

**Office of the Secretary of Defense**

**REPORT TO CONGRESS**

**Department of Defense**

# **DoD Renewable Energy Assessment**

## **Implementation Plan**



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## Management Plan

The FY 2005 Military Construction Appropriations Act, Senate Appropriations Committee Report 108-309, directed that a strategy and projected budget be provided for implementing the renewable energy report.

Once the study verified approaches to acquire renewable energy, it progressed to the development of a year-by-year acquisition approach or roadmap that provides for acquiring a mix of on-installation systems and purchasing energy over a span of years. Since procurement of renewable energy is very complex, with different strategies required for each region, the roadmap lays out three levels of accomplishment based on the level of success in awarding contracts: high (procure 1,442 megawatts [MW]); moderate (procure 854 MW); and minimum (procure 330 MW).

The roadmap approaches the competitive renewables marketplace with aggregated cross-Service, multi-installation purchases beginning over the next several years. It also recommends the rapid implementation of on-installation renewable projects where they are cost-effective and technologically ready in these early years. Special attention must be paid to the continuing evaluation of on-installation opportunities as the resources themselves become better characterized and the balance between the cost of conventional energy and renewable energy tilts more towards renewable energy.

As the report outlines, DoD intends to pursue a strategy that carefully considers a combination of both on-installation renewable energy projects and commercial renewable energy purchases based on an analysis of the lifecycle costs, benefits, and source reliability. On-installation renewable energy projects will be funded by either third-party financing or appropriated funds, primarily using Energy Conservation Investment Program (ECIP) funds provided through the annual Military Construction (MILCON) appropriation. The approach taken in the assessment of potential was to immediately implement projects and purchases identified as outstanding opportunities rather than await completion of the entire report. This provided the additional benefit of lessons learned early in the effort. Specifically, not every project or procurement opportunity translated directly from potential to successful execution and implementation; however, several projects are a successful direct result of this assessment effort. We are proud that in January 2005 nearly a megawatt of wind power became operational at Guantanamo Bay, Cuba, using third-party financing, and 1.3 MW of wind power is under construction at F.E. Warren Air Force Base (AFB), Wyoming, using ECIP funding. "Initiatives Launched to Implement the Military's Renewable Energy Vision" below addresses some of DoD's early successes and other continuing actions.

The resource assessment and roadmap have been adopted by DoD and comprise a new renewable energy strategy that will be pursued. DoD will also continue to coordinate closely with DoE to develop more aggressive goals for renewable energy development and procurement.

Following the approach outlined above, as project and procurement potential was identified, the most promising opportunities were immediately implemented and executed concurrent with the assessment effort. As a result, some of the earliest identified projects have been executed in the FY 2004 ECIP program, several more are being executed in the FY 2005 program, and even

more are under design and programmed in the FY 2006 president's budget. Many more projects have been identified in concept, including some third-party initiatives. We plan to continue the evaluation and planning required on the remainder of these projects that exhibit potential and execute design and construction in future years. Rather than provide a specific list of projects for out-years, given that the planning must be accomplished to ensure project viability, DoD will rely upon the existing Congressional Notification process to convey the specifics of the projects as they are programmed for execution.

We are proud to note that DoD's FY 2005 ECIP program contains \$13 million dedicated to renewable energy projects identified through this assessment. DoD's proposed FY 2006 ECIP program, per the president's budget, has identified over \$18 million in new renewable energy projects. In FY 2003, DoD executed only \$5 million in renewable energy projects. With the continued strong support of OMB and Congress, this increase in dedicated ECIP funding is expected to support an even larger percentage of renewable energy projects in the future.

Concurrent with identifying, planning, programming and executing renewable energy projects to develop renewable energy resources on military installations, DoD has also undertaken a proactive strategy to partner with the commercial sector and utility industry to increase our purchase of renewable energy when cost-effective. This partnership includes both strategies for third-party financing and approaches for purchasing renewable energy. Imperative to DoD's third-party financing initiatives is the recent reauthorization of Energy Savings Performance Contracts (ESPC). DoD learned that purchasing strategies had to be tailored to regions for many reasons, including availability of transmission, utility interest, and Federal, state and local laws and regulations. As DoD attempted to implement some purchasing strategies, difficulties were encountered and frequent adjustments were necessary. DoD has much to learn in these efforts as these strategies are new to the Services and industry. "Initiatives Launched to Implement the Military's Renewable Energy Vision" below describes some strategies DoD is exploring; however, note that these and other strategies currently pursued may change or prove uneconomical. In some cases, specific installation opportunities will provide better options than a regional approach. DoD must stay the course and take a progressive yet tailored approach with each purchasing strategy and document lessons learned to improve strategies for future opportunities. A number of possible legislative or procedural barriers have been identified; however, suggestions for change should be delayed until more experience is gained and strategies are tested. When and if appropriate, DoD will submit proposals through the established legislative proposal process and seek Office of Management and Budget (OMB) and Congressional support.

To help maintain energy awareness throughout DoD, a bi-weekly telephone conference call is held. Participants include the senior energy engineers in each of the Services and other DoD agencies along with key supporting staff members. This group, with hundreds of years of collective energy experience, is a forum for generating new energy initiatives, tracking the status of ongoing actions, and communicating/sharing organizational programs that may be of value for adoption by other participants. To raise visibility and maintain an awareness of renewable energy within DoD, renewable energy is a permanent agenda item in the bi-weekly telephone conference call. In other initiatives, DoD and the Services actively participate in the Federal Green Building Council, DoE's Interagency Energy Task Force, DoE's Sustainable Design Working Group, DoE's Renewable Energy Working Group, and the EPA's Green Power

Partnership to stay abreast of major issues and facilitate inter-agency partnerships and cooperation.

Training is another important aspect of DoD's energy program. DoD is a co-sponsor of DoE's Energy 200X series of education and training workshops which provide opportunities for DoD to advertise and promote renewable energy efforts to representatives of Federal, state and local government agencies and the public. For the last two years and at the upcoming Energy 2005 (August 2005 in Long Beach, California), DoD has led and will lead development of the renewable energy track. In conjunction with this workshop, Services sponsor their own workshops attended by installation and higher headquarters energy managers where a wide variety of energy issues are discussed, including an emphasis on renewable energy.

DoD is already the national leader in constructing renewable energy equipment on military installations and in the retail purchase of renewable energy. Examples of our leadership and commitment to renewable energy are in the section titled "Initiatives Launched to Implement the Military's Renewable Energy Vision." DoD looks forward to increasing this leadership as an example to the nation and a stimulus for the renewable energy industry.

## Purchasing Strategy

### Recommended Procurement Strategy

After evaluating on-installation renewable potential, it is evident that, although there are some notable opportunities, the greatest opportunity to acquire renewable energy will come from purchases. This finding is supported by official DoD policies issued in 2004 that encourage renewable electricity purchases and encourage the Services to aggregate renewable and other electricity purchases. This policy can be implemented with only minor modifications to procurement procedures, including timing contract renewal dates so accounts can be aggregated for better market power; longer-term contracts where economically beneficial to elicit lower energy costs; use of standardized renewable energy contracts and terms; and specific guidance to installations for implementing the new DoD energy policy.

This approach, described further below, begins to take real advantage of deregulated electricity markets. It has the added benefits of reducing installation workload; being consistent with emerging “joint” practices; contributing to environmental stewardship of air, water, and non-renewable energy resources; and diversifying power supplies in regional electric grids for increased system reliability.

Recent history demonstrates that renewable electricity can be acquired at roughly the same price as conventionally generated electricity—sometimes at a slight premium and sometimes at a discount, depending upon a number of market factors. In any case, installations would retain the right to opt out of any deal not to the installation’s advantage.

The following are key actions DoD is pursuing for the effective, efficient, and economical purchase of renewable electricity in the marketplace. These actions will form the basis of DoD’s near-term renewable electricity procurement policy.

1. *Work with DoE Federal Energy Management Program (FEMP) to establish a new renewable energy goal.* The goal should set a percentage of the government’s electricity load to come from renewable energy. This goal should provide sufficient incentive to leverage the Federal government’s buying power to encourage commercial renewable energy development.
2. *Buy renewable electricity in the marketplace.* The largest, least-expensive, and most rapid renewable electricity purchases can be made from off-installation independent power suppliers, compared to on-installation developers and most utilities. In most cases, developers can develop more and larger resources more quickly on non-military property. DoD can facilitate these developments by entering into contracts that fix future power prices at the cost of development. DoD is in the early stages of testing a few of the differing strategies and as a result will learn more about improving the process.
3. *Aggregate renewable electricity load across the Services.* The Services should coordinate aggregated, cross-Service regional purchases that will exert DoD’s market power. DoD procurement practices may need to be modified to implement the new aggregation policies.
4. *Once experience is gained in implementing procurement strategies, modify and standardize procurement practices to facilitate long-term (twenty-year) contracts when needed.* Renewable power developers state that longer-term contracts will enable them to

acquire lower-cost development capital, making it possible to offer cheaper power to the Services.

5. *Focus in open markets or in regulated markets where utilities are cooperative.* Focus renewable procurements in states and regions favorable to such purchases, in states that have deregulated electricity markets, and in other areas where individual regulated utilities show interest. Additionally, Federal power marketing authorities, such as the Western Area Power Administration (WAPA) and Bonneville Power Administration (BPA), can aggregate renewable purchases, as can the Defense Energy Support Center (DESC).
6. *Purchase renewable electricity at the earliest market opportunities.* There may be a window of opportunity through 2012 for favorable acquisition on long-term supply contracts. Renewable power supplies are increasing rapidly because technology has advanced and costs per kilowatt-hour (kWh) have dropped, while prices for conventional electricity have increased and are not anticipated to return to pre-2000 levels. After 2008, the benefits and lower potential costs of renewable energy will be more obvious to mass markets, increasing competition for this resource and consequently raising the price.

### **An Alternative Procurement Approach: Green Tags**

Where purchasing renewable electricity directly is difficult or too expensive, an installation can consider the purchase of a Green Tag to meet its renewable purchase requirements. Because Green Tags effectively increase the cost of power, DoD does not see this approach used extensively.

A Green Tag is a contract to buy the renewable attribute associated with power from any existing renewable power generation plant. Green Tags are easier to acquire than direct renewable power because they do not require physical power transmission, do not incur transmission costs, and do not need to be located close to the purchaser. The Green Tag is sold to a renewable buyer and the project power is sold in the wholesale market at prevailing prices. The Green Tag price is the difference between market prices and renewable power development costs. Green Tag sales make renewable power projects feasible that otherwise would be uneconomical. Green Tags are tradable rights to renewable energy production that do not require the project to deliver the green power to the buyer. The Federal buyer's benefit is that a Green Tag counts as the purchase of renewable energy to meet the goals of E.O. 13123. The disadvantage is that the Green Tag is an incremental cost that must be added to the cost of electricity actually delivered to the installation to determine the total electricity cost for that installation.

### **Recent DoD Renewable Energy Experience and Lessons Learned**

Since 2001 the military has purchased electricity generated from renewable resources at multiple installations, and in one case hedged a rising electricity market, saving the military and the taxpayer approximately \$42 million in projected electricity costs over five years. In FY 2002, the Services spent approximately \$1.3 billion on electricity. The challenge is to refine and institutionalize these lessons learned: procuring renewable source electricity as a hedge against rising energy costs, and, where possible, to reduce electricity and energy conservation equipment costs. The renewable electricity purchasing strategy described in this report identifies specific opportunities and procurement strategies through 2012 where this could be accomplished.

## **Cost Projection**

The DoD goal is to acquire renewable energy at costs at or near the cost of conventional energy. DoD anticipates below-market prices for some renewables purchases, market prices for others, and a premium of from 0.1 to 0.3 cent for a limited number of purchases. The decision to pay a premium is at the discretion of the installation commander who may consider economics, energy security, public relations, etc.

Procuring renewable energy, other than Green Tags, can be very difficult and produce mixed results. For example, two different Air Force attempts to obtain renewable power in late 2004 failed due to high costs. We believe that market conditions tied to lack of the production tax credit (PTC) during most of CY 2004 may have been the cause. The Air Force will try again late in CY 2005 now that the PTC has been reinstated. A stable PTC is important to the success of DoD's renewable energy strategy.

Three scenarios are envisioned based on the actual success of renewable contracting attempts: high (procure up to 1,442 MW); moderate (procure up to 854 MW); and minimum (procure up to 330 MW). The higher goals are very optimistic and our ability to meet them will be based upon many factors, some not even recognized as of yet. The size of the procurement goals is based upon anticipated market supplies and not on specific installation demands in a region. Our ability to achieve these goals will also be dependent upon the availability of transmission assets to transmit power from often remote areas to the installations.

## Implementation Roadmap

This section presents a year-by-year timeline of actions required to implement the roadmap. The annual potential for electricity purchases and on-installation projects is shown in ranges. As described above, lower ranges represent minimal success and higher ranges represent high levels of success. Implementation success is dependent on market factors, PTC, state utility laws, utility rebates, availability of transmission, utility cooperation, etc. The involvement of installation leadership in making resources available is also a key factor. The roadmap is composed of specific actions proposed by the RWG based on market projections and an estimate of Federal and third-party funding available for on-installation projects. It addresses near-term goals and relies heavily on the ability to purchase renewable energy at or below current rates. Until DoD gains experience in renewable energy purchases it will be too uncertain to predict what can be accomplished eight to twenty years in the future.

### 2005

The renewables implementation begins with submission of this report to Congress. This report identifies the acquisition potential and steps DoD will be taking over the next several years and beyond. Further information will be submitted within ninety days of this report, as directed by Congress.

2005 has the largest number of electricity purchasing opportunities in terms of both megawatts and purchasing agreements. DoD will attempt to move quickly to capture low-cost renewable electricity in the emerging market. Since this is untried territory the degree of success cannot be predicted. Electricity purchases will focus in the East (PJM Interconnect, Northeast, and Florida) and include biomass resources. Attempts to purchase will also involve use of WAPA in the West and Southwest. An inhibiting factor to this CY 2005 plan may be caused by the lack of the PTC during FY 2004 which stopped construction of new renewable power systems—especially wind farms—and created short-term market uncertainty. Now that the PTC has been reinstated, construction will rebound, making more renewable power available and prices more competitive.

On-installation development of solar projects begins this year. The potential ranges between 0.3 and 0.5 MW for ECIP-funded photovoltaic (PV) projects (primarily in the Southwest). The high success scenario assumes a large Independent Energy Provider (IEP) -type PV project in a Western state (now under consideration).

### 2006

After adjusting procurement strategies for lessons learned, one or two purchasing opportunities are identified for 2006, providing between 40.5 to 224 MW in renewable potential. These are focused in the Eastern U.S., particularly the PJM Interconnect (Mid-Atlantic) market area.

While still small in comparison with purchased electricity, on-installation renewables will begin to expand significantly. Construction of the first wind projects will begin and on-installation solar projects will expand. These totals only include ECIP-funded PV projects as test results from the IEP model are not expected until 2007. Periodic regional renewable reassessment will occur as technology and utility costs change, creating new opportunities. DoD has identified FY 2006 ECIP funding for exploratory drilling at Hawthorne Army Depot, Nevada.

## **2007**

Only a single purchase for 2.0 MW of electricity in Alaska is identified, assuming critical opportunities are exploited in 2005 and 2006. If these opportunities are not captured, 2007 would potentially be a “catch-up” year before the market becomes overly competitive and renewable prices rise.

More focus is given to on-installation development. The number of wind projects could double. Solar projects are level. By 2007, a decision is also expected on geothermal development at Hawthorne Army Depot, Nevada, based on exploratory drilling. As biomass opportunities become more evident, we see the potential to construct more installation-specific projects.

## **2008**

One purchasing contract is identified, but it is significant as it calls for a 30 MW purchase and is the first opportunity in a regulated state with a cooperative. ECIP-financed projects will level off as funding plateaus. Wind projects at sites originally surveyed will decrease as those with the best economics will have already been developed. As power prices rise in other market areas, new wind projects may become viable. Solar projects will remain steady.

## **2009 and Beyond**

The plan beyond the next three to four years will be dependent upon lessons learned and successes achieved in the near future. Long-term goals are dependent upon new energy goals developed by DoE and DoD, the energy market, and the presence of technology breakthroughs. DoD will continue to identify energy goals that reflect the needs of the nation.

## **Training and Education: On-Going Beginning in 2005**

An effective renewable acquisition effort requires the support of well-trained and experienced utility, procurement, and legal staff in each Service and the Office of the Secretary of Defense. DoD will continue to encourage training programs to ensure that the appropriate skill sets are available to meet the opportunities of the next decade. DoD is active in Energy Manager training by participating in DoE’s premier annual energy workshop, Energy 200X. DoD has led the Renewable Energy Track of the workshop the last two years and will do so at Energy 2005 (August 2005) as well. This year, DoD has arranged with the Association of Energy Engineers (AEE) to provide the opportunity for engineers to receive “Certified Energy Manager” training and certification during the week before Energy 2005.

## **Continuing Support**

DoD will explore developing strategies and approaches for renewable energy development and acquisition, including case studies, sample contracts, and lessons learned. This information will be disseminated within the Services through formal training and other mechanisms. The development of long-term contracting authorities is critical for success in some renewable energy markets. DoD will evaluate the risks in such contracts and encourage contractual provisions that consider the possible technological and market changes that can occur over two decades. DoD supports developing a load aggregation approach across the Services when beneficial.

## **Lead Service**

DoD has assigned lead Service responsibilities on several renewable technologies to two Services. The Air Force is the recognized source of knowledge on wind power and the purchase of renewable energy. The Navy is the lead in solar, geothermal, wave, and ocean thermal energy conversion (OTEC). Lead Services act as the repository for technical knowledge and expertise on emerging technologies.

## **Institutional Planning: Activities for 2005–2006**

DoD has increased emphasis on renewable energy opportunities by including it as an agenda item in the biweekly energy conference call of the DoD Energy Steering Group. The Services discuss current initiatives, propose opportunities, and communicate their implementation plans to the other Services and DoD. This will be a way to create greater cooperation between the Services, start aggregating projects, and cross-feed ideas.

DoD will work with DoE to evaluate the meaning of “lifecycle/cost-effective” so that “lifecycle” is the life of the technology or contract. The definition should include the benefits of renewable technologies serving missions that are not easily monetized. DoD will ask the Services to consider renewables in all competitive procurements, with standard application of the revised lifecycle cost test for comparison with competing proposals.

## **Adopting Financial Incentives and Models: 2005**

In the process of accomplishing pilot acquisitions, the Services will enhance the mechanism for doing IEP and performance-based leasing options with industry.

## **Demand Aggregation**

DoD will work with DESC to expand its role as a multi-installation aggregator for electricity purchases and look for innovative ways to provide staff and other resources. DoD and the Services will also consult with other potential aggregators such as WAPA, BPA, Tennessee Valley Authority (TVA), and the General Services Administration (GSA) to enhance renewable power procurement effectiveness.

## **Other Renewable Technologies—Ongoing Beginning in 2005**

Together, DoD and DoE should demonstrate and develop enhanced geothermal and biomass systems on military installations and provide models that can be applied to a larger number of installations and on private property. DoE and DoD will encourage the Services to identify locations on nearby installations where conditions favor development. These locations should be added to existing Geographical Information System (GIS) data for comparison with other options and to assess whether these systems can serve critical mission and security needs on particular installations.

## Initiatives Launched to Implement the Military's Renewable Energy Vision

The initiatives in this report demonstrate that DoD is already implementing many of the renewable energy opportunities identified through the course of this study and in parallel with developing an overall plan.

### Progressive Solar Photovoltaic Projects



**Photovoltaic crystalline panels angled toward the sun**

Traditional photovoltaic (PV) systems feed power to a single building, such as the system serving the Pentagon. Some large-scale PV systems can feed power to a utility distribution system serving clusters of buildings, like those on military installations. One military installation is exploring with private industry the feasibility of allowing land to be used to construct a world-class, grid-connected power system. The system would provide secure power to the installation at prevailing rates while helping the utility meet newly legislated solar-purchase requirements. This approach may be a model for future projects in states with solar mandates; it would continue to reduce military ownership of energy assets while providing clean, secure, cost-effective power.

### Navy, Marine Corps and DoD Solar Initiatives

The Navy and Marine Corps have a long history of constructing solar projects in Hawaii, where high energy prices have justified substantial implementation costs. In addition, in FY 2004, the Marine Corps inaugurated operations at a 1.2 MW PV system at MAGTFTC Twentynine Palms, California—the largest PV system in the Federal government. New Navy and Marine Corps renewable projects installed in FY 2003 include hot water heaters at MCB Quantico, Virginia; PV at the Naval Air Engineering Station (NAES) in Lakehurst, New Jersey, and at the Naval Air Station (NAS) in Kingsville, Texas; and daylighting at MAGTFTC Twentynine Palms, California.

The performance of solar systems has increased and costs have declined in recent years. In 2004, DoD recognized the security and energy supply values of solar technology by modifying the Energy Conservation and Investment Program (ECIP) criteria to accommodate these contributions.

### Demonstrating Power from Ocean Buoys in the Continental U.S. (CONUS)

Demonstration projects test and document the feasibility and value of new technologies, providing lessons learned for other installations. One Air Force base in the CONUS is considering a proposal to evaluate the feasibility of generating power using ocean buoys. Ocean buoy power is being demonstrated by the Marine Corps in Hawaii.

## Reliability, Energy Security, and Micro-Grids



**The land needed for a wind project varies depending on energy output goals, turbine size, terrain, wind strength, accessibility, and land uses.**

The nation's electric grid was designed in the 1930s and has been reinforced to withstand or recover quickly from most conventional power outages caused by single-point failures. The grid is not, however, designed to withstand massive unconventional threats or simultaneous multiple-point failures. One way DoD facilities are addressing increased reliability needs is through micro-grids. The Marine Corps base at Twentynine Palms, California, is establishing a micro-grid based upon a co-generation plant and grid-connected PV, with an option for adding wind turbines in the future. While micro-grids may not meet an installation's total demand, a micro-grid can direct available power to the

highest-priority loads when the grid is down. Micro-grids need not rely upon on-installation generation; adjacent or nearby generation can also be designed into the micro-grid.

### Training Future Leaders

Siting renewable projects on and adjacent to military installations requires the full cooperation of installation commanders and facility managers. Showcasing alternative energy technologies at high-visibility locations—coupled with education and training programs—will increase exposure to military leaders. Some of the military academies are considering installing small- or commercial-scale wind turbines and/or solar equipment to demonstrate the technologies. West Point, New York, in addition, has studied use of a renewable energy-powered micro-grid, coupled with distributed conventional generators to provide secure, off-grid power and identify the technical challenges of combining various power sources.

### Purchasing Renewable Energy from the Grid

Since 2001, the military has purchased electricity generated from renewable resources at multiple installations, including Edwards AFB, California, and Dyess AFB, Texas. The Navy purchases cost-effective renewable power from a waste-to-energy plant developed when a landfill at Norfolk, Virginia, was privatized.

Projected electricity costs were rising sharply in 2001 at the height of the California energy crisis. By contracting for renewable energy (primarily wind and biomass), Edwards AFB hedged the market, saving the military and the taxpayer approximately \$42 million in projected costs over five years. Dyess AFB reduced its bottom-line energy cost by purchasing power on the deregulated market and then adding renewable credits for 100% of its energy load. The net result was Dyess AFB was paying less than it would have with the standard rate and became the first DoD installation to go to 100% renewable power.

DoD's challenge is to refine and institutionalize these models, procuring renewable-source electricity as a hedge against rising energy costs.

### **Washington, D.C. Region: Testing a Model for Purchasing Renewable Power in 2005**

DoD can most easily procure renewable power competitively in the twenty-five states where electricity has been deregulated. The District of Columbia, Maryland, Delaware, Pennsylvania, West Virginia, and New Jersey participate in the PJM Interconnect, the largest competitive wholesale electricity market in the U.S. that also contains one of the largest concentrations of DoD customers. Most PJM contracts are now short-term to accommodate the risks of fuel price uncertainty. However, because the energy in renewable energy systems is free (wind, solar, and geothermal) or low-cost with little price volatility (biomass), contracts for renewable power delivery have less price uncertainty. Developers have indicated an interest in offering lower prices on long-term fixed-price renewable contracts. Currently, the Services are testing prices in the PJM market by aggregating demand for renewable power on fixed-price long-term contracts. This test should prove the assumption that long-term renewable contracts can hedge against rising electricity prices and help reduce costs to the military and the taxpayer. It could also model a path forward in other deregulated markets.

### **Sharing the Navy's Geothermal Legacy with Sister Services**



**Geothermal resources include hot springs, geysers, and underground resources of pressurized water and steam accessible via wells, as well as dry steam, hot water, hot dry rocks, and low-temperature geothermal heat.**

For over two decades the Navy has supported the production of 180 MW of geothermal-based electricity at the Naval Air Weapons Complex at China Lake, California. The Navy is now sharing its success with its sister Services. A world-class geothermal resource, China Lake is probably unique in the military. However, a handful of other installations have the resource potential for utility-grade geothermal power. At Hawthorne, Nevada, the Navy is managing the feasibility study for geothermal power production in a financial partnership with the Army, recycling some revenues from China Lake to validate the new resource. The results of the feasibility study are expected in 2007.

### **Biomass (Biogas) Potential**

Biomass, such as woodchips, crops, animal waste, and landfill gas, can be burned directly to create power or heat, or can be gasified for transport, storage, and ultimate combustion for heat and electricity production at another time and place. Although this report does not methodically quantify the potential for biomass-based generation on DoD property, some DoD facilities have collaborated with developers. For example, Hill AFB, Utah, has contracted for power using methane from a nearby landfill to fuel two reciprocating engine generators that are expected to produce an average 1 MW of electricity annually. The project uses a twenty-year energy savings

performance contract (ESPC) and is expected to save \$650,000 in annual utility bills while reducing greenhouse gas emissions. There are approximately twenty additional installations where on-installation or adjacent landfills or sewage plants could be tapped to serve Air Force energy needs. The DoD's existing long-term power purchasing authority can be used to develop this resource potential.