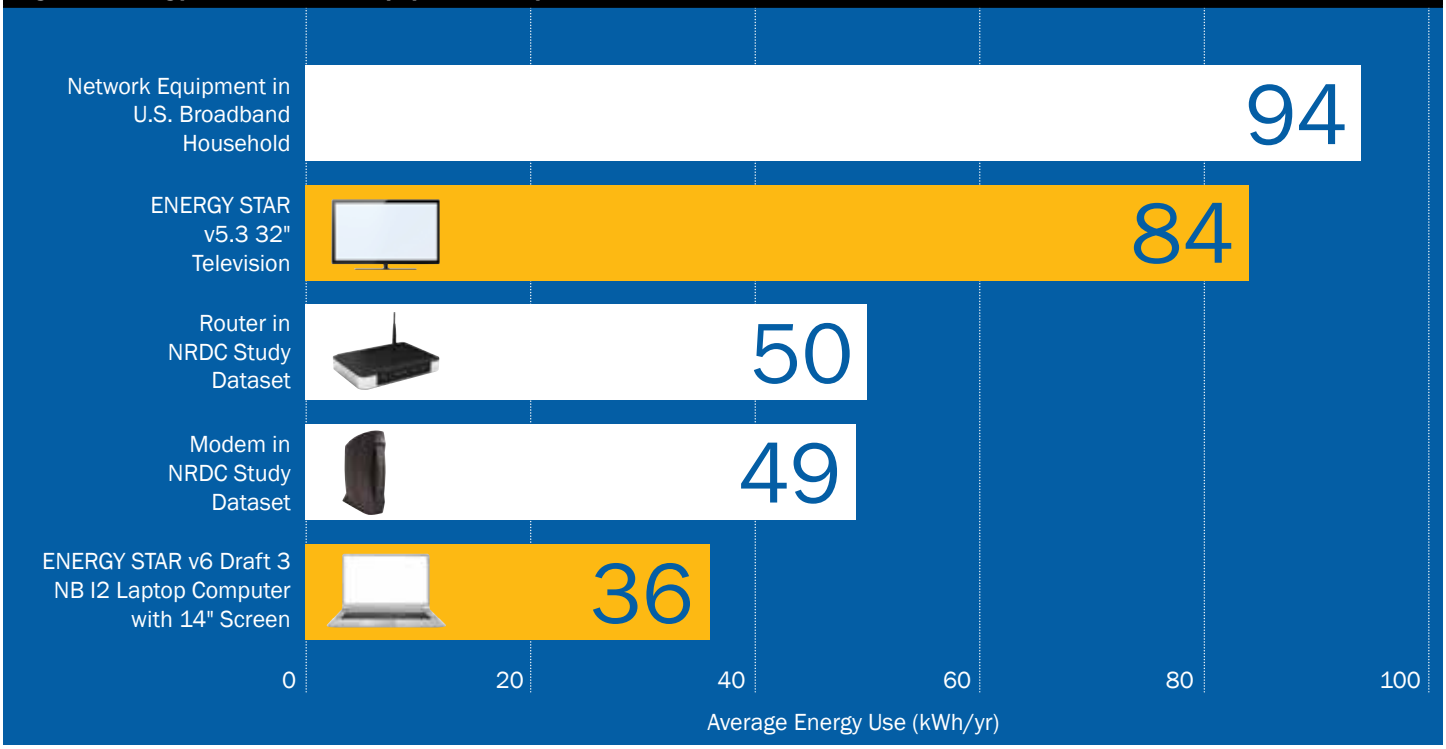
Cutting Energy and Costs to Connect to the Internet: Improving the Efficiency of Home Network Equipment

Approximately 88 million U.S. households subscribe to high-speed Internet service, which typically requires a modem to access the web and a router to move digital content around the home. These small network devices consume power around the clock, even when the household is asleep. While much has been learned about the energy use of the televisions, computers, cable set-top boxes, and other electronic equipment these devices serve, little is known about the seemingly innocuous black boxes that link all of these devices. NRDC and its consultant Ecova partnered to determine the energy use of residential small network equipment and how much could be saved with more efficient designs. We found the energy consumption of all of these devices really adds up: Small network equipment in America's homes consumes more than $1 billion worth of electricity annually—equivalent to the output of three large, polluting coal-fired power plants and enough to power every home in Silicon Valley, the high-tech capital of the world. Fortunately, there is great potential for improving the efficiency and reducing the operating cost of these network devices on which so many U.S. consumers rely.

Figure 1: Energy use of network equipment compared with other consumer electronics



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KEY FINDINGS:

- Approximately 145 million small network devices are in use in America's homes. Under the most common configuration, each household operates a modem to connect to the Internet and a wireless router—or a "gateway" combining both functions—to move the data to computers, printers, game consoles, tablets, and other electronics.
- Small network devices consume an average of 94 kilowatt-hours (kWh) of electricity per household—nearly the same as a new 32-inch flat screen television, or more than twice the annual consumption of an efficient 14-inch laptop computer, as shown in Figure 1.
- Most small network devices draw roughly the same amount of power when idle as they do while transmitting large amounts of data at high rates, racking up 8.3 billion kilowatt hours of yearly electricity use nationwide.
- The power required to run small network equipment in U.S. homes also produces **5 million metric tons of carbon dioxide emissions, equal to the annual tailpipe emissions of 1.1 million vehicles**.
- Replacing today's residential small network equipment with more efficient models could **save 2.8 billion kilowatt hours of electricity—or about $330 million worth of customer energy bills—per year**.

WHAT WE TESTED AND LEARNED

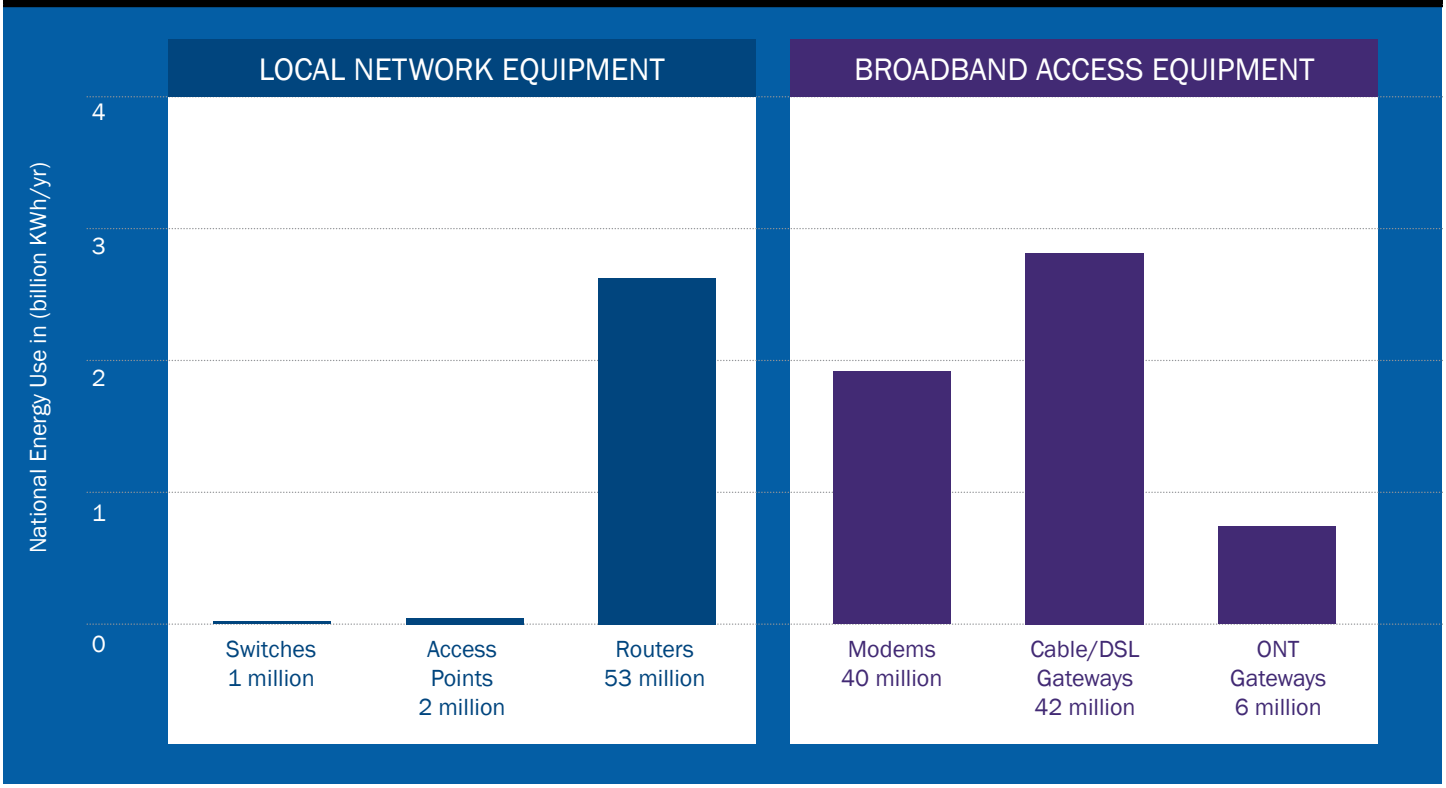
Consumers today cannot easily determine which modems and routers are the most energy efficient, and few manufacturers make energy-saving models. In addition, some of these devices are purchased at the retail level while in other cases the customer simply gets whatever box their Internet provider gives them when they sign up for service.

To better understand the power use of each type of small network device, we tested 60 models from a wide range of manufacturers in people's homes and in the laboratory using a simplified version of the ENERGY STAR® test method. The devices had been either purchased in stores or leased from an Internet service provider.

From our measurements and modeling, we estimate that in 2012, small network equipment in U.S. homes consumed 8.3 billion kilowatt hours, or in excess of $1 billion worth, of electricity.

Overall, gateways (boxes that include both a modem and router) represented the most energy use nationally, followed by routers and then modems, as shown in Figure 2. Each Optical Network Terminal (ONT), which is a box placed on the outside of a home to provide fiber optic service (Verizon FiOS), consumed the largest amount of electricity of all the devices tested.

Figure 2: U.S. residential small network equipment energy use



WE ALSO FOUND:

- It is generally more energy efficient to use a gateway with combined modem and routing functionality than to use separate devices.
- There is a broad range in the amount of energy used by small network devices with similar functionality. The most efficient ones use one-third less energy than average models. Some operate at lower power, while others scale power downward to adjust for light network traffic while remaining sufficiently awake to receive/transmit data when the user wishes.
- Replacing today's wasteful equipment with more efficient models could save 2.8 billion kilowatt hours of electricity (about $330 million) annually (see Figure 3).

Industry has only begun to develop and deploy products with sophisticated abilities to scale power without affecting performance. First-generation Energy Efficient Ethernet (EEE) devices are expected to produce near-term savings of 5 to 20 percent. Next-generation models may save as much as 80 percent, more than offsetting the increased power necessary for considerably faster Ethernet devices.

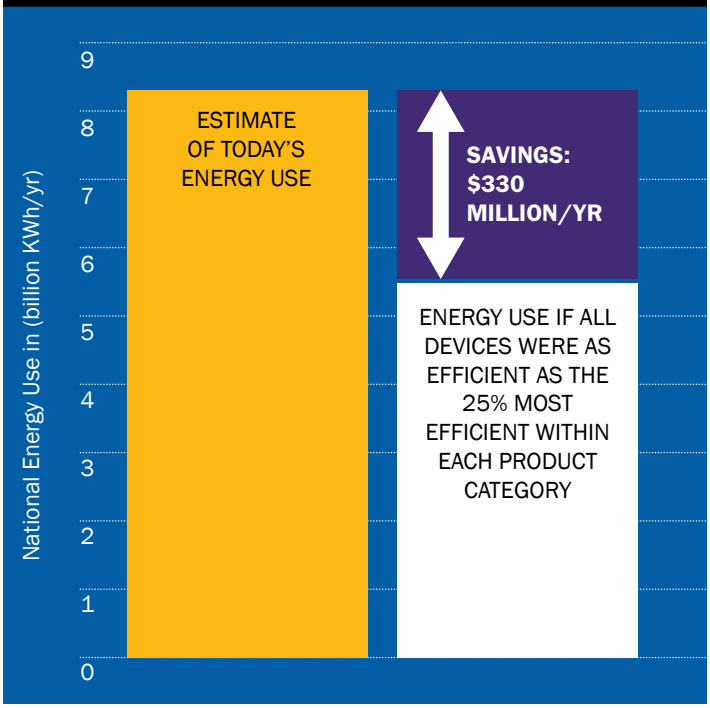
Although our study does not quantify the energy use of commercial small network equipment, that sector also consumes a significant amount. Introducing technologies and standards that increase the efficiency of network equipment, whether in the home or office, will add to the potential national energy savings.

REDUCING ENERGY USE AND COSTS

While it is difficult for consumers to know which devices are the most efficient, the Environmental Protection Agency's ENERGY STAR program is scheduled to soon finalize its specification for this category. ENERGY STAR-labeled products will help customers buy efficient models and choose Internet providers offering energy-saving network equipment in their subscription packages, reducing home electric bills. Qualifying models will not have to meet the industry's EEE advanced power-scaling benchmarks, but ENERGY STAR should make that a future requirement.

In addition, state and federal policymakers should consider mandatory energy-saving standards to eliminate the most wasteful products from the market, along with possibly requiring EEE in network equipment as well as in the electronics it connects.

Figure 3: U.S. residential small network equipment energy use and savings potential



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