Artificial lighting is vital to our way of life, yet we take it for granted until the lights go out. Our dependence is even embedded in our term for an interruption of the supply of electricity – a “blackout”. Today’s lighting devices are notoriously energy inefficient, ranging from about 5% for incandescent bulbs to about 20% for fluorescent lamps. Lighting is therefore a large target for increasing energy efficiency, with the potential for significant reduction in impact on energy supplies and environmental stress. Recently, semiconductor devices emitting infrared light have demonstrated an efficiency of >75%. There is no known fundamental physical barrier to achieving similar, or even higher, efficiencies for visible white light, perhaps approaching 100% efficiency. Realizing such a technology will require breakthroughs enabled by fundamental understanding of the science of light-emitting materials and detailed control of those materials at the nanoscale. Exciting areas of current research include nanostructured substrates, exploitation of nanoscale light-emitting structures, use of photonic crystals to optimize extraction of light from devices, and exploration and optimization of nanoscale materials for phosphors tailored for solid-state lighting applications.