

Missing weapons

The US defence department should be at the centre of the nation's energy policy, says **Daniel Sarewitz**.

When Jeffrey Marqusee looks at the US Department of Defense (DOD), what he sees is not history's most fearsome war machine, but a gigantic test-bed for advanced environmental technologies. Marqusee runs the Pentagon's environmental-technology programmes, and he likes to tell anyone who will listen that the DOD's infrastructure includes 500 fixed installations (some the size and complexity of small cities), 546,000 buildings and other structures and 160,000 non-tactical vehicles.

Combine these numbers with the fact that no institution on Earth has anything close to the DOD's buying power and technical capabilities, and it's hard not to conclude, as Marqusee does, that the Pentagon has the capacity to become the world's most important weapon in the fight to reduce greenhouse-gas emissions.

Consider buildings. They account for about 38% of the nation's greenhouse-gas emissions. Technologies exist that could greatly improve their efficiency, but little overall progress has been made since the 1980s, despite an array of government incentives and regulations, and popular voluntary programmes such as the LEED (Leadership in Energy and Environmental Design) system.

To Marqusee, the problem is largely organizational. For example, in the civilian world, the performance of a building's heating, ventilating and air-conditioning system is impossible to optimize. The components are built by manufacturing firms, integrated into the building plan by engineers and architects, purchased by a developer, installed by a contractor, used by tenants and maintained by a service company. Each player has different and often conflicting goals and interests. And, over time, the building's interior evolves to accommodate different and perhaps unanticipated users and uses.

End-to-end innovation

The DOD provides a setting to tame this chaos. Marqusee's programmes are funding demonstration projects on zero-energy housing units and advanced energy-management systems that continually minimize building energy costs and consumption. "Demonstration is a crucial role for us, to create confidence in new technologies," he says. "But what makes our role particularly powerful is that we work both sides of the equation, not just the manufacturers but also the customers. They trust us, and



we understand their needs and constraints."

The DOD sets the technical specifications, demonstrates the technologies, then buys, uses and maintains them. Unlike in the civilian world, this means that the building (or power plant, airfield, vehicle fleet, etc.) can be managed over its lifetime for specific performance goals such as maximum energy efficiency. Moreover, the DOD's market is big enough — US\$23 billion this fiscal year for construction and facilities maintenance alone — to stimulate healthy competition between the private-sector firms that manufacture the advanced technologies. Firms see a big, reliable, long-term customer, giving them the impetus to innovate while also giving private-sector consumers confidence in the technologies. Confidence in turn drives consumption and improvements in performance and cost for both government and private customers.

This innovation chain is neither utopian nor theoretical. Many, if not most, of the major waves of technological innovation over the past 60 years have had at their core the performance needs and purchasing power of the US military: telecommunications, information and computer technology, advanced materials, satellites, aircraft and jet engines, robotics and human-performance enhancement.

What's true for the DOD's buildings is true for its electricity grids, vehicles, aircraft, ships and combat supply lines. Technological leadership underpins the agency's approach to ensuring national security, and security is increasingly recognized as being integrally related to energy. According to the department's 2010 *Quadrennial Defense Review*: "Energy efficiency can serve as a force multiplier, because it increases the range and endurance of forces in the field and can reduce the number of combat forces diverted to protect energy supply lines ... The department is increasing its use of renewable energy supplies and reducing energy demand to improve

operational effectiveness, reduce greenhouse gas emissions ... and protect the department from energy price fluctuations."

National security, climate change and energy economics are convergent rationales that provide the DOD with a potentially huge institutional advantage over other energy innovators. A litre of petrol transported along highly vulnerable supply lines to Afghanistan costs an average of about \$100. Enhancing the energy independence of forward-base operations in combat zones — to save lives and money — is thus a powerful short-term incentive for energy-technology innovation in everything from building insulation to fuel efficiency for jeeps, tanks and jets, to renewable power generation and storage. The price at which new technologies make economic and strategic sense is enormously higher than what the energy market — or any plausible cap-and-trade or energy tax scheme — would allow. This means that the DOD is well positioned to aggressively invest in energy technologies that have little economic logic outside the military context, a situation that in the past has often led to rapid innovation and reduced costs for civilian applications.

The visible hand

Marqusee believes that a five-year commitment to demonstration projects aimed at reducing energy use, fuel costs and emissions on fixed installations in the United States could move a broad array of technologies off the drawing board and into widespread use in the military's enormous infrastructure, a key step towards proliferation in the commercial marketplace.

But Marqusee's brand of thinking must proliferate as well. Congress and the administration of President Barack Obama have lavished budget increases and new programmes on the Department of Energy in the hope that it can accelerate US energy innovation. But despite the energy department's capabilities in research and development, it lacks the institutional attributes that have made the defence department the dynamo of global technological innovation for the better part of a century. Most importantly, the DOD's ability to carry out its mission depends critically on the performance of the technologies that it purchases. It is a discerning customer — with a giant development and procurement budget. The Pentagon, it turns out, is the only institution in the United States with the scale, structure and mandate to start an energy-technology revolution. ■

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