## Replace Desktops with Laptops or Thin Clients

### Description

Laptop computers and thin clients are typically much more efficient than desktop computers, providing the same (or better) performance while using less energy. As a result, switching from desktops to laptops or thin clients can save energy. Typically, laptops use about 80% less electricity than desktops (1) and thin clients use (77%) less, assuming that servers and server cooling are handled on-site (2).

### Modeler Description

Assume that each occupant in the building has a computer. Assume that 53% of these are desktops, and 47% are laptops (1). Assume that desktops draw 175W at peak, whereas laptops draw 40W and thin clients draw 45W (including data center cooling load). Calculate the overall building installed electric equipment power in W, then calculate the reduction in W from switching from desktops. Determine the percent power reduction for the overall building, and apply this percentage to all electric equipment in the building, because electric equipment is not typically identified in a granular fashion.

### Use Case Types

Retrofit, New Construction

### Arguments

No arguments

### Initial Condition Message

### There are 100 people in this building. Assuming 0.53 of them have desktops (and that the remainder have laptops already), there are currently 53 desktops in the building. There are currently 10000 W of electric equipment installed in the building.

### Final Condition Message

After replacing 53 175W desktops with 40W laptops, there are now 2845W of electric equipment installed in the building.

### Not Applicable Messages

Not applicable if no multi-zone VAV systems with constant supply-air temperature were found.

### Warning Messages

### Information Messages

Assume that each desktop uses 175W at peak.

Assume that each laptop use 40W at peak.

### Error Messages

### Code Outline

* Calculate the number of people in the building
* Assuming 53% of them have desktops, calculate the number of desktops.
* Calculate the total wattage of all electric equipment present in the building
* Calculate the total wattage reduction for switching this number of desktops to laptops or thin clients.
* Calculate the fractional reduction required to represent the desktop switch
* Apply this fractional reduction to all electric equipment definitions in the model because there is no way to identify which loads are desktops and which are other miscellaneous equipment.

### Tests

**This measure applies to:**

1. Large Office
2. Medium Office
3. Primary School
4. Secondary School
5. Large Hotel
6. Hospital
7. Small Office
8. Stand-Alone Retail
9. Strip Mall
10. Supermarket
11. Quick Service Restaurant
12. Full Service Restaurant
13. Small Hotel
14. Outpatient Healthcare
15. Warehouse
16. Midrise Apartment

**Test results:**

### References

1. <http://eetd.lbl.gov/sites/all/files/achieved_and_potential_energy_savings_through_energy_efficient_procurement_lbnl-5737e.pdf>
2. <https://www.igel.com/fileadmin/user/upload/documents/PDF_files/White_Paper_EN/WP_Green_99-EN-44-1.pdf>