of stipulated savings, for weather or equipment replacements, and post-installation measurements at the component, system, or meter level.

5.2 End of Warranty Assessment

As equipment warranties come to a close, a project owner should conduct an end of warranty assessment to determine whether any corrective action is needed from the equipment supplier. Given the importance of the end of warranty assessment, the owner should ensure that staff and any contractor support are trained and capable of collecting and analyzing the appropriate information.

Typical Components Identified in the End of Warranty Assessment

Foundation	Cables	Blade bearing	Roads
Tower structure	Bedplate	Generator	Substation equipment
Blades	Gearbox	Generator slip ring	Transformers
Converter	Pitch systems	Yaw system	

Source: DOE 2011

5.3 Condition Monitoring Equipment and Predictive Maintenance

For infrastructure and other critical equipment, condition monitoring and predictive maintenance may protect these large investments better than other approaches to O&M. Condition monitoring sensors can collect information on performance indicators and analyze discrepancies from specification in order to facilitate maintenance before service disruptions or other failures occur.

For the wind industry, a major component of post-warranty operations expenditures is unscheduled maintenance, indicating that honoring a maintenance schedule and using condition monitoring can help reduce costs. (Industrial control systems, such as linking to a supervisory control and data acquisition system, may also be appropriate, depending on the equipment and its role in the energy system.)

5.4 Phase 5 Resources

Information Resources

A comprehensive O&M strategy should include plans regarding the monitoring and maintenance of equipment, personnel activities, and compliance and reporting requirements. *Photo by Joe Verrengia, NREL 16996*

Information Resources for Phase 5

These information resources and useful links are illustrative, not comprehensive.

A Retrocommissioning Guide for Building Owners (U.S. Environmental Protection Agency 2009). This guide covers the business case for retrocommissioning and describes the process step-by-step, including key strategies for success.

Building Operations & Maintenance Best Practices: A Guide to Achieving Operational Efficiency (U.S. Department of Energy [DOE] 2010). This guide provides energy managers with information and actions aimed at achieving these savings and benefits.

Commissioning for Federal Facilities (DOE 2006). This guide describes operations and maintenance (O&M) aspects of building commissioning and quality assurance.

Energy Efficiency Program Impact Evaluation Guide (DOE 2012). This guide describes the common terminology, structures, and approaches used for determining energy and demand savings, avoided emissions, and other non-energy benefits.

ESPC Life of Contract Plan: Documents Management and Checklist for Energy Savings Performance Contracts (State of Hawai'i 2012). This planning aid provides helpful guidance on effective energy efficiency retrofit project management.

Establishing an In-House Wind Maintenance Program (National Renewable Energy Laboratory 2011). This report discusses components of wind O&M plans.

Field Inspection Guidelines for PV Systems (Interstate Renewable Energy Council 2010). This guide provides a basic knowledge of how to inspect a photovoltaic system so that a field inspector can take this framework and develop the experience necessary to perform these inspections quickly and thoroughly.

Hounsfield Wind Farm Operations and Management Plan (Upstate NY Power Corp 2009). This is an example of a real-world O&M plan for a wind farm.

Introduction to Measurement & Verification (DOE 2007). This publication provides an overview of why and how measurement and verification is conducted.

Model Energy Savings Performance Contract Attachment 1 (Energy Services Coalition 2011). This model contract provides insight into the structure and content of an ESPC agreement, including monitoring and verification.

Planning and Reporting for Operations & Maintenance in Federal Energy Saving Performance Contracts (DOE 2007). These guidelines describe the O&M on planning and reporting in energy savings performance contracts.

PV System Operations and Maintenance Fundamentals (SolarABCs 2013). This report includes practical guidelines for PV system maintenance and options for inspection practices for grounded PV systems.

Reviewing Measurement & Verification Plans for Federal ESPC Projects (DOE 2007). These guidelines provide a framework for implementing uniform and consistent reviews of measurement and verification (M&V) plans for Federal ESPC projects

The **Maryland System Development Lifecycle website** (*http://doit.maryland.gov/SDLC/Hardware/Pages/Phase09Single.aspx*) provides a framework on reducing project failure, and provides an example of how to develop an O&M policy for an organization.

PHASE 6:
PROCESS IMPROVEMENT

Not long after a program ends or a project closes out, collecting insights from team members and other stakeholders provides information critical to improving the next project. By incorporating the learning that comes from project development and execution into subsequent projects, the team will accelerate progress toward realizing the Phase 1 vision and help ensure that the progress made to date will be a part of lasting change.

After a few projects have been completed, the information collected in Phase 6 can help the community reassess opportunity pathways from Phase 2 under new conditions and ensure that the next round of Phase 3 project selections take the next steps toward realizing the energy vision.

Phase 6 Describes How To:

- ☐ 6.1 Conduct Closeout Interviews with Project Partners and Stakeholders
- ☐ 6.2 Collect Lessons Learned and Identify Skills Development
- ☐ 6.3 Report Results of Review to Management, Project Partners, and the Public

6.1 Conduct Closeout Interviews With Project Partners and Stakeholders

The project team, project partners such as vendors, and other stakeholders such as customers and neighbors, all have unique perspectives on the conduct and outcomes of a project. For those involved with the project, the project lead should solicit specific feedback on the accuracy of schedule and budget estimates, the process of changing schedules or budgets, team member performance, risk identification and management, and project communications. Other stakeholders should be included because their input was considered in Phases 1–4, and a project review can identify to what extent the project met their expectations. Closeout interviews can also ask respondents to identify lessons learned or areas where improvement is needed, as well as overall satisfaction with the project.

Interviewing stakeholders and partners at the end of a project can help the project team identify lessons learned, areas for improvement, overall team member performance, and more.
Photo by Ted Sears, NREL 17434

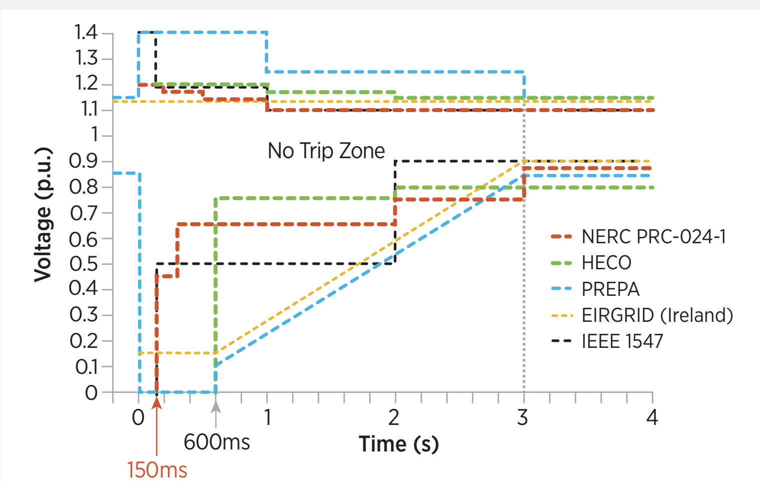
Updates to Generator Interconnection Minimum Technical Requirements in Puerto Rico

Puerto Rico has a significant opportunity to develop renewable resources, such as wind and solar, and undertook revisions to its interconnection procedures. Interconnection procedures govern how generating facilities, including renewable resources, are incorporated into the electric grid, and involve meeting minimum technical requirements (MTRs).

Because many MTRs were written to address relatively large fossil fuel-fired power plants, they can prove to be an unintentional barrier to the development of renewable and distributed energy projects. At Puerto Rico's request, the U.S. Department of Energy and the National Renewable Energy Laboratory (NREL) analyzed the MTRs that applied in Puerto Rico against the generally accepted practices of utilities in the United States and Europe, as well as the technical aspects of wind and solar photovoltaic projects. NREL's recommendations for improvements or additional study fell into several categories, including:

- Voltage fault ride-through
- Voltage regulation system, reactive power, and power factor requirements
- Short-circuit radio influences
- Frequency ride-through and response
- Ramp rate control
- Power quality.

Staff from the Puerto Rico Electric Power Authority (PREPA) participated in the review, and ultimately incorporated some recommendations into revised MTRs in August 2012. For other recommendations, utility engineers responded with a technical rationale for not modifying some of the requirements. By seeking out and considering the results from the analysis, Puerto Rico worked to address the significant challenges presented by high renewable penetration, and provided project developers and other stakeholders with clear guidance on the MTRs and the rationale behind them.



As part of its analysis, NREL developed this comparison between low-voltage ride-through requirements and high-voltage ride-through requirements for PREPA, North American Electric Reliability Corporation, and other islands systems such as the Hawaiian Electric Company and EirGrid while also incorporating Institute of Electrical and Electronics Engineers Standard 1547 clearing times. *Figure by NREL*

Reducing Maui Wind Curtailment

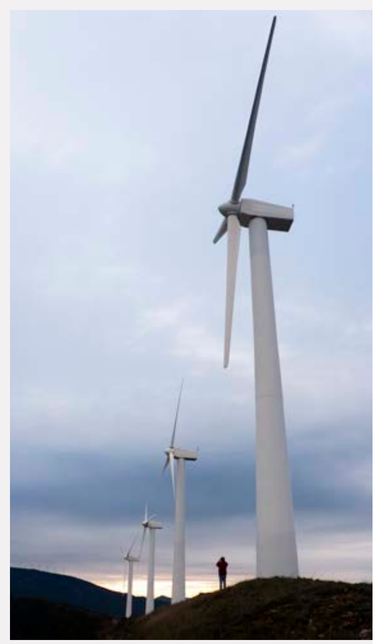
Island power grids such as Hawai'i's do not have the advantage of geographically diverse resources, which helps smooth out variable renewable generation output on interconnected power systems. This makes the integration of high levels of renewable energy a challenge, requiring utilities to regularly review their operations to ensure that the intermittent nature of the renewable energy does not compromise the reliability of the electricity system.

The island of Maui has a high percentage of wind and solar power compared to larger islands such as Oahu, thanks to wind power plants, distributed solar power, and a 10-megawatt battery energy storage system. However, a lack of familiarity with renewable resources created operational challenges, and the utility curtailed wind and solar energy because of concerns about grid reliability on this smaller island.

To help the utility meet its renewable energy targets, the HCEI leadership team convened a technical review committee (TRC) to evaluate potential mitigation strategies for reducing curtailment. The TRC included local stakeholders and national and international experts, and delivered the Hawai'i Solar Integration Study (HSIS), which assessed integration challenges for dynamic wind and solar resources and how to address those challenges—exactly what Maui was looking for.

HSIS developed a new method for calculating reserve requirements, based on simulations of how often solar and wind resources would be curtailed to maintain grid control parameters. At the time of the study, contingency and operating reserves were pooled together on Maui, and HSIS evaluated whether operating reserves could be allocated to cover variability of wind and solar resources.

The top mitigation measure identified for Maui was to upgrade the utility's combined-cycle units to enable it to switch between single- and dual-train operations as needed. The new method, with new control technology, allowed for different operational behavior, with significantly different reserve requirement curves. The HSIS found that switching could increase wind and solar penetration from 23.5% to 25.1%, reduce curtailment from 23.1% to 17.9%, and increase the percentage of additional renewable energy that was actually delivered to 94%. Other potential mitigation strategies included relaxed operating schedules for the utility's four oil-fired units and a change in the commitment process to increase the priority of operating reserves.



Thanks to the information provided in the HSIS, the Maui Electric Company and HECO are implementing mitigation strategies to reduce wind curtailment on Maui. *Photo from iStock 30420596*

The Maui Electric Company and Hawaiian Electric Company are now in the process of implementing mitigation strategies identified in the HSIS to reduce wind curtailment on Maui, including reducing minimum power levels of thermal units and switching from dual-train to single-train operation.

Other island communities facing the common challenges associated with increasing levels of renewable energy penetration will benefit from the mitigation strategies identified in the HSIS and the lessons Maui learns as it works to achieve balance between state clean energy goals and system reliability requirements.

6.2 Collect Lessons Learned and Identify Skills Development

Regardless of success or failure, the experience gained from each project can highlight opportunities to improve the next project. For example, the project team may have identified a way to streamline the permitting process, facilitate communications between project partners, select the most suitable vendor, or even project documentation processes. Using the closeout interviews, the project team should identify lessons learned from their experience on the project. By articulating these lessons, the experience from one project can transfer knowledge of the solution to improve Phase 4 of the next project. It can also help project teams balance consistency of approach with tailoring processes to meet their unique needs.

In addition, the project team likely gained new and developed existing skills. By keeping track of these developments, the project team will inform the project identification process in the next iteration of Phase 3.

6.2.1. Lessons Learned Key Features

- Provide basic information on who, what, where, and why.
  - The [technology/program/policy] project completed by [who] in [where] represents/demonstrates successful implementation of [Phase #].
- Identify the common challenge that is topic of this lessons learned.
  - When undertaking this type of project, one will need to address [common challenge in Phase #].
- Explain why this is a common challenge, with as much specificity as possible.
  - This common challenge arises because it involves [technology risk/financing risk/social risk/changing status quo]. This results from [add detail on challenge that relates to solution].
- Discuss replicable actions (i.e., the how).
  - [Who] addressed [common challenge] in completing the project by [how].
- If appropriate, provide history of reaching the decision point to provide context for course of action taken.
  - [Who] chose this project because [it lowers cost, etc.].
- Highlight reasoning behind decision (i.e., the why).
  - [Who] chose this solution because [why].
  - Indicate alternatives that may suit different circumstances.
- Conclude, emphasizing replicable actions, decisions, or paths to success.
  - This [how] addressed [common challenge] by [resolving tech/social conflict, etc.], and may be useful for others as they [implement Phase #].

6.3 Report Results of Review to Management, Project Partners, and the Public

The review of the project will generate useful information that can save time and resources in the next project, so it is important to communicate the results of the review. As the final step in completing the project, share the lessons learned, skills developed, and other information with other project teams, senior leadership, project partners, and stakeholders who participated in the project. Beyond making sure the project review was worth the effort, sharing this information is important if policy changes or other larger issues need to be addressed for future projects. Sharing this information with project participants demonstrates that their input was a valuable part of the project and was put to good use, not only in this project but in others as well.

6.4 Phase 6 Resources

Lessons Learned

- Energy Permitting Wizard Helps Reduce Project Barriers in Hawai‘i

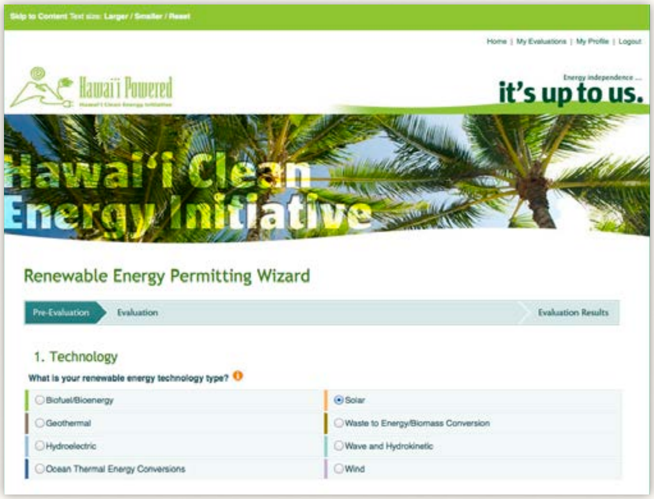
Worksheet

- Project Skills Register

Information Resources

LESSONS LEARNED

Energy Permitting Wizard Helps Reduce Project Barriers in Hawaiʻi



Similar to many jurisdictions, the complex permitting process for renewable energy projects has been identified as a critical barrier to renewable energy development in Hawaiʻi. The inability of project proponents to reliably predict the duration, outcome, and cost of the permitting process increases the investment risk for renewable energy projects, preventing the construction of projects that align with the state's clean energy goals.

The Hawaiʻi Clean Energy Initiative (HCEI) is a multiyear partnership between the U.S. Department of Energy and the state of Hawaiʻi to encourage collaboration between state utilities, business leaders, policymakers, and citizens committed to reducing the state's dependence on imported fossil fuels. With the support of the National Renewable Energy Laboratory (NREL) and others, HCEI has been involved in streamlining Hawaiʻi's permitting processes to help alleviate delays, improve the feasibility of renewable energy projects throughout the state, and aid Hawaiʻi as it strives to achieve 70% clean energy by 2030.

To specifically address these permitting challenges, HCEI and its partners developed the Renewable Energy Permitting Wizard to assist project teams with siting and designing a project according to the permitting requirements identified, resulting in more appropriate project siting and shortened permitting timelines.

Challenge

Prior to the development of the Renewable Energy Permitting Wizard, there was no central resource providing information on multijurisdictional (federal, state, and county) permits required for renewable energy or other projects in Hawaiʻi. People looking to determine the permitting requirements of a specific project needed to consult multiple sources and/or agencies, which required considerable time and resources. Because permitting impacts the financing of projects, reducing the permitting time or reducing the number of permits required can significantly impact total project costs.

The project team held three meetings with county planning agencies and local renewable energy professionals to identify and discuss Hawaiʻi's permitting processes. Through these meetings, a number of renewable energy project developers and industry professionals identified specific permits that were so difficult or time consuming to obtain that the developer either considered stopping or completely halted work on a project.

Project developers and industry professionals identified the following as the greatest barriers to renewable energy use in Hawaiʻi:

- Utility permitting and Public Utilities Commission processes can take a long time
- Community and political opposition to renewable energy

- Environmental agency inflexibility
- Unsuccessful implementation of the mandate to expedite permit reviews for renewable energy projects
- Large number of permits required and therefore large number of agencies involved in the process
- Unclear regulations and associated interpretations
- Applicant confusion about permitting requirements resulting in the frequent submission of incomplete applications.

Solution

During the stakeholder meetings, industry representatives identified four main streamlining priorities:

1. Standardized checklists
2. Permit application templates (e.g., digital and Web-based)
3. Reduce level of application detail as appropriate
4. User fees for expedited permit review.

In order to act on these recommendations, the Hawai‘i Department of Business, Economic Development, and Tourism (DBEDT) partnered with NREL to develop a series of guidebooks to provide project developers with a comprehensive resource on permitting renewable energy projects in Hawai‘i. These guidebooks summarize the types of permits that a renewable energy project developer may need to acquire and provide information on how to determine if a permit would be necessary based on the specifics of the project. Permit packets were also developed for each permit to provide more detailed information on the permit requirements and the process for applying for the permit.

DBEDT decided to use the information provided in the initial guidebooks to develop an online permitting tool that would help renewable energy project developers quickly determine the permits that would apply to a renewable energy project in Hawai‘i. The tool works by presenting a series of questions about the proposed project and based on responses, a list of permits potentially required is displayed with typical timeframes for each permit. The Permit Packets available through the Renewable Energy Permitting Wizard provide details and relevant information for each individual county, state, and federal permit. The tool allows developers to understand early in the planning phase not only the expected timeframe for acquiring permits, but also how altering the design or location of the project could change which permits are needed.

Key Takeaways

The Renewable Energy Permitting Wizard helps utilities, developers, and policymakers meet Hawai‘i’s renewable energy goals by simplifying and expediting review. The tool helps those proposing renewable energy projects understand the county, state, and federal permits that may be required for their individual project and works for projects ranging in size from residential solar installations to large utility-scale facilities. The Permitting Wizard also provided information on the processing of more than 160 federal, state, and county permits, and links to the various agencies and other resources needed to satisfy permitting requirements.

Such insights can also be used by permitting agencies and other organizations pursuing the difficult task of improving the permitting process for renewable energy projects in Hawai‘i and elsewhere.

Worksheet: Project Skills Register

Skill	Project Management	Budget	Training	Technical Writing	Document Management	Project Coordination	Vendor Selection
Team Member Name	Proficiency: Interest:	Proficiency: Interest:	Proficiency: Interest:	Proficiency: Interest:	Proficiency: Interest:	Proficiency: Interest:	Proficiency: Interest:

Information Resources for Phase 6

These information resources and useful links are illustrative, not comprehensive.

Post Implementation Survey (Pennsylvania 2008). This is a real-world project closeout survey for project team members.

Project Closeout: Guidance for Final Evaluation of Building America Communities (National Renewable Energy Laboratory 2008). This evaluation demonstrates a real-world example of a comprehensive closeout review of a large project.

Project Closeout Template (U.S. Centers for Disease Control and Prevention 2006). This template provides a useful foundation for an energy project closeout form.

The **Cornell Project Management Methodology website** (*http://www2.cit.cornell.edu/computer/robohelp/cpmm/CPMM_Guidebook.htm*) hosts a variety of project management templates, including a project closeout checklist.

Photo from iStock 25167961

ENERGY TRANSITION INITIATIVE

Islands

The Energy Transition Initiative leverages the experiences of islands, states, and cities that have established a long-term vision for energy transformation and are successfully implementing energy efficiency and renewable energy projects to achieve established clean energy goals. Through the initiative, the U.S. Department of Energy and its partners provide government entities and other stakeholders with a proven framework, objective guidance, and technical tools and resources for transitioning to a clean energy system/economy that relies on local resources to substantially reduce reliance on fossil fuels.

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