Summary

Next Generation Environmental Technologies (NGETs) represent a set of advanced manufacturing technologies that have the potential to produce environmentally benign products and processes. These technologies offer a new approach to environmental protection: Rather than focusing on the cleanup and control of waste and hazardous materials, they involve the redesign of industrial products and processes to reduce the quantity of material inputs required and to eliminate broad classes of environmentally detrimental outputs. When successfully implemented, NGETs offer the promise of substantial new advances in environmental protection often at low cost and even with a net economic benefit. They also raise important policy issues related to the magnitude and importance of the benefits that can be realized and the types of actions that might be taken to encourage their development and diffusion.

This report examines 25 existing NGETs to begin to address these issues. The technologies considered span the range of development from early research to full deployment in profitable businesses. Those that have been commercialized are offering benefits in a variety of areas, including the environment, national security, occupational safety and health, and the economy. Others that are still in various developmental stages offer similar promise.

Most of the technologies reviewed here draw on applications of the emerging science of green chemistry, an important source for NGETs. For each case study, we describe the underlying chemistry, the commercializing firm(s), the incentives that caused those firms to adopt the technology, and the role played by government support. Particular attention is paid to the identification of both near- and long-term benefits as well as to any barriers to technology adoption.

These case studies provide a review of the benefits and problems associated with NGETs. Taken together, they demonstrate the following:

1. NGETs can provide significant benefits to society in all the areas considered in our study: the environment, national security, occupational safety and health, and the economy.

2. NGETs can in some cases eliminate the use and generation of hazardous substances at little or no additional cost.

3. NGETs can be adopted by businesses for a variety of different reasons: to meet environmental regulations in a cost-effective way; to provide environmentally benign products economically; or to develop profitable new products in new and environmentally beneficent ways. NGETs provide new approaches to competitive advantage.

4. The barriers to the widespread use of NGETs can be technical, economic, and/or societal in nature.

This report represents a first step toward assessing the potential benefits of NGETs, reviewing the barriers to their successful deployment and pointing out where government actions have supported their successful adoption. Our case studies indicate that although green chemistry can be a powerful source of environmentally and economically beneficial technologies, its development is still in its infancy. Substantial work is needed both to create new NGETs and to encourage demand for their use. Much also remains to be learned about the basic science and practical application of green chemistry principles.