ALASKA NATURAL GAS TRANSPORTATION PROJECTS
OFFICE OF THE FEDERAL COORDINATOR

LNG could ease Hawaii's high energy costs

Living amid the warm breezes and sandy beaches of the Hawaiian Islands comes at a cost. Residential electricity customers in Hawaii in April paid three times the national average for each kilowatt hour they used to run their refrigerators, TVs and ceiling fans. Much of that power came from oil-fired generating plants.

Hawaii residents who use natural gas to fuel their stoves and heat their water paid more than five times the national average last year.

The world of $100-a-barrel oil is making life ever more expensive to flip a light switch, turn on the oven or take a shower in Hawaii.

In addition, new environmental regulations will require the oil-fired generating plants to reduce sulfur emissions, forcing the choice of using even higher-priced low-sulfur oil or installing equipment to scrub the emissions, estimated to cost as much as $900 million.

Rather than accept rising costs as inevitable, the state government and Hawaii's utilities are working to bring online more renewables, including wind, solar and biofuel power. And they're looking at whether importing liquefied natural gas could help reduce fuel costs and meet new environmental regulations.

"Our main questions will be logistics and costs," said Lt. Gov. Brian Schatz, assigned by the governor to help coordinate the look at LNG. "Can we get it done, and at what price?"

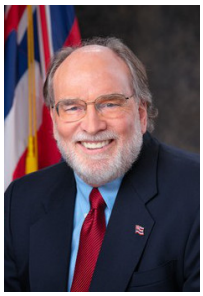
To answer those questions, Gov. Neil Abercrombie has asked the state's biggest electric utility to try to convert as much as possible to natural gas-fueled generation while continuing toward the ultimate goal of clean energy from solar panels, wind, biomass fuels and other sources.

Credit: State of Hawaii

Hawaii Lt. Gov Brian Schatz

"In particular, Hawai'i continues to suffer from record high prices for the low-sulfur fuel oil used to generate the majority of our electricity," Abercrombie said in a May 22 letter to Hawaiian Electric Industries, which provides power to 95 percent of the state's population through its three utility subsidiaries.

"A prudent question," the governor wrote, is whether utilities could convert their operations to burn "potentially cheaper and cleaner" liquefied natural gas as the state continues its transition to renewable energy.



Credit: State of Hawaii

Hawaii Gov. Neil Abercrombie

"I understand there are numerous logistical, environmental and economic questions that need to be addressed in order for LNG to become a reality," the governor said.

Among the issues:

- Hawaii is a small market that would require heavy capital spending — perhaps half a billion dollars — to dock LNG tankers, unload the cargoes and convert to natural gas-fueled power generation.

- Gas demand actually would decline over time as the islands increasingly turn to renewable energy as state law requires.
- Each island fends for itself for power generation because no undersea transmission lines connect the islands.
- Though Alaska or the U.S. Gulf of Mexico could offer domestic LNG supplies, a 92-year-old federal shipping law would make it difficult and costly to operate the trade.

More information is expected early this fall, the lieutenant governor said. The Hawaii Natural Energy Institute, created by the state legislature in 1974 during the OPEC-led oil embargo against the United States, is researching issues with natural gas imports.

The 50th state is similar to the 49th state, Alaska, where high energy costs also are pushing residents and their elected leaders to find a way to use more natural gas and less oil.

Alaskans want to pipe abundant natural gas from the North Slope into homes and electrical generating plants in the state's population centers. And while working on that, maybe also find a way to pull propane out of that gas stream and ship it to rural communities burdened by energy costs that rival Hawaii's.

PAYING TO PLUG IN

Among all 50 states, the average retail price for electricity in April was 11.95 cents per kilowatt hour, according to the U.S. Energy Information Administration. Triple that to 34.19 cents per kwh and you get the residential energy charge on Oahu, the most populated of Hawaii's islands.

And that's only for the first 350 kilowatt hours of juice each month on Oahu. The rate rises another penny or two from there, depending on usage. The average residential customer uses about 600 kwh per month, said Robert Isler, manager of generation project development at Hawaiian Electric.

Costs are even higher on the islands of Maui, where the residential charge starts at 36.92 cents, and Lanai, where the first 350 kilowatt hours cost 44.49 cents each.

By comparison, Anchorage looks like a bargain. Municipal Light & Power's and Chugach Electric Association's published residential rates as of July 1 were 8.56 cents and 13.08 cents, respectively.

But step outside Alaska's population center, which mostly burns affordable natural gas to generate electricity, and the costs look more like Hawaii's.

Golden Valley Electric Association, which serves the Fairbanks area, was charging a residential rate of 21.38 cents in July to cover its cost of burning a lot of expensive oil products.

Takotna, population 50, about 260 air miles northwest of Anchorage, paid for the painful distinction of the highest electric rates in the state, according to the Alaska Energy Authority's Fiscal Year 2011 Power Cost Equalization report. The residential rate averaged $1.02 per kilowatt hour last year, the report said. Fueling diesel-burning generators in remote villages comes at a high cost. Takotna burned 21,000 gallons of diesel fuel for electrical generation that year.

The state-funded Power Cost Equalization program dropped the actual cost paid by Takotna residents to about 45 cents, but only for the first 500 kwh per month. Government offices, schools and commercial accounts get no state subsidy and pay the full tab.

Looking down the list from Takotna's $1.02, the unsubsidized rates in several communities were in the 80s and 90s cents per kwh.

The subsidy last year covered 77,000 residents in 183 communities statewide, at a cost of $32 million.

The 2 million residents of Hawaii and Alaska may wish they could stretch an extension cord from Idaho, where cheap hydroelectric power helped hold the average price in April down to 8.02 cents per kwh, the nation's lowest.

NATURAL GAS COSTS

Hawaii residents are even worse off than everyone else when it comes to paying for natural gas. The average residential cost for natural gas nationwide last year was $10.81 per thousand cubic feet, according to federal statistics. Hawaii's average was five times that, at $55.28. Alaska, with its access to Cook Inlet gas for its population core, came in well below the national average at $8.78.

Average retail price for residential electricity April 2012

(per kilowatt hour)

The five lowest-cost states	
Idaho	8.02 cents
Washington	8.48 cents
Louisiana	8.48 cents
North Dakota	9.19 cents
Arkansas	9.39 cents
The five highest-cost states	
Connecticut	17.66 cents
Vermont	16.98 cents
New York	16.71 cents
New Hampshire	16.47 cents
New Jersey	15.92 cents
The 49th and 50th states	
Alaska	17.57 cents
Hawaii	37.52 cents

* Though residents of the population core in Southcentral Alaska pay far less, the high energy costs of Interior and rural Alaska drive up the statewide average.

Source: U.S. Energy Information Administration

Hawaii residents don't use conventional natural gas. Instead, The Gas Co. supplies its 68,000 customers statewide with a synthetic natural gas and propane. Customers use the gas for cooking and hot water heaters, said the company's Kevin Nishimura.

The Gas Co. has been around since 1904. These days it buys naphtha from the Tesoro refinery on Oahu and cracks it into methane. But it's expensive. The feedstock naphtha cost the company more than $30 per million Btu at its peak this spring, while the final delivered retail price to customers — after turning it into gas and piping it around the island — ranged between $40 and $60 per million Btu, Nishimura said. A million Btu is about the same as 1,000 cubic feet.

LNG could replace synthetic natural gas, but not so easily the small deliveries of bottled propane shipped to customers on all of the islands. The Gas Co. buys propane from both of Hawaii's refiners — Tesoro and Chevron — and also imports some into the islands.

The company previously rejected the idea of replacing synthetic natural gas with imported LNG. But now, with the wide gap between oil and natural gas prices, it's making sense to look again at LNG, Nishimura said.

"We're still at square one in the process," he said.

The Gas Co. is also at the start of another process, this one to refine local fish oil and eventually other animal and vegetable byproducts into natural gas and biofuels. The company in December opened a pilot plant capable of processing up to 1 million gallons of feedstock a year. It's located next to the company's synthetic natural gas plant in West Oahu.

The U.S. Department of Energy contributed $1 million to the project.

PILOT LNG PROJECT

To test the economics and logistics of LNG, and to start educating Hawaii residents about the fuel, The Gas Co. wants to try a small pilot project. It would bring in LNG via a tanker truck carried aboard a cargo ship, regasify the molecules and feed the gas into its pipeline system.

A 40-foot LNG tanker can hold almost 1 million cubic feet of natural gas.

The Gas Co. also is working with a consultant on the feasibility of a larger-scale development, Nishimura said.

If the project works out, the ideal would be to import enough gas to justify using a more cost-efficient oceangoing tanker rather than a fleet of 40-foot containers. But that much volume would require the electrical utilities to participate, too, he said, noting that The Gas Co.'s annual synthetic natural gas sales total just 3 billion cubic feet (about 8 million cubic feet per day), about one medium-size LNG tanker delivery a year. (Southcentral Alaska uses about 30 times that amount for electrical generation and heating.)

"The prospect of bringing natural gas, particularly liquefied natural gas, to Hawaii has been discussed at various times in the past, but has been largely

dismissed due to high costs," said a 2007 consultant's report for the Hawaii Energy Policy Forum and Hawaii Natural Energy Institute.

"If Hawaii was developing its energy infrastructure from scratch, natural gas, whether in the form of LNG or CNG (compressed natural gas), would be an ideal fuel, especially given the available options," the report said. Gas burns cleaner than oil and it could serve as a "bridge" fuel until better options come along.

"Of course," the report reminded everyone, "Hawaii is not developing its energy infrastructure from scratch." But it still might work.

WHY IS IT SO MUCH?

Electricity costs so much in Hawaii for pretty much the same reasons as in rural Alaska. It costs a fortune to deliver fuel to remote places. And each state's small, isolated market means no savings from economies of scale or cost sharing between communities.

"The electrical systems on each island are independent; there are no neighboring utility companies from which to draw power in the event of a problem," is how the Hawaiian Electric Co. describes it. "Therefore, for system reliability we must have reserve generating capacity and multiple distribution routes." For example, Oahu generating plants can make 50 percent more electricity than the island's historical peak demand.

No undersea electrical transmission lines link the islands, though that's a "hot topic these days," Isler said, as people talk about bringing in wind power from other islands to Oahu, home to almost 1 million of Hawaii's 1.4 million residents.

Legislators earlier this year passed a measure adopting a regulatory framework for undersea cables to connect Oahu with neighboring islands. The law doesn't approve any particular project but does create an opportunity for developers, though some residents oppose inter-island transmission lines because they don't want wind farms.

Hawaii's 410,000 other residents are spread over five other islands. The second smallest, Lanai, with 3,100 residents, has small diesel generators, just like Alaska villages.

Oahu has four generating stations with a total of 14 oil -fired boilers, two diesel-powered turbines, and a 3-year-old plant that uses biodiesel to run its single turbine. The oil-fired boilers "are as old as they get," Isler said, ranging from 30 to 65 years old. "If we're going to bring in LNG in bulk, that's where we're going to bring it," he said of the most populous island.

There also are a few independent power producers on Oahu that sell their output to Hawaiian Electric (which also serves military bases). It's an eclectic mix: a coal-fired plant, a combined-cycle plant that burns heavy oil, a generating station that burns trash to make steam to spin a turbine, and a wind farm.

A RENEWABLE FUTURE

The future for Hawaii is renewable energy. The garbage-to-energy plant is expanding from 46 megawatts to 73 megawatts and may be ready later this month, Isler said. Oahu's second wind-power farm, at 69 megawatts, should start up by the end of the year.

Credit: Hawaiian Electric Co.

The Kaheawa Pastures Wind Farm on Maui, operated by the First Wind Co. The 30-megawatt operation went online in March 2011.

Those will join almost 20 other existing and under-development renewable energy projects on the islands, totaling 450 megawatts of biofuel, waste-to-energy, geothermal, wind, hydroelectric and solar stations providing power to Hawaiian Electric Co. An additional 380 megawatts of renewable projects were under discussion or negotiation as of March, the company reports on its website.

It's not just about cleaning up the air and saving money from buying less foreign oil. It's the law.

In 2010, renewable energy sources provided 10 percent of Hawaiian Electric's sales. Last year that total grew to 12 percent, "well on the way" to meeting the state standard of 15 percent by 2015, the company said.

"Hawaii has created a legal mandate — known as a renewable energy portfolio standard — which requires that by 2030, 40 percent of the electricity sold by the Hawaiian Electric companies come from renewable sources," the company said.

Credit: en.wikipedia.org.

Keahole Solar Power's 2-megawatt Holaniku installation on the Big Island of Hawaii went online in 2009.

State lawmakers adopted the 40 percent standard three years ago. The standard also mandates a 30 percent reduction in demand through energy efficiencies.

"Hawaiian Electric sees that mandate as a floor, not a ceiling," the company said on its website. "Our commitment is to exceed the renewable portfolio standard and add as much renewably sourced electricity as soon as possible, with a goal of reaching 100 percent."

The state Public Utilities Commission can assess penalties against utilities that fail to meet the standard.

The Alaska Legislature went a different route two years ago, adopting renewable energy goals — not a mandate. Lawmakers said they wanted to see a 15 percent gain in energy efficiency by 2020 and half of the state's energy coming from renewable and alternative sources by 2025. The law provides no penalty for failing to meet the goals.

QUESTIONS FOR LNG

Over time, Hawaii's need for LNG probably would erode due to more renewable-energy projects coming online.

If Hawaiian Electric today were burning LNG instead of oil and diesel, and The Gas Co. were importing LNG instead of making synthetic natural gas, Hawaii would use less than 43 billion cubic feet of gas per year, or under 120 million cubic feet a day on average.

That's a small volume to underwrite the cost for Oahu port improvements, including docking facilities for an LNG tanker, plus storage tanks, a regasification plant and pipelines. The 2007 consultant's report estimated the capital expense could total between $360 million and $590 million. In the past, the cost savings of natural gas vs. oil was not sufficient to justify the investment.

"We believe we can bring in LNG cost-effectively now," Isler said.

But that doesn't mean it will happen.

"We don't know exactly how we would bring LNG to Oahu right now," Isler said. There just isn't much pier space in the harbor and not much industrial land available. Plus, there are some local concerns about liquefied natural gas storage on the island.

Possibilities include offloading the gas from an LNG tanker into aboveground steel storage tanks. Or using tankers that also house regasification units, then piping gas to generating plants as needed. That would require at least two tankers – one to sail for the next delivery while the other was anchored in Hawaii, providing storage and feeding the power plants. But the sea conditions are strong, presenting problems for tie-ups and ship-to-ship transfers.

One option being considered to get LNG to Hawaiian Electric's generating plants on the less populated islands — and to get it there sooner — would be to ship it there directly in 40-foot-long trailer-mounted tanks aboard oceangoing cargo ships. Drive it from the dock to the power plant and feed the turbines. It's similar to what The Gas Co. is considering for its pilot project.

Hawaiian Electric knows the options, Isler said. It just needs to figure out what's feasible. "We're still in the very early stages" of reviewing the options.

Other questions include:

- Whether Hawaiian utilities would pay global oil-linked prices for LNG or prices tied to U.S. natural gas markets. Today, U.S. prices are a lot lower, but there are no guarantees that will continue long term.
- Whether LNG would be bought on the spot market or via long-term sales contracts.
- Who would own the tankers and onshore facilities.

And where to get the gas.

THE JONES ACT PROBLEM

Alaska is one possible source. But federal law poses a big challenge to getting natural gas from Alaska, Nishimura said. A provision known as the Jones Act — part of the Merchant Marine Act of 1920 — requires use of U.S.-built, U.S.-owned, U.S.-registered and U.S.-crewed ships when moving commercial cargoes between U.S. ports. The act was named for Sen. Wesley Jones of Washington state, who wanted to protect the shipyards and ports of his state.

No U.S. shipyard has built an LNG tanker since the 1970s, and those were subsidized by the federal government. Some industry estimates place the cost of a U.S.-built LNG tanker at double the price tag from South Korean shipyards, the world leader in the trade.

The Jones Act "is one of our top bullets of discussion every day," Nishimura said. Options include pushing for congressional action to change the law, which could take years, he said, or perhaps finding a tanker and an owner willing to petition for reflagging the vessel in the United States.

COST OF ALASKA GAS

If there is a way around the Jones Act, or a ship is found that meets the law, it's hard to estimate how much it might cost for Alaska LNG delivered to Hawaii.

Would it be North Slope gas or Cook Inlet gas? If from the North Slope, would the gas move in a large-capacity pipeline developed by ExxonMobil, BP and ConocoPhillips to serve growing Asian markets? Or would the gas move in a much smaller, state-sponsored pipeline? The bill for liquefying the gas would depend on the size and cost of building a new LNG plant, or maybe using the 43-year-old ConocoPhillips plant at Nikiski.

Rough, very rough estimates put the cost for treating North Slope gas to remove carbon dioxide, water and other impurities, piping it to Southcentral and liquefying it at $7 to $13 per million Btu. Only a very large pipeline project with its economies of scale could get anywhere close to the low end of that estimate.

Add the cost of buying gas from the producers and the tanker expense of making the delivery, and Alaska gas

Alaska wants to help

Alaska's U.S. senators are well aware of their state's potential as a liquefied natural gas supplier to Hawaii. Staffers for Sens. Mark Begich and Lisa Murkowski have discussed the issue with their counterparts in the offices of Hawaii Sens. Daniel Inouye and Daniel Akaka.

And Begich has met with Hawaii Lt. Gov. Brian Schatz, the governor's point person for the effort to consider lower-cost natural gas to replace ever-more-costly diesel and fuel oil at Hawaii's electrical generating plants.

Begich and Murkowski touted Alaska's potential as an LNG supplier in a letter to Senate leadership this spring: "Whether the buyers are in Hawaii and U.S. territories … or Japan … Alaska could deliver a much needed, stable energy supply."

The letter advised Senate leaders that if North Slope producers "come forward with a specific liquefied natural gas project," Begich and Murkowski would consider legislation amending federal law to extend permit coordination and assistance to an LNG project. The law currently limits federal assistance to a pipeline project serving the North American market.

The Anchorage Economic Development Corp. last year prepared for Begich an eight-page summary of how Alaska LNG deliveries could help cut energy costs for Hawaii residents.

— Larry Persily

could run from $11 to $17 landed at the dock in Hawaii — or more.

Even at the high end, it could be a lot less than what Hawaii residents pay for synthetic natural gas, and it's in line with today's oil prices for power plants. The question for Alaska LNG will be: Could Hawaii get gas for less elsewhere?

Alaska's other problem is that Hawaii doesn't want to wait forever for its first gas delivery. And no project developer in Alaska is talking LNG before 2020 — at best.

An option to avoid the high capital costs of a liquefaction plant could be a smaller and less expensive compressed natural gas operation in Alaska, said Hawaii's 2007 report on natural gas options. Compressed natural gas squeezes methane molecules into a smaller space but not nearly as tight as supercooled, liquefied natural gas. Transportation investments, however, would add up to more, since it takes more shipboard space and more voyages to deliver the same amount of gas.

But here, too, federal shipping laws are a problem. "Alaska would be a prime candidate for supplying CNG to Hawaii, assuming one could get an exemption from the Jones Act," the report said.

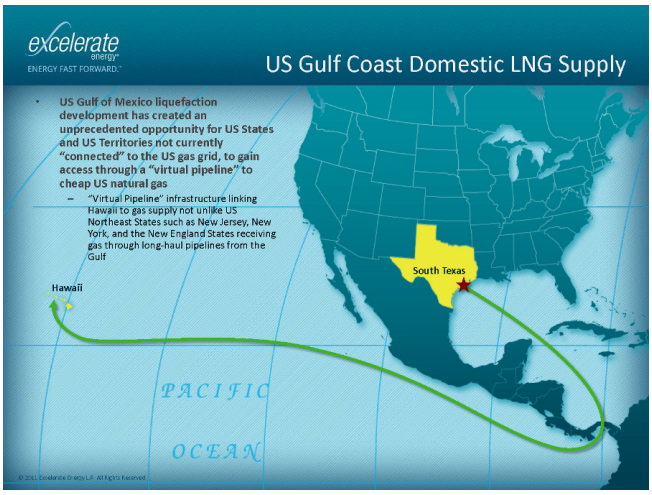
With just 2,700 miles between potential LNG plant sites in Southcentral Alaska and Honolulu, Alaska certainly has a distance advantage over the Mideast nation of Qatar, the world's largest LNG producer, and even Australia. But it's close to the same distance between Hawaii and the LNG plants proposed for Kitimat and Prince Rupert, British Columbia, and the Canadian proposals are further along than Alaska's plans.

GULF OF MEXICO GAS

Another option for Hawaii might be to bring in LNG from the Gulf of Mexico. The advantage could be lower-cost U.S. shale gas. The disadvantage would be the 7,000-plus miles a tanker would have to travel to reach halfway around the world — and that's after the expanded Panama Canal opens to traffic in 2014.

There is at least one company promoting that long-haul delivery.

Texas-based Excelerate Energy has proposed a floating liquefaction terminal offshore between Galveston and Corpus Christi, Texas. The company is still in the early stages of the estimated $1.7 billion project, but says it could be running by 2017, liquefying U.S. gas and loading it aboard tankers, in particular targeting smaller markets.



Credit: Excelerate Energy

Excelerate Energy is promoting a proposed floating LNG export plant in Texas as a potential supplier for Hawaii.

Still, shipments between Texas and Hawaii would trigger the Jones Act.

Relaxing the Jones Act has been debated over the years without achieving any change. The issue has arisen again, especially with interest in lower-cost U.S. Gulf of Mexico LNG deliveries to Hawaii and Puerto Rico — or maybe Alaska LNG deliveries to Hawaii.

The Hawaii Shippers Council in April restated its position in support of congressional action for a partial waiver from the Jones Act so that foreign-built but U.S.-owned ships could serve Hawaii, Alaska, Guam and Puerto Rico. So far, the proposal hasn't gone anywhere in Congress.

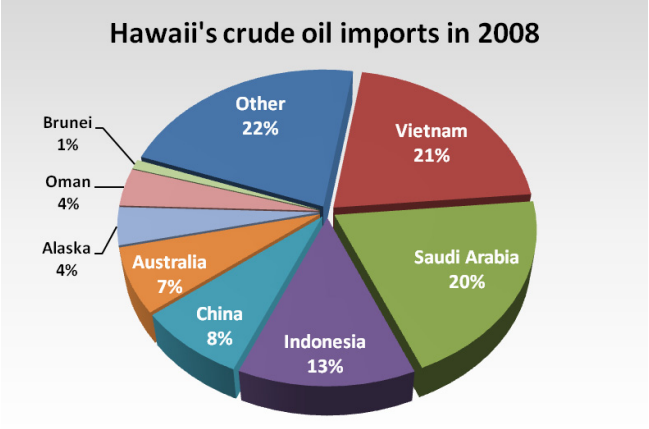
HAWAIIAN REFINERIES

Though not the utilities' problems, Hawaii's two refineries have their own stakes in the LNG discussion.

Their largest customers are the electrical utilities. Last year Hawaiian Electric purchased about 7 million barrels of fuel oil and diesel, most of it from the refineries.

The 2007 consultant's report for the university and a similar report from 2004 both commented that one of the two refineries could close if LNG imports eat into their sales.

The refineries have their own troubles, regardless of the prospect of losing market share to LNG, the 2007 report said. "Both refineries face challenges in terms of changing environmental specifications … scale [the refineries are small], and high operating costs." The alternative would be importing refined products to the islands, something Tesoro said in 2010 it was considering.



Credit: Hawaii Department of Business, Economic Development and Tourism

Tesoro announced in January it would put its Hawaii operations up for sale, including its refinery and retail stations. The refinery was running at about 70 percent capacity, the company said, processing less than 70,000 barrels a day.

The plant makes gasoline, diesel, jet fuel, ship fuel, asphalt and low-sulfur fuel sold to The Hawaiian Electric Co. for its generating plants. It just doesn't make them as profitably as the refiner's other plants. Tesoro's first-quarter 2012 financial report showed a gross refining margin of $2.07 per barrel at the Hawaii refinery vs. an average $12.15 per barrel for all its refineries.

The state's other refinery, operated by Chevron, is 62 years old and has a capacity of 54,000 barrels a day.

According to state of Hawaii numbers, the refineries' biggest suppliers of crude oil in 2008 were Vietnam, Saudi Arabia and Indonesia, with 54 percent of the business. About 4 percent came from Alaska.

For more information, please visit our website: www.arcticgas.gov

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