



# ENERGY STAR Large Network Equipment Framework Specification June 2013

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no later than July 12th

## ***Introduction***

The U.S. Environmental Protection Agency (EPA) is developing a new ENERGY STAR® specification for Large Network Equipment (LNE). The U.S. Department of Energy (DOE) is developing the LNE test method as part of the specification development process. The launch of this effort is closely aligned with other ENERGY STAR work on IT and consumer electronics specifications and will bring significant savings to users of these products. Capabilities present in LNE may also enable more efficient operation of other IT equipment. An energy efficiency specification for LNE presents a clear opportunity for reducing national building energy use due to the large installed base of these products and their always-on status. In 2008, network equipment in the USA consumed 18 TWh—nearly 1% of building electricity—and was expected to grow at 6% per year to 23 TWh in 2012. It is possible to reduce overall network equipment energy consumption by 20% to 50% with sufficient market penetration of efficient technologies.

The ENERGY STAR program has also been actively developing a Small Network Equipment (SNE) specification, nearly finished, which covers products that represent nearly 30% of all network equipment energy consumption nationwide. EPA intends for the LNE specification to pick up where the SNE specification leaves off, with the scope covering a substantial portion of the remaining 70% of network equipment energy consumption, focusing primarily on fixed switches and routers, but also incorporating modular products.

This Framework Specification document is an expansion of the previous LNE discussion document, taking recent stakeholder feedback and discussions into account. It proposes an expanded list of definitions, identifies specific product types that EPA plans to include in Version 1.0 ENERGY STAR LNE specification, provides more detail of the specification's proposed focus, provides additional detail for potential energy efficiency criteria, and presents questions for discussion. EPA is providing the document to serve as a foundation for the Draft 1 LNE specification. The original LNE discussion document can be found at: <https://www.energystar.gov/products/specs/node/413>.

Stakeholders are encouraged to provide feedback on the concepts and definitions presented in this document, as well as to share their knowledge of topics not addressed here that they believe important to the development of this specification. Communication among EPA, DOE, and industry stakeholders is critical to the success of the ENERGY STAR program. To that end, EPA and DOE are sharing this Framework Specification and Draft 1 Test Method and will host a webinar on July 2nd to discuss the questions outlined in this document (access details to be provided separately). EPA will consider stakeholder input on all aspects of this document as the Agency creates the Draft 1 LNE Specification.

In each section below, EPA has developed questions for discussion and appreciates any additional information, studies, or data to supplement any answers provided.

Thank you for your continued support of the ENERGY STAR program. Please direct any questions about the Framework Specification to RJ Meyers, EPA, at [Meyers.Robert@epa.gov](mailto:Meyers.Robert@epa.gov), or 202-343-9923; or John Clinger, ICF International, at [John.Clinger@icfi.com](mailto:John.Clinger@icfi.com), or 215-967-9407. For any questions related to the Test Method, please contact Bryan Berringer, DOE, at [Bryan.Berringer@ee.doe.gov](mailto:Bryan.Berringer@ee.doe.gov), or 202-586-0371.

## Definitions

- a) **Purpose:** Establish a set of definitions to explicitly describe which products are covered by the specification and to clearly differentiate Large Network Equipment products from other ENERGY STAR product categories. Definitions describe classes and sub-classes of products, operational modes, key components, etc. A product may not be qualified as ENERGY STAR under more than one specification – the specifications make clear which, if any, applies to each product.
- b) **Approach:** EPA prefers to use existing definitions that are generally accepted by industry. In cases where industry accepted definitions are not available or appropriate, EPA works with stakeholders to develop acceptable definitions.
- c) **Preliminary List of Definitions:**
- Equipment: A group or groups of devices within a product category
  - Device: A single product within a product category.
  - Network Equipment: A device whose primary function is to pass Internet Protocol traffic among various network interfaces/ports.
    - i. Large Network Equipment (LNE): Network Equipment that is rack-mounted, intended for use in standard equipment racks, or contains more than eleven (11) wired Physical Network Ports.
    - ii. Small Network Equipment (SNE): Network Equipment that is intended to serve users in either small networks or a subset of a large network. SNE includes a) all Network Equipment with integral wireless capability and b) other Network Equipment meeting all of the following criteria:
      1. Designed for stationary operation
      2. Contains more than eleven (11) wired Physical Network Ports;
      3. Primary configuration for operation outside of standard equipment racks;

**Note:** The proposed scope of the Large Network Equipment (LNE) specification covers devices meeting the LNE definition. The general Network Equipment category also covers Small Network Equipment. The definition above is provided as a reference.

- Product Types:
  - i. Router: A network device that determines the optimal path along which network traffic should be forwarded. Routers forward packets from one network to another based on network layer information.
  - ii. Switch: A network device that filters, forwards, and floods frames based on the destination address of each frame. The switch operates at the data link layer of the OSI model.
  - iii. Security Appliance: A stand-alone network device whose primary function is to protect the network from unwanted traffic.
  - iv. Access Point Controller: A network device whose primary function is to manage wireless local area network (WLAN) traffic through one or more wireless access point devices.

**Note:** Based on stakeholder feedback on the previous LNE discussion document, and a lack of data, EPA is not currently planning to cover Security Appliances and Access Point Controllers in the Version 1.0 LNE Specification. EPA welcomes additional feedback and/or data that may support the reintroduction of these products in coming drafts of Version 1.0.

- Product Characteristics
  - i. Fixed Network Equipment: A network device that consists of hardware which is mostly a single functional unit.
  - ii. Modular Network Equipment: A chassis which can accept a variety of functional units to enable networking services.
  - iii. Managed Network Equipment: A managed network device allows precise control over ports or groups of ports. Managed network equipment must meet the following criteria:
    - 1. can be configured with redundant power supplies; and
    - 2. includes a dedicated management controller
  - iv. Unmanaged Network Equipment: A network device that does not meet the managed network equipment criteria.
  
- Operational States and Modes<sup>1</sup>
  - i. On Mode: The mode of the equipment or device where all design functionality is enabled and available for useful purposes.
    - 1. Active State: The operating state where the equipment or device is carrying out work in response to prior or concurrent external requests.
    - 2. Idle State: The operating state where the equipment or device is capable of carrying out work, but is not actively transferring data.
  - ii. Off Mode: The mode whereby the equipment or device is connected to the mains but is switched off for an indefinite time. An indicator that only shows the user that the product is in the off position is permitted in this mode.
  
- Other Definitions
  - i. Physical Network Port: An integrated physical connection point primarily intended to accept IP or similar traffic via a cable.
  - ii. Energy Efficient Ethernet: A technology which enables reduced power consumption of Ethernet interfaces during times of low data throughput. Specified by IEEE 802.3az.
  - iii. Power over Ethernet (PoE): A technology which enables transfer of electrical power, along with data, to network end point devices through an Ethernet cable. Currently specified by IEEE 802.3af and IEEE 802.3at.
  - iv. Standard Equipment Rack: An equipment enclosure commonly seen in data centers or managed facilities and intended to house a variety of information technology equipment. Front panel width is typically 19 inches (482.6 mm) in

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<sup>1</sup> [http://ec.europa.eu/information\\_society/activities/sustainable\\_growth/docs/broadband\\_eq\\_code-conduct.pdf](http://ec.europa.eu/information_society/activities/sustainable_growth/docs/broadband_eq_code-conduct.pdf)

width. Standard equipment racks are defined by EIA-310, IEC 60297, or DIN 41494.

#### **Questions for Discussion:**

1. Are there alternate definitions for the terms above that should be reviewed and considered by EPA?
2. Are there any LNE product types not addressed above that should be added to the list of products under consideration for Version 1.0 LNE specification? Are there any products that should be explicitly excluded?
3. Are there any product characteristics not included above that EPA should be aware of, beyond modular vs. fixed or managed vs. unmanaged? What impact do these categories have on product capabilities and energy consumption?

### ***Eligible Product Categories***

- a) **Purpose:** Identify specific product categories to be covered by the specification. Clearly defined categories are particularly important where requirements may not be appropriate for products that perform distinctly different functions. It is important to identify product types that are not eligible for ENERGY STAR qualification for reasons such as: use of proprietary technologies; limited availability of data; lack of differentiation with regard to product efficiency; or niche markets.
- b) **Initial Approach:** EPA's intention for the Version 1.0 LNE specification is to cover a substantial portion of the LNE market and do so in a timely manner, while maximizing the opportunities for energy savings. EPA may propose a tiered approach for the specification, concentrating on the greatest opportunities for energy savings in the Version 1.0 LNE specification, and expanding the scope in later versions.
- c) **Market Segments:** EPA proposes that the Version 1.0 LNE specification focus on fixed routers and switches. These types of devices are best suited as the target for the LNE specification since they consume most of the energy in the LNE category, are sold into a large and diverse market for deployment in a large number of installations, feature excellent savings opportunities, and are relatively easy to measure and evaluate. EPA intends to cover both managed as well as unmanaged large network equipment. After reviewing stakeholder feedback from the LNE discussion document, EPA is proposing to exclude security appliances and access point controllers from the Version 1.0 LNE specification.

EPA is proposing to include modular products in the Version 1.0 LNE specification, but recognizes that these products are typically more complex and that the testing method and eligibility requirements for them may be different from that used for fixed products. EPA is proposing to collect and display efficiency measurements of modular equipment, but not set levels for these products in the Version 1.0 LNE specification. This approach would mirror the ENERGY STAR Version 2.0 Computer Servers specification for three and four socket servers, blade systems, and multi-node systems.

### ***Energy Efficiency Criteria and Test Procedures***

- a) **Purpose:** Once it is determined which products will be included in the ENERGY STAR specification, the next step is to identify requirements for energy efficiency performance. Requirements may address the efficiency of key components, operational states, and/or whole-system energy efficiency. Efficiency requirements must be supported by generally accepted test

procedures. EPA will evaluate the need to develop allowances for product functions that require additional energy. EPA is aware that the current ATIS test procedure, proposed for use in the Draft 1 Test Method, contains a TEER efficiency metric, and continues to investigate whether this metric can serve as a foundation for metrics in the Version 1.0 LNE specification. EPA believes that the ATIS test procedure can be used for measurement purposes even if the TEER efficiency metric is not used in the Version 1.0 LNE specification.

There are two primary avenues that EPA will continue to explore in setting requirements for fixed routers and switches in the Version 1.0 LNE specification; the use of efficiency metric(s), and the creation of limits based on product type, characteristics, and functionality. EPA will continue to work with industry to determine which approach most accurately identifies the most energy efficient LNE products on the market.

**b) Initial Approach:** EPA will work with DOE to refine the Draft 1 Test Method. Once the DOE developed test method is stable, EPA will begin to assemble and analyze data from product tests performed by manufacturers. This data assembly is critical to the success of the program, since the test data will be used to develop the energy efficiency criteria in the Version 1.0 LNE specification.

**c) Existing Test Procedures for Reference:**

- ENERGY STAR Large Network Equipment Draft 1 Test Method
- Alliance for Telecommunications Industry Solutions (ATIS) -0600015.2009, Energy Efficiency for Telecommunication Equipment: Methodology for Measurement and Reporting—General Requirements
- Alliance for Telecommunications Industry Solutions (ATIS) -0600015.03.2013, Energy Efficiency for Telecommunications Equipment: Methodology for Measurement and Reporting of Router and Ethernet Switch Products

**d) Requirements EPA is considering for the Version 1.0 LNE specification:**

- Minimum power supply efficiency
- Active State and possibly Idle State power levels
- Collection and display of test results via the product finder tool on the ENERGY STAR website.
- Standard methods for reporting product energy use and system performance over the network
- Specific energy efficient features or capabilities, such as:
  - i. ability to power down unused ports;
  - ii. remote administration of ports individually;
  - iii. presence of variable speed fans;
  - iv. ability to scale power dynamically with the level of utilization;
  - v. implementation of Energy Efficient Ethernet (IEEE 802.3az); and
  - vi. ability to perform well at higher operating temperatures.

**Questions for Discussion:**

1. Are there features not listed above that provide substantial energy savings? What are the energy and performance impacts of these features as they currently exist? What about in the near future?

2. Are the savings from the more efficient Power over Ethernet (PoE) large enough to include in this specification? Should PoE mid-span devices be considered to be network equipment or external power supplies?

## ***Information and Management Requirements***

- a) **Purpose:** EPA is interested in developing tools to facilitate the efficient design and operation of facilities. EPA is proposing to adopt (1) Standard Information Reporting requirements and (2) Data Measurement and Output requirements. These facilitate efficient capacity planning, procurement, and device operation.
- Standard Information Reporting: Manufacturer reports of specified test data for display in the product finder tool on the ENERGY STAR web site. EPA will consider how industry standardized data reporting may be integrated into the ENERGY STAR web site.
  - Data Measurement and Output: Ability of devices to provide nearly real-time system performance data to network for use by management systems.

### **Questions for Discussion:**

1. What aspects of the Standard Information Reporting or Data Measurement and Output requirements in other ENERGY STAR data center specifications (servers, UPS, storage) are relevant to LNE devices? Do any existing LNE standards approximate the ENERGY STAR requirements described above?

For reference, please see the specifications at the following links:

Computer Servers Version 2.0 Eligibility Criteria (see Sections 4 and 5):

<http://www.energystar.gov/products/specs/sites/products/files/Final%20Version%202.0%20Computer%20Servers%20Program%20Requirements.pdf>

UPS Version 1.0 Eligibility Criteria (see Section 3.5):

[http://www.energystar.gov/ia/partners/product\\_specs/program\\_reqs/UPS\\_ENERGY\\_STAR\\_Program\\_Requirements.pdf?bdac-65a2](http://www.energystar.gov/ia/partners/product_specs/program_reqs/UPS_ENERGY_STAR_Program_Requirements.pdf?bdac-65a2)

Storage Version 1.0, Draft 4 Specification (see sections 3.5 and 3.7):

<http://energystar.gov/products/specs/sites/products/files/Version%201.0%20Storage%20Draft%2004%20Specification.pdf>

2. What are typical performance data measurement, reporting, and output capabilities of LNE devices? What industry trends address reporting capabilities?
3. What information should be displayed in the product finder tool on the ENERGY STAR web site?
4. Do LNE products have the ability to measure and self-report operations characteristics in an open, accessible format when interfacing with a third-party management software?
5. How is utilization defined for LNE products? What utilization information would be helpful to managers for procuring LNE equipment?