

Lockheed Martin—Supporting Global Energy and Climate Challenges

As a global security company, Lockheed Martin recognizes the economic and strategic challenges posed by a dependence on foreign oil, the potential destabilizing effect of climate change, and the vulnerability of the aging U.S. power grid. That is why we are bringing decades of relevant experience and more than 133,000 innovating minds to help address global energy and climate challenges.

Energy Efficiency: Over the last four years, Lockheed Martin's energy services practice has grown into one of the nation's largest implementers of energy efficiency programs for utility customers.

- **Efficiency for Utilities:** Whether residential or industrial, we manage programs to ensure that our utility customers conserve energy, increase operation efficiencies, and maximize capital spending. To help utilities, we coordinate financial incentives; provide marketing, customer recruitment, contractor management and technical services; identify and implement large energy efficient capital improvement projects in their facilities; and help utilities adopt digital technologies.
- **Federal Energy Management Program:** Lockheed Martin is approved by the U.S. Department of Energy to help the government reduce its energy costs and environmental impact through increased energy efficiency, additional use of renewable energy, and improved utility management decisions at Federal sites.

Alternative and Renewable Power Generation: Lockheed Martin teams are bringing engineering and manufacturing expertise to the research, design and production of the next-generation of alternative energy solutions. For example, we are applying composite manufacturing processes from space programs to capture energy from the depths of the ocean.

- **Ocean Thermal Energy Conversion:** Lockheed Martin is involved in Ocean Thermal Energy Conversion, a process that generates power from the thermal differences between the surface and the ocean depths. The process works by drawing warm surface seawater into an evaporator heat exchanger to boil a fluid with a low boiling point. The vapor from this "working fluid" drives a turbine that generates electricity and is then condensed back into a liquid when it passes through a heat exchanger cooled by seawater pumped up from the deep ocean. A potential byproduct of a variation of this process is fresh drinking water, which could provide additional benefit to developing coastal communities around the world. Recently, Lockheed Martin has won two U.S. government contracts to take steps toward potentially building pilot plants.
- **Wave Power:** Lockheed Martin announced in January 2009 that it is collaborating with a company named Ocean Power Technologies to develop a utility-scale wave power generation project in North America, likely off the West Coast.
- **Concentrated Solar Power:** At our plant in Moorestown, NJ, workers this year completed building a large test bed for concentrated solar energy technology that Lockheed Martin intends to leverage for utility-scale solar power plants. The Solar System Test and Engineering Site (SolSTES) Array provides our engineers with the opportunity to integrate and test a variety of solar technologies and materials, and to conduct production modeling. Concentrated solar energy array uses its curved mirrors to focus sunlight on pipes filled with oil, which flow through the system and heat water into steam, ultimately driving a turbine generator. A typical solar array field could power about 65,000 homes.
- **Wind Power:** WindTracer, a Doppler lidar (light detection and ranging) system developed by Lockheed Martin to detect dangerous wind conditions at airports, can also be used by wind farm developers to select locations with the strongest and most-consistent winds.
- **Biofuels/ Biomass:** Another alternative energy being pursued by Lockheed Martin on a large scale is synthetic fuels, or biofuels, from non-food sources. Our team is using a thermo-chemical process that gasifies biomass, turning it into a steam that can be further converted into fuels. Our Owego, NY, plant is powered by the technology.

Energy Management and Storage: In the near future, a new mix of traditional and alternatives energies will need to be smartly and securely stored, managed and distributed to consumers. Lockheed Martin teams are leveraging command-and-control, systems integration, nanotechnology, and cyber security expertise to make that vision a reality.

- **Grid Management:** Lockheed Martin is pursuing business opportunities for better management of power supply, demand and distribution. The Corporation's command-and-control and system integration expertise will help power companies manage their enterprise more efficiently and meet demand with less generating capacity or off-grid power purchases. Smart grid technologies also will help new renewable and distributed power generation sources, such as solar and wind, integrate more effectively into the power grid.
- **Smart Energy Enterprise Suite (SEESuite™):** Lockheed Martin's SEESuite is a powerful set of smart grid software products that help utilities improve grid reliability, reduce operating costs and enhance organizational responsiveness. SEELoad™ allows utilities to dynamically manage electric loads across their distribution networks by precisely controlling the amount, duration and location of Demand Response events.
- **Smart Grid/Advanced Metering:** Lockheed Martin also provides a comprehensive suite of program management services to help utilities better implement and manage Smart Grid and Advanced Metering Infrastructure (AMI) solutions.
- **Energy Lab Management and IT Solutions:** We currently provide a full range of outsourcing solutions to government and regulated industry including the U.S. Department of Energy, state and regional energy organizations, utilities and businesses. Additionally, we leverage expertise in engineering and technology to help our energy customers set up and manage complex facilities, perform advanced R&D and other technical services.
- **Cyber Security and Energy:** Our energy grid continues to face complex security risks and challenges, including cyber threats. We limit security risk before attacks occur by combining risk assessment and management, technology, processes, systems and industry teams into all of our solutions, including our energy solutions.
- **Micro-Grid:** On a smaller scale, we are creating a micro-grid laboratory to develop software that allows installations such as refugee camps and forward military bases to manage power more efficiently and incorporate alternative energy sources more effectively.
- **Storage:** We have developed several effective energy storage products, ranging from personal power vests for soldiers that incorporate a lithium ion battery and fuel cell technology, to a scalable central energy storage unit that could be used to supply power to larger sites in the field. Lockheed Martin engineers are maturing technology to support solar power and fuel cell energy storage to power military air vehicles.
- **Nuclear Energy Control Solutions:** We also support the nuclear energy community, on both the commercial and DoD sides, with safety-critical control room solutions and services for power generation.

Climate Monitoring and Environmental Services: Finally, space-based climate monitoring, an area Lockheed Martin has been supporting for 50 years, will ensure that our Nation and the world are making positive progress. Additionally, its data systems can help manage, store and analyze environmental information.

- **Space-Based Climate Monitoring:** The leading environmental monitoring satellite builder, Lockheed Martin has helped collect environmental data for nearly 50 years—supporting severe weather monitoring, forecasting, and climate data monitoring. From the world's first weather satellite, the Television Infrared Observation Satellite (TIROS-1), to the NIMBUS spacecraft, seven LANDSAT satellites, the NASA Earth Observation System TERRA, and the Upper Atmospheric Research Satellite (UARS), we have designed and built dozens of environmental monitoring spacecraft. Going forward, these types of spacecraft and technologies can help monitor treaty compliance and validate emissions, as well as support carbon monitoring and sensing.
- **Environmental Protection Agency Work:** Lockheed Martin has been supporting the U.S. Environmental Protection Agency and its environmental missions for 35 years with information technology solutions and services. Our team supports its Environmental Response Team with technical and analytical expertise during environmental emergencies and provides the EPA's Environmental Response Team with 24-hour support during environmental emergencies.

The energy industry is rife with complex challenges. The need for high-level capabilities in complex systems integration, information technology, cyber security, nanotechnology, and advanced manufacturing techniques — along with the global security component of the effort — make energy and climate solutions a natural fit for Lockheed Martin. We believe that we have the ability and responsibility to innovate solutions to help address our world's energy and climate challenges.