Testimony to the US House of Representatives
Committee on Natural Resources
Insular Affairs and Energy/Minerals Subcommittees
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Good Morning Madame Chairwoman Christensen, Chairman Costa and other members of the two Subcommittees. My name is Bevan Smith Jr. and I have been working with the Virgin Islands Energy Office for 25 years and served in the capacity as Director since 2004. It is a pleasure for me to appear before you today to offer testimony on such a timely subject matter:

Charting a Clean Energy Future for the Insular Areas

The U.S. Virgin Islands is an unincorporated territory of the United States located in the Lesser Antilles islands group between the Atlantic Ocean and the Caribbean Sea.

The Territory faces many of the same problems encountered by all small island nations with our relatively small electric power system, limited interconnection, and generation units that are based on older petroleum fuelled technology with relatively poor heat rates. This is further complicated by reliability criteria that require online generation to maintain high spinning reserve margins in the absence of a supply grid. These conditions lead to excessive costs for the sole electric utility which are further increased by the recent upturn in petroleum prices.
The U. S. Virgin Islands (USVI) currently relies on virtually 100% imported petroleum as the source of its energy. The Territory's generating facilities are included in that slim minority of just 1.6% of the total electricity generated nationwide that utilizes oil-fired plants. Due to the concentration of the majority of the world's oil reserves in countries unfriendly to the US, the growing international demand for oil and the associated increase in the price of oil, the economy of the USVI is highly vulnerable to supply disruptions and energy price increases. This vulnerability is further exacerbated since much of the petroleum is imported from PDVSA - the state-owned petroleum company of Venezuela. The current political instability in that region of the world could result in a severe disruption or curtailment of petroleum shipments to the Hovensa refinery on St. Croix, which is partially owned by PDVSA.

Furthermore, the reliance on imported energy sources creates a large financial burden on the USVI economy. Typically two-thirds of the price of electricity in the USVI is attributed to fuel adjustment charges, all of which is derived from the escalating cost of purchasing petroleum. The dependence on imported fossil fuels forces our residents to pay a higher percentage of their disposable income for energy than residents of the mainland United States. An increasing number are forced to make decisions to either pay for food, medicine, or their utility bill.

High energy cost is driving up the cost-of-living in the Territory by fueling inflation; it serves as a deterrent to business development, and is perhaps the greatest threat to the Virgin Islands economy. It is imperative that this reality is taken into consideration throughout all testimonies to this Joint Oversight Field Hearing on "Charting a Clean Energy Future for the Insular Areas".
The U.S. Department of Energy has been instrumental in the Territory's development of energy programs over the past 34 years through its formula driven Energy Extension Service, State Energy Conservation Program, Institutional Conservation Program and State Energy Program (SEP) grants. The former three grants have been phased out and the SEP continues to supplement funding to the Territorial State Energy Plan. Over the past decade, the USVI has been awarded an average of $235,000 annually in USDOE formula grant funds, which represents eight percent of each fiscal year's total budget. Program year 2008 will bring $174,000 to the Territory to assist with the mission of the Virgin Islands Energy Office. Low Income Heating and Energy Assistance Program (LIHEAP) funds are awarded directly to the local Department of Human Services to supplement their Energy Crisis Assistance Program. Significantly, our focus on general energy education programs earned the USVI the 2003 National Energy Education Development State Program Award from the NEED Project.

In charting a clean energy future for the Insular Areas, we need both the Insular Affairs and the Energy and Minerals Resources Subcommittees to address on behalf of all Territories of the United States of America, funding challenges, program priorities, and our unique energy issues. An adequate resolution will bring self-sufficiency through increased utilization of renewable energy technologies and energy efficiency measures. As it pertains to funding issues, the USVI is often inappropriately compared to the continental US when it comes to allocation of energy funds. This comparison is grossly unfair since the USVI is not as densely populated as the continental US, therefore distributing electricity generation costs among fewer utility customers. Electricity rates in the Southeast continental US averages between $0.05 – $0.10/kWh while electricity in the USVI is presently $0.35/kWh and forecasted to be $0.42 in the near future. Additionally, the USVI is often inappropriately compared to Hawaii when it comes to energy. While the climates of the Pacific and Caribbean islands are somewhat similar, the demographics are starkly different. Hawaii is densely populated and has a highly sophisticated energy infrastructure and a large industrial base. The USVI is not as densely populated and has an increasingly antiquated energy infrastructure. The State Energy Program formula for allocation of funds to the States and Territories has not been updated in over 20 years. The formula was developed when energy costs in the Territory were much lower. To discontinue this inadvertent discrimination the formula needs to be updated to include changes in energy costs, insular location, climate, demographics, etc.

The US Department of Energy's Weatherization Assistance Program (WAP) is the nation's largest residential energy efficiency program. Its mission is to

insulate the dwellings of low-income persons, particularly the elderly, persons with disabilities, families with children, high residential energy users, and households with a high energy burden, in order to conserve needed energy and to aid those persons least able to afford higher utility costs. While the USVI does not require funding to insulate against cold winter temperatures, low-income citizens of the Territory can increase energy efficiency through the insulation of conventional water heater tanks or the installation of domestic solar water heaters to reduce electricity costs. The latter program was successfully implemented by the sunshine State of Florida using Weatherization Assistance Program funds. However, under current law, the USVI cannot participate in the WAP. Even if we were made eligible through an act of Congress, the USVI's portion would be approximately $25,000 based on the existing formula. Here again is another example of inadvertent discrimination against the Territories when it comes to the allocation and distribution of Federal Funds. This disparity should be corrected and the allocation formula for both LIHEAP and WAP should be updated.

There are specific program priorities that must be addressed in charting a clean energy future for the Territories. We need every opportunity available to improve our energy efficiency, increase the use of renewable energy and to reduce our 100% dependence on imported fossil fuels. As previously mentioned, the USDOE formula grant makes up a relatively small percentage of the overall SEP Territorial State Plan's budget; therefore, participation in the USDOE Competitive Solicitations is necessary. In many instances when the USDOE issues solicitations the Territories are either excluded from competition or the program areas for funding are not applicable or relevant to energy priorities within the particular insular area.

Despite the difficulties of acquiring private partnerships, matching non-federal grant funds, and competing with the 50 states, the USVI has been successful in winning a handful of USDOE Special Projects Solicitation grant awards. We formed partnerships and conducted technical building audits through a Rebuild American Paradise grant; the Building Energy Codes grant was instrumental in the Territory's adoption of the 2003 International Building Codes. Plans are currently underway for an upgrade to a tropical building energy code through a grant to Hawaii on behalf of the Territories; a grant for the development of a distributed generation policy led to a Net Metering policy for the Territory; and a grant to conduct a Wind Energy Case Study provided data that supplemented Wind Mapping efforts of the National Renewable Energy Laboratory and the USDOE Wind Powering America in a recent wind workshop with record breaking attendance by residents of the USVI. The technical assistance was beneficial in showing the potential of each category of the grant award, but due to the lack of funding for actual implementation, no energy or cost savings were realized.

Section 251 of the 2005 Energy Policy Act authorizes the Secretary of the Interior among other items, to make grants to governments of insular areas of the United

States for project plans that include an analysis of a range of options to address energy security projects such as protecting electric power transmission and distribution lines or significantly reducing the dependence of an insular area on imported fossil fuel. There are authorized in the Act, but not yet appropriated, $6,000,000 for each fiscal year after the enactment. Similar authorization existed in previous EPACTs but no appropriations have actual been made even though the Territorial Energy Assessment Plan has been completed with its findings and recommendations. The Virgin Islands Energy Office and the Water and Power Authority (WAPA) have already employed many of the strategies or projects identified by the Secretary of Energy as having the greatest potential for reducing the dependence on imported fossil fuels. Through the appropriation of these grants, the recommendations in the recently updated Energy Assessment report and other subsequent reports can serve as the roadmap towards reducing the Territories dependence on imported fossil fuel and begin to chart a clean energy future for all.

The Office of the Governor has taken a lead by example posture by instituting an energy demand reduction program for the central Government. This project aims to reduce energy consumption in government facilities and vehicles by at least 5 percent per year over the next four years. The program will implement the best practices in order to advance energy-efficiency throughout government, improve utility management decisions in government facilities, and promote the use of renewable and advanced vehicle technologies and/or alternative fuel blends.

The Virgin Islands Energy Office was recently relocated to the Office of the Governor to bring a serious focus on energy issues in the USVI by commissioning the development of a comprehensive energy strategy for the Territory with the collaboration of the Southern States Energy Board, USDOE National Energy Technology Laboratory, and Virgin Islands energy stakeholders. The goal of the comprehensive energy strategy is to develop a comprehensive energy strategy for the USVI that will increase the standard of living of the citizens of the Territory by assuring the long-term availability of affordable, secure supplies of energy. A secondary goal is to become a Caribbean and worldwide showcase for the development and use of renewable energy.

In closing, I thank both chairs of the subcommittees, and would like to reiterate that the driving factor in the economy of the USVI is the high cost of energy. We are hoping that clean energy technologies can be the solution. However, there are significant impediments to their implementation and the USVI may not be able to overcome without assistance from the Federal Government. This will require immediate Congressional action.

U. S. Virgin Islands WAPA White Paper
(Spinning Reserve Issues, Interconnections, & West Indies Power Proposal)

Prepared by
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Oak Ridge National Laboratory
March 2008

The U. S. Virgin Islands faces many of the same problems encountered by all small island nations. One of these problems is a relatively small power system with limited interconnection and generation that is based on older technology petroleum fueled with relatively poor heat rates. This is often further complicated by a reliability criteria that requires that the online generation have in spinning reserve a capacity that is equal to the largest of the two generating units that are presently online (the N-2 criteria). This criteria leads to excessively high spinning reserve margins and excessive costs which are further increased by the recent upturn in petroleum costs. While replacement with more modern higher efficiency, multi-fuel generation is a technical solution; the utility is probably not in a position to handle a large financial outlay. The use of demand side management via a modern SCADA system and load control system as a means of shedding load and supplying an alternative to added generation is a also possibility but was not considered here because of the limited scope of work.

Generation and Spinning Reserve Issues

Examining the average and peak loads on the WAPA main islands (St. Croix [SC] and St. Thomas - St. John [STSJ]) and the break out of the generating capacity for each system, we find a system with nominal peak / average loads in 2005 of about 90 MW / 65 MW for STSJ and 56 MW / 42 MW for SC. Without going into detail and since the heat rates for the plants are not known to the author, it is evident form the generation mix available that for STSJ only about 35% of the capacity can serve the average load but 65% of the capacity is on line at that time (a near 85% spinning reserve margin). During peak load the values climb to 50% of capacity serving load with 83% of total capacity online (a near 60% spinning reserve margin. Similar statements hold for the system on SC. The problem is complicated by the use of steam plant boilers in the desalinization process. The author bases this analysis on the report Territorial Energy Assessment (Wade, 2005). It is not possible to estimate the cost of the spinning reserve component form this information but fuel expenses are reportedly very high (Devan Smith, private communication).

Conservation, Demand Side Management, and Renewable Energy

The aforementioned Territorial Energy Assessment provides several strong recommendations with which the author strongly agrees. The most important being improved generation efficiency with newer generation, increased conservation efforts, and the use of renewable energy where possible. Wind was briefly evaluated but must be considered carefully because of the variable nature of the resource and limited spinning reserve margins available. In most applications, the maximum wind resource could not exceed 20% of installed capacity without severe impacts and unit sizes would probably be less than 1 MW. Providing incentives for hotel, large business, and the limited large industry on the island to accept curtailed loads or allow there generation to be connected to the islands grids in emergency should be explored because it would allow a lower spinning reserve margin and relieve load on the distribution grid. On the conservation side, it is evident to the author that at least for the commercial side high electricity prices do not seem to curtail use. A very good example is the open shop door to attract customers (B. Smith, private communications and authors observation during visits to the VI). The author suggest the use of air curtains and ceiling fans coupled with incentives to set thermostats higher as a means of reducing this wasteful energy practice.

Interconnection of St. Thomas (ST) and St. Croix (SC) Systems

As a means of increasing system reliability and reducing spinning reserve requirements without adding new generation, it has been suggested that the two island systems be interconnected by the use of an undersea cable between ST and SC rated at 100 MW. The author has referenced the literature and prepared an estimate of the cost of such an interconnection. It is not possible to estimate the savings because many operational parameters are not available during this short study. The distance, the capacity, and the voltage ratings used present few technical problems with the cost estimates since all are within present cable capability. The world's presently installed power cable systems have exhibited long life and high reliability (more than 20-30 years with limited maintenance). However, the depth of the seabed between ST and SC (2-6 km) is a **large issue** (Hawaii Interisland Cable). All power cable systems presently in service are in waters less than 1000 meters deep. A contract has been awarded to ABB/Prysmian for a cable between Italy and Sardinia that will reach 1600 meters and cover a 75 km distance. The Prysmian web site suggests that depths up to 2000 meters are possible with careful design and additional R&D using composites for strength and careful insulation system design. Discussions with ABB (Rosenqvist, private communication) indicate that the depth is an issue because of the mechanical stress that the able must be designed to withstand during installation and repairs, such as the cable weight plus other forces; e.g., current and bottom drag. Because the cable must be designed with minimal weight and the possibility of using the ocean and earth as return conductors, a dc cable is the preferred and potentially least expensive system (Russia-Finland presentation , ABB, Siemens, Prysmian web sites). In addition, the dc link would provide very controlled power flow in both directions. The best available technology is the use of high voltage dc obtained by using voltage source inverter stations with either bi-polar sea return or metallic return. Such systems are available from ABB, Siemens, Areva et al. with cable supplied by

ABB, Prysmian, Nexans et al. Long term reliability remains to be established but results have initially been favorable.

It is possible to provide a rough estimate for the cost of such a system by examining published cable system prices for inverters and cables. Inverter station costs for a 100 MVA voltage source, HVDC inverter (nominally +/- 100 kV) would be $125/kVA or for two stations a total price of about $25M installed. The cable presents the major difficulty but assuming 1) the earth is used for the return current, 2) an installed distance of an estimated 135 km that follows the undersea ridge east from SC and returns from the east to ST staying above the 2000 m depth, 3) two conductors in cable at $500/m leads to an estimated cable cost of about $135M or a total system cost of $160M installed. If a metallic return (third conductor) is included for operating flexibility and enhanced reliability the cable cost increase to $200M for a total cost of $225M. Design and installation time 2-3 years. The VI WAPA can estimate whether this cost is viable as a means of offsetting spinning reserve and adding capacity but at present fuel prices the author suspects that it is viable. However, it is **strongly advised that the availability of cable** that can be installed and operated in the area be discussed with cable and HVDC systems suppliers such as ABB, Siemens, Nexan, Prysmian et al. prior to performing a full systems design effort.

West Indies Power Geothermal Proposal

West Indies Power (WIP) a Caribbean based independent power producer specializing in the development and operation of geothermal power plants and their offshoots has approached the Virgin Islands WAPA. WIP is a Netherlands Antilles company with offices in Charlestown, Nevis, W.I. and in Roseau, Commonwealth of Dominica, W.I. and is owned by Caribbean and European shareholders.

WIP proposes to invest in the expansion of the geothermal plants on Nevis and Saba and the submarine HVDC cable to supply the USVI with 100MW's of firm power in 2011 at a price of USD $0.11-0.12/kWh escalating at labor, expendables, and material costs with a cap. Benefits to the WAPA are said to be the following:

- Lower electrical prices
- Known escalators for planning purposes
- Eliminate dependence on importation of diesel
- Clean renewable reliable power
- Multiple power plants to insure security of supply
- Savings from not having to purchase imported oil
- No land or pollution issues.

With the requirement that WIP and WAPA enter into a long term Power Purchase Agreement (PPA) in which WIP will supply 100MW's of geothermal power to WAPA at an agreed upon price and delivery date (

Is this proposal viable? Given the fact that the U.S. Department of Energy estimates potential availability of geothermal energy as 202 MW from Saba and 610 MW at Nivis with 200 MW and 600 MW available for export, the question becomes is there a cable route that is viable and highly reliable at a reasonable cost to WIP. **The question again is one of depth (install above the 2000 m level) and an experienced supplier with appropriate warranty**.

An estimate of the cable cost to supply 100 MW each to SC and ST using the methods of the previous paragraph and nominal lengths of 135 km to SC from Saba and 150 km from ST to Nivis gives estimated cable costs of $135 M and $150 M respectively. Metallic return costs are $202 M and $225 M and is preferred for reliability and flexibility. To this one adds the inverter costs of four (4) inverter stations $50 M and generating plant costs of a nominal $100 M for a total investment of $435 M.

Using a VI WAPA electric use of 1 B kwh/year and the proposed tariff results in revenue of $120 M /year which with 10% ROI leads to 5-6 year payback. So if a cable can be designed to work at the depths and voltages suggested, the investment and offer look very attractive. Interestingly, the entire chain of Caribbean islands with it's 10,000 MW potential can be linked with HVDC in a multi-terminal arrangement and connected to the North and South American grids. This is a ***very ambitious but perhaps achievable*** project.

The limited details of the WIP proposal do not provide sufficient detail to determine the true cost or savings to the WAPA. Clearly, WAPA would not scrap all existing generation because of possible emergency needs. Details are beyond the scope of this effort.

References

The author has collected a rather large number of references from the web and private communications that can be supplied on a DVD.

Territorial Energy Assessment (Wade, 2005)

Bevan Smith (private communications)

Roger Rosenqvist (ABB, Private communication)

Hawaii Interisland Cable Project (http://hawaii.gov/dbedt/info/energy/renewable/geothermal

Extensive reviews of cables and HVDC technology in (www.abb.com. www.siemens.com, www.prysmian.com)

Russia-Finland Cable Link (http://www.baltenergo.com/projecteng) (This cable link was ultimately rejected by both governments see winkipedia report (en.wikipedia.org/wiki/HVDC_Russia-Finland)

MacDonald, Kerry (USVI Geothermal Presentation)(from Devan Smith

Development of a Comprehensive Energy Strategy for the U. S. Virgin Islands

BACKGROUND

The U. S. Virgin Islands (USVI) currently relies on virtually 100% imported petroleum as the source of its energy. Due to the concentration of the majority of the world's oil reserves in countries unfriendly to the US, the growing international demand for oil and the associated increase in the price of oil, the economy of the USVI is highly vulnerable to supply disruptions and energy price increases. This vulnerability is further exacerbated since much of the imported petroleum is from the state-owned oil companies of Venezuela. The current political instability in that region of the world could result in a severe disruption or curtailment of petroleum shipments to the Hovensa refinery on St. Croix, which is partially owned by PDVSA - the Venezuelan state-owned petroleum company.

Furthermore, the reliance on imported energy sources creates a large financial drain on the USVI economy. For example, typically two-thirds of the price of electricity in the USVI is attributed to fuel adjustment charges, which all comes from imported petroleum. As another example, as much as 80% of the funds paid for gasoline at the pump may leave the Territory. Therefore, in addition to creating energy security, any move to use energy resources from within the Territory will mitigate increases in energy costs and create economic growth in the form of jobs, enhanced income, and taxes. Additionally, by assuring the long-term availability of affordable energy, the USVI will be able to compete in the global market for additional resorts, industry, and other economic development activities.

Fortunately, recent advances in renewable energy technologies have provided new opportunities for the USVI to reduce its dependence on imported petroleum for its transportation, electricity, and other energy needs. However, a comprehensive energy strategy is needed to show the citizens of the USVI and other potential investors how this could be accomplished and the benefits from implementing a comprehensive energy strategy.

GOAL

The goal of this project is to develop a comprehensive energy strategy for the USVI that will increase the standard of living of the citizens of the Territory by assuring the long-term availability of affordable, secure supplies of energy. A secondary goal is to become a Caribbean and worldwide showcase for the development and use of renewable energy.

WORKPLAN

Task 1. Project funding and planning. A core Project Team consisting of representatives from the Governor's Office, U. S. Virgin Islands Energy Office (VIEO), Southern States Energy Board (SSEB), and others as deemed appropriate will be established to guide the project. Clear project goals will be established by team consensus. A project work plan, schedule, and budget will be created and funding will be identified.

Task 2. Assess current and future USVI energy situation. This task will identify the current types, amounts, and sources of energy imported into the Territory. Additionally, this task will identify the amount of energy used by the industrial, transportation, residential, and commercial sectors, the cost of energy to these end users, and to the extent possible an analysis of how this

energy is being used within each sector (e.g., domestic hot water, diesel highway and off-highway use). Projections on the types and amounts of energy required for the next 20-30 years in the USVI will also be developed.

Task 3. Identify potential USVI energy options. The potential energy options available to the USVI, with a focus primarily on renewable energy, will be identified and for each option the following developed:

- Description of each energy option/technology;
- Limitations on application or deployment (e.g., solar water heaters for residential water heating);
- Advantages and disadvantages of each energy option/technology; and
- Relative cost of energy produced by each option.
- Environmental characteristics of each option including CO2 output, e.g.

A key portion of this task will be to identify and explore the role that energy efficiency and conservation can play in reducing energy demand. The concepts from the recently released reports from the National Petroleum Council "Facing the Hard Truths About Energy" and the National Energy Efficiency Action Plan from EPA should be explored, including provisions for the complete recovery of costs for implementing actions that reduce energy usage. The government should lead by example in ensuring building efficiencies, including schools and academic institutions, fleet mileage requirements, and in other energy uses.

Task 4. Assess the fit of potential energy solutions to the USVI current and future energy use. The information derived from Tasks 1 and 2 will be used to make a preliminary evaluation of how to best match the energy needs and available options to meet the goals of the project.

Task 5. Hold group meetings of interested stakeholders in the USVI. A group of stakeholders representing St. Thomas/St John and another group of stakeholders representing St. Croix will be identified by the Project Team. These stakeholders will include the following:

- Governor's Office
- Lt. Governor's Office
- The VI Energy Office
- USVI Department of Planning & Natural Resources
- USVI Waste Management Authority
- USVI Water and Power Authority
- Environmental advocacy groups
- Private industry including
    - Honvensa
    - St. Croix Renaissance Project
    - USVI Hotel & Tourism Association

Other stakeholders will become evident once Task 2 is completed.

At least one stakeholder meeting with the Project Team will be held at a minimum on St. Croix and St. Thomas. At these meetings, the Project Team will present findings of the first three tasks, request group comment as to how the goal can be reached, and identify potential issues and concerns and, if possible, means of addressing these issues and concerns.

Subtask 5: Public Input Process

A portion of each meeting will be set aside for comments from the public at large so that they have a means to participate and make comments and suggestions.

Task 6. Comprehensive Energy Strategy development.
Based on the previous project tasks, a comprehensive energy strategy with specific recommendations on the following will be drafted:

- Policies
- Technologies
- Timelines
- Funding amounts and sources for implementation of the plan

Within each of the action items and recommendations, key individuals or institutions responsible for developing and/or implementing that action (e.g. legislative requirement) will be identified. Additionally, methods of addressing public issues and concerns will be developed as a separate document.

Task 8. Assess potential economic impact from implementation of recommendations. The current heavy reliance on imported petroleum results in the USVI exporting large amounts of money for energy. The shift to indigenous energy sources also will mean the creation of jobs associated with the deployment and use of new technologies. This task will assess the economic return to the USVI for investing its resources to implement the recommendations of the strategy.

Task 9. Conduct second group meeting. A second group meeting of interested stakeholders and the public in the USVI will be held to review the revised draft strategy.

Task 10. Revise the draft strategy. The Project Team will revise the draft strategy based on feedback from relevant stakeholders and the public.

Task 11. Present the plan to the Governor and his staff. The Project Team will meet with the Governor to present the plan, receive his input and answer his questions. If necessary, the plan will be revised based on feedback from the Governor. Following this step, and at his discretion, the Governor may wish to present the plan to the legislature and hold a press conference to brief the citizenry.

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