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# INDONESIAN & HAWAIIAN UTILITIES SHARE EXPERIENCE ON RENEWABLE ENERGY & POWER CABLES TO INTERCONNECT ISLAND GRIDS

## EXECUTIVE EXCHANGE WITH HAWAIIAN ELECTRIC COMPANY AND MAUI ELECTRIC COMPANY

HONOLULU AND KAHULUI, HI - Under the Energy Utility Partnership Program (EUPP) and the Indonesia Clean Energy Development Program (ICED), funded by the U.S. Agency for International Development (USAID), the U.S. Energy Association conducted an Executive Exchange on Clean Energy Development from April 13 to 20, 2013. Nine senior managers from PT PLN Persero (PLN), the Indonesian electric utility, traveled to Oahu and Maui for meetings with Hawaiian Electric Company, Maui Electric Company, First Wind, H-Power, Hawaii Public Utilities Commission, Hawaii State Energy Office and SunPower.

PLN is the national electric utility for Indonesia, owned by the Government of Indonesia. PLN is a vertically-integrated utility serving over 46 million customers. PLN owns approximately 85% of the installed power generation capacity in Indonesia, while independent power producers (IPPs) own the remaining 15%. The total generating capacity for Indonesia is 30,583 MW. The generation fleet is powered by coal, gas, oil hydro and geothermal.

In response to rising electricity demand, a distributed population and high and volatile fuel costs, Indonesia has set an aggressive renewable energy development plan, with a goal of 12 GW of new additional renewable energy generation planned by 2020, including solar and wind. With such a high penetration of intermittent renewable resources on isolated island grids, PLN is preparing to face the challenges of maintaining grid stability and reliability. In order to identify best practices in renewable energy integration, PLN delegates met for five days with Hawaiian utilities, regulatory bodies, state energy agencies and energy companies.



*Above: The delegation from PT PLN of Indonesia at Hawaiian Electric Company with HECO, USAID and USEA staff.*

**USEA** and **ICED** organized the utility executive exchange, which was sponsored by **USAID**. USAID’s Indonesia Clean Energy Development (ICED) project works with the Indonesian government agencies (central, provincial, and local), the electric utility (PLN), non-governmental organizations, communities, universities, and the private sector to provide support for Indonesia’s clean energy objectives.

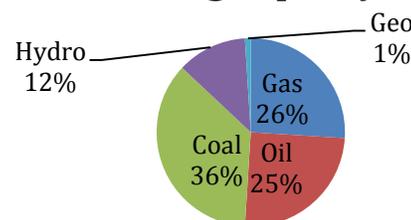
The **Energy Utility Partnership Program (EUPP)**, funded by USAID, seeks to increase access in USAID-assisted countries to environmentally sound energy services. EUPP activities include seminars, workshops and executive exchanges that promote the transfer of utility best practices.

**PARALLELS BETWEEN HAWAIIAN AND INDONESIAN ENERGY SECTORS**

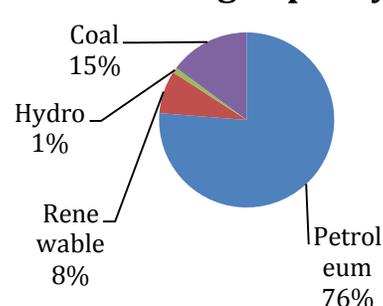
As island chains with populations spread across many isolated grids, Indonesia and Hawaii face similar challenges in energy development. Both rely heavily on fossil fuels, as shown in the charts to the right. With the exception of Indonesian coal, most of these fuels are imported and subject to volatile price shifts. This can have extreme effects on the price of electricity.

In 2008, during a fuel price spike, Hawaii spent 13% of its Gross State Product on fuel for transportation and electricity. As a result, Hawaii’s Department of Business, Economic Development and Tourism (DBEDT), along with the U.S. Department of Energy, Hawaii Public Utilities Commission, U.S. Department of Defense, Hawaiian Electric Company, Maui Electric Company, Hawaiian Electric Light Company, Kauai Island Utility Cooperative and the Hawaiian business community launched the **Hawaii Clean Energy Initiative (HCEI)**. The goal of the HCEI is to reduce energy consumption by 30% and generate 40% of energy for transportation and electricity from renewable sources by 2030. In the pursuit of these goals, Hawaiian Electric Company has become a global leader in integrating renewable and intermittent generation into the grid.

**Indonesia's Generating Capacity**



**Hawaii's Generating Capacity**



**INTEGRATING RENEWABLE ENERGY**

**Hawaiian Electric Company (HECO)** serves over 400,000 customers on Oahu, including Hawaii’s most populous city, Honolulu. Because each island’s grid is isolated, each island requires more generation reserves than a typical mainland utility. It also increases the technical challenge of integrating high levels of intermittent renewable energy. HECO’s subsidiaries, **Maui Electric Company (MECO)** and **Hawaii Electric Light Company (HELCO)**, have some of the highest penetration rates of renewable energy in the world. 21% of Maui’s generating capacity and 47% of Hawaii’s generating capacity are renewable sources.

HECO and MECO discussed the operational and planning best practices for maintaining reliability with such high penetration of intermittent resources. These practices included the use of battery storage on intermittent generators to help overcome intermittency by “ramping”. In addition, HECO is using cutting edge technology to increase the frequency and accuracy of load forecasting to 15 minute intervals. HECO has also incorporated operational practices for IPPs into their power purchase agreements (PPAs) to address intermittency challenges, including aggressive low-voltage ridethrough standards and remote dispatch capabilities.



*Above, from left: Ami Indriyanto, Dan Giovanni and Mochamad Sofyan discuss the technical challenges of integrating large intermittent resources to island grids. HECO’s aggressive development plans target 40% renewable energy generation by 2030 and HECO is on the cutting edge of renewable energy deployment.*

## REDUCING ENERGY CONSUMPTION

The second component of the Hawaii Clean Energy Initiative is increasing energy efficiency. PLN has found it difficult to encourage energy efficiency because electricity rates are subsidized nationwide. Since the electricity rates paid by consumers are less than 25% of actual generation costs, the incentive to reduce consumption is low. Because PLN cannot pass the cost of fuel through to the customer, PLN incurs significant revenue losses during fuel price spikes. The regulatory environment in Hawaii is much more conducive to efficiency programs due to utility revenue decoupling. Hermina Morita, Chair of the **Hawaii Public Utilities Commission**, explained the concept of decoupling electricity sales from revenue, which enables the utility to pursue efficiency programs without suffering a financial disadvantage.

The Public Utilities Commission (PUC) regulates all franchised or certificated public service companies operating in the State. The PUC prescribes rates, tariffs, charges and fees; determines the allowable rate of earnings in establishing rates; issues guidelines concerning the general management of franchised or certificated utility businesses; and acts on requests for the acquisition, sale, disposition or other exchange of utility properties, including mergers and consolidations. Chair Morita highlighted Hawaii's ability to foster cooperation between the regulator, policymakers and utilities as a crucial factor in carrying out the Hawaii Clean Energy Initiative.



Above: Hermina Morita, Chair of the Hawaii PUC (right) with Mochamad Sofyan, Head of the New and Renewable Energy Division, PLN.



Above: Sharon Suzuki, President of Maui Electric Company (left) and MECO staff with the PLN delegation at MECO headquarters.

HECO and MECO also discussed their efficiency programs. MECO explained a statewide program designed to encourage the use of efficiency appliances. Residential consumers who live on Maui can have new, efficient refrigerators delivered and the old refrigerators removed free of charge. Coupled with state efficiency tax credits on the appliances, this encourages customers to make the investment in efficient technologies that will save them money in the long run.

The delegation then met with the **Hawaii State Energy Office** to further discuss the Hawaii Clean Energy Initiative. The Hawaii State Energy Office employs a range of programs designed to support Hawaii's clean energy goal of 70% by 2030 and spur economic development in the energy sector. The Hawaii State Energy Office's mission is to act as a catalyst for creating efficiency measures, renewable energy resources, transportation initiatives, and progressive policy that lead to green jobs and investments in Hawaii's economy. Veronica Rocha, Renewable Energy Branch Chief, and Carolyn Shon, Energy Conservation Program Manager for the State Energy Office, detailed their efforts to encourage sustainable

development and energy independence.

Some of Hawaii's statewide programs include public information dissemination on energy efficiency financing, public directories on renewable energy projects, and facilitating federal American Recovery and Reinvestment Act programs in energy efficiency, renewable energy integration and transportation. Through ARRA funds, Hawaii's Department of Business, Economic Development and Tourism (DBEDT) has deployed over \$37 million in projects.

## INTERCONNECTING ISLAND GRIDS

Electric utilities in both Hawaii and Indonesia are exploring the possibility of interconnecting grids from adjacent islands through undersea power cables. This



Above: Mochamad Sofyan (PLN) with Veronica Rocha and Carolyn Shon (DBEDT)

will enhance electric reliability by enabling neighboring islands to share power resources and facilitating the integration of intermittent renewable energy resources across a larger section of the islands. PLN has several existing undersea interconnections and shared its experience with Hawaiian Electric.

### OPERATING RENEWABLE POWER STATIONS

The PLN delegation conducted several site visits to renewable generating stations to gain exposure to operator’s perspectives on intermittent renewable generation grid integration.

#### SOLAR

On Oahu, the PLN delegates toured **SunPower’s** 5 MW Kalaeloa Solar facility. Kalaeloa I features SunPower’s own solar tracking system, which maximizes production by rotating the photovoltaic panels to track the sun’s movement across the sky. The SunPower staff described the process of developing a solar photovoltaic plant in Hawaii, including the PPA negotiation, interconnection study, and operation of the plant. Solar photovoltaic power has high potential in most of Indonesia due to times of exposure and the strength of Indonesia’s Equatorial sun. Indonesia is also exploring solar facilities with tracking technology.



*Above: SunPower staff demonstrates the tracking equipment used at the 5 MW Kalaeloa Solar generating station outside of Honolulu.*



#### WIND

The delegates toured two wind farms owned and operated by **First Wind** on Oahu and Maui. On Oahu, First Wind staff detailed the operating procedures at the Kawailoa 69 MW facility. Kawailoa has operated since 2012 and powers up to 10% of Oahu’s homes. First Wind staff highlighted the 300,000 bbls of oil consumption annually avoided by operating the wind farm and the company’s Habitat Conservation Plan (HCP) on Oahu. On Maui, the delegates toured First Wind’s 51 MW Kaheawa wind farm. At Kaheawa, First Wind mitigates the fluctuation in power output due to changing winds by using a battery backup to “ramp” output. The battery has a storage capacity of 20 MWh, and enables First Wind to more easily work with MECO to maintain grid stability.

*Above: Ryan Pierce of First Wind explains how First Wind utilizes battery storage to mitigate fluctuations in power output at the 51 MW Kaheawa Wind farm on Maui.*

#### BIODIESEL

The delegation also visited the CIP-CT1 is a 100 MW combustion Honolulu. HECO staff discussed biodiesel consumed in the plant, as well as the differences in requirements between different combustion turbines. PLN is considering deployment of biofuels in current combustion turbine power stations. The practical biodiesel experience of HECO served as a valuable example for PLN. In fact, HECO had successfully tested biofuels native to Indonesia, such as palm oil, in CIP-CT1.

CIP-CT1 biodiesel plant owned by HECO. turbine generating unit outside the technical specifications of the

#### WASTE TO ENERGY

After visiting the biodiesel plant, the PLN delegation toured **H-Power’s** 73 MW waste-to-energy plant. H-Power combusts municipal solid waste and reduces 90% of the volume of refuse destined for Oahu’s landfill. H-Power staff explained the revenue stream for the project and showcased their latest addition to the plant. The new burner enables H-Power to burn solid waste while reducing the amount of sorting necessary. In the plant operations center, PLN delegates watched a crane operator feeding municipal solid waste into the burner. In addition, operations staff for the plant demonstrated the plant’s operations monitoring equipment in real time.



*Above: The PLN delegation studies the operations center of the H-Power waste-to-energy power station.*

Overall, the site visits provided useful perspective for the delegates. As utility

employees, the tours exposed them to the views of a plant operator. In particular, the tours demonstrated the technical requirements for interconnection from an IPP perspective, and the concerns of private developers. These lessons will prove valuable as Indonesia prepares to develop standards for PPAs for large renewable IPP projects.

## **BEST PRACTICES PRESENTED**

Through the course of the program, the PLN delegation exchanged best practices in:

- Utility interconnection requirements for intermittent resources;
- Net metering and management of distributed generation;
- Renewable energy project development and financing;
- Policy and regulatory best practices for renewable energy development;
- Intermittent generation management;
- Load forecasting and backup generation dispatch;
- Power Purchase Agreement negotiation for independent power producers;
- Biodiesel fuel switching;
- Utility energy efficiency programs and demand-side management, and;
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## **RESULTS**

As a result of this program, the PLN delegates:

- Will incorporate many of the best practices observed at HECO and MECO into their plans to develop 12 GW of new renewable energy;
- Will design a standard PPA for interconnection of renewable energy to facilitate IPP development;
- Received sample PPAs from HECO detailing the technical steps to interconnection approval;
- Identified technical specifications of biodiesel for use in different gas turbines;
- Discussed IPP requirements for project development;
- Received regulatory policies to encourage the development of renewable energy from Hawaii PUC, and;
- Identified utility initiatives and programs to encourage energy efficiency and demand-side management.

## UTILITY EXCHANGE PROGRAM PARTICIPANTS

### PLN Participants

1. Mr. Mochamad Sofyan, Head of New and Renewable Energy Division, PLN
2. Mr. Machnizon Masri, Senior Manager of Distribution System, PLN
3. Mr. Krishna Kartodirdjo, Team Leader of Biofuel Usage Program, PLN
4. Mr. Heri Priambodo, Manager of Planning Department, PLN
5. Ms. Dewi Setiani, Primary Energy, PLN
6. Mr. Daryanto Margono, Geothermal Engineer, PLN
7. Mr. Dwi Hartono, Assistant Analyst of IPP Procurement, PLN
8. Mr. Ahmad Syauki, Assistant Manager of Distribution, PLN
9. Mr. Edo Adrianto, Assistant Engineer of Distribution Asset Management, PLN

### USAID Participants

10. Ms. Retno Setianingsih, Energy Program Specialist, USAID/Jakarta
11. Mr. Bill Meade, Chief of Party, USAID/ICED
12. Ms. Ami Indriyanto, Senior Energy Policy and Regulatory Advisor, USAID/ICED

### USEA Participants

13. Mr. John Hammond, Senior Director, U.S. Energy Association
14. Mr. Andrew Palmateer, Senior Program Coordinator, U.S. Energy Association



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