

## Supplement to ENERGY STAR® Commercial Ovens Draft 3 Version 2.0 Proposed Convection Oven Cooking-Energy Efficiency Levels

The purpose of this document is to provide more detailed analysis on the proposed changes to the convection oven minimum cooking-energy efficiency levels presented in the ENERGY STAR Commercial Ovens Draft 3 Version 2.0 specification. Stakeholders are encouraged to provide feedback on this document along with any Draft 3 comments to [commercialovens@energystar.gov](mailto:commercialovens@energystar.gov) by November 2, 2012.

### Overview

The U.S. Environmental Protection Agency (EPA) released the ENERGY STAR Commercial Ovens Draft 2 Version 2.0 specification on July 18, 2012 with the intent of revisiting the convection oven cooking-energy efficiency levels due to: (a) increasing ENERGY STAR market penetration and (b) revisions to the referenced ASTM F1496 Standard. Based on ENERGY STAR 2010 Unit Shipment Data<sup>1</sup>, the market penetration of ENERGY STAR qualified convection ovens was 36%. Preliminary review of the 2011 market penetration data suggests that this percentage has increased to 46%.

Since the release of Draft 2, EPA was provided with a dataset based largely on testing conducted by several California utilities which provided an opportunity to evaluate the energy performance of products using the revised ASTM convection oven test method. EPA conducted an analysis comparing the 1999 ASTM cooking-energy efficiency data to that resulting from the new 2012 test method and determined that the modifications to the test method warrant revisiting the convection oven Version 1.2 cooking-energy efficiency performance levels.

EPA is proposing new convection oven levels in the Draft 3 to: (a) reflect inherent increases in efficiency values captured by changes to the ASTM test method and (b) bring the overall market penetration of convection ovens down to approximately 25%. Details on the ASTM revision process and EPA's analysis are provided below.

EPA is anticipating finalizing this specification revision by December 1, 2012 and with an effective date of September 1, 2013. Only convection ovens which have been third party certified and meet the efficiency requirements of Version 2 would be eligible to continue to be labeled and marketed as ENERGY STAR.

### ASTM Update

The ASTM F-1496-99 *Standard Test Method for Performance of Convection Ovens* is currently in its final stages of revision. The new 2012 version is scheduled to be finalized by December 2012. This new test method includes critical changes to the test procedure and calculations to more closely align with the ASTM test method for combination ovens operating in convection mode. It's important to note that these changes only affect cooking-energy efficiency test results. The idle rate test procedure remains unchanged and thus, idle performance results are unaffected.

The two key convection oven test method changes that affect the efficiency results include:

- 1) **Loading to Maximum Capacity:** The oven shall be loaded to its maximum capacity with a 2.75" spacing from the upmost rack position to the internal oven cavity's ceiling. The 1999 standard required that a maximum of 5 pans of product be used for all efficiency tests. If the oven was

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<sup>1</sup> ENERGY STAR Unit Shipment Data Report: [www.energystar.gov/usd](http://www.energystar.gov/usd)

incapable of accommodating 5 pans, then the test would be run with the oven's maximum load. If an oven could accommodate greater than 5 pans, the tests were still to be completed with only 5 racks of product.

Though most of the ovens in the data set that EPA acquired still have a maximum capacity of only 5 pans, those that are larger and can accommodate greater than 5 pans while still allowing the 2.75" spacing, will show a slight increase in efficiency.

- 2) **Consideration of Pan Energy Consumption:** The energy absorbed by the pans during cooking-energy efficiency tests shall be taken into consideration. When calculating the efficiency results, the energy absorbed by the mass of the pans is significant enough to account for about a 0.5-2.5% increase in efficiency. The 2012 standard accounts for that energy consumption and reflects an almost unanimous efficiency gain for the ovens, which is reflected in the charts below.

### Convection Oven Datasets: 1999 and 2012

Following are the three convection oven categories that are included in the ENERGY STAR Commercial Oven Version 2.0 specification scope and evaluated for this revision effort: electric half-size, electric full-size, and gas full-size. Using results based on the 1999 and 2012 test procedures, EPA plotted comparison charts to determine the impact on cooking-energy efficiency values. As presented in the bar and line charts provided for each oven size and fuel-type below, EPA observed a consistent increase in efficiency when comparing results between the two standards.

#### *Electric Half-Size*

Though there are only four electric half-size models represented in the dataset, characterized in figures 1 and 2, below, the efficiency increase is considerably consistent with an average absolute efficiency difference of 1.4%. The increases range from 1% to 2.2%. This translates to an average 1% increase from 1999 versus 2012 test methods. Note that all four models were originally tested with their maximum pan capacity. Therefore, the only efficiency gains come from consideration of energy being absorbed by the pans.

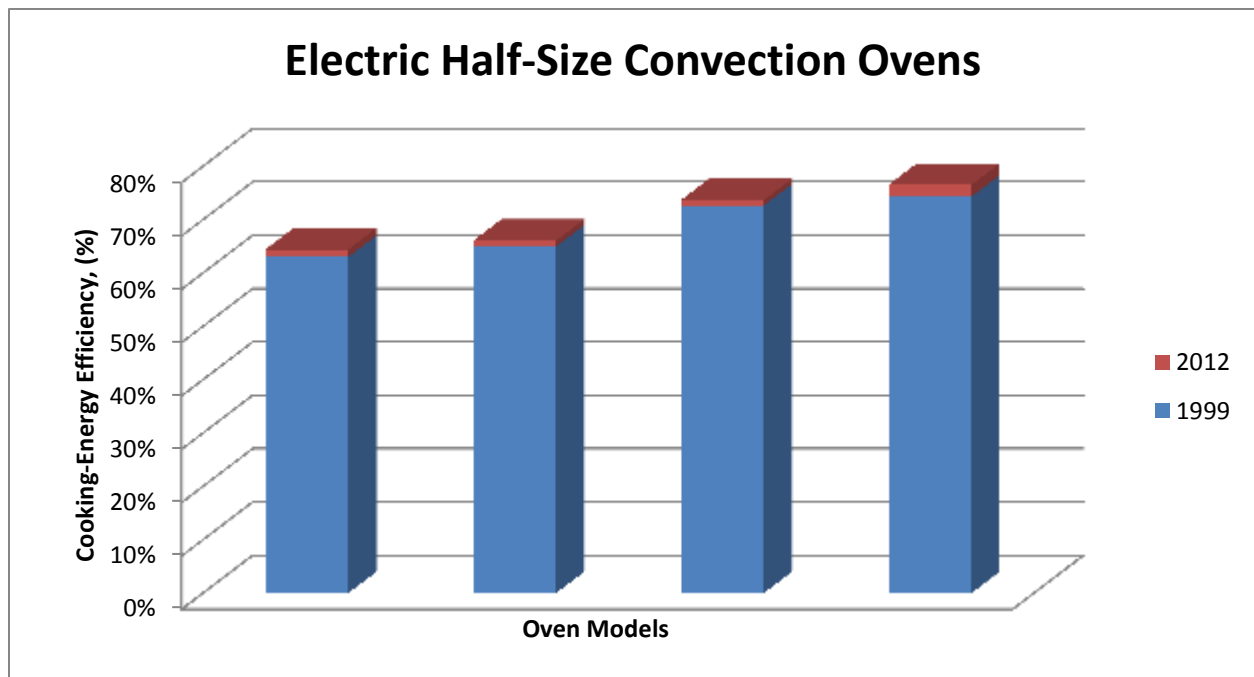


Figure 1. Electric Half-Size Convection Ovens.

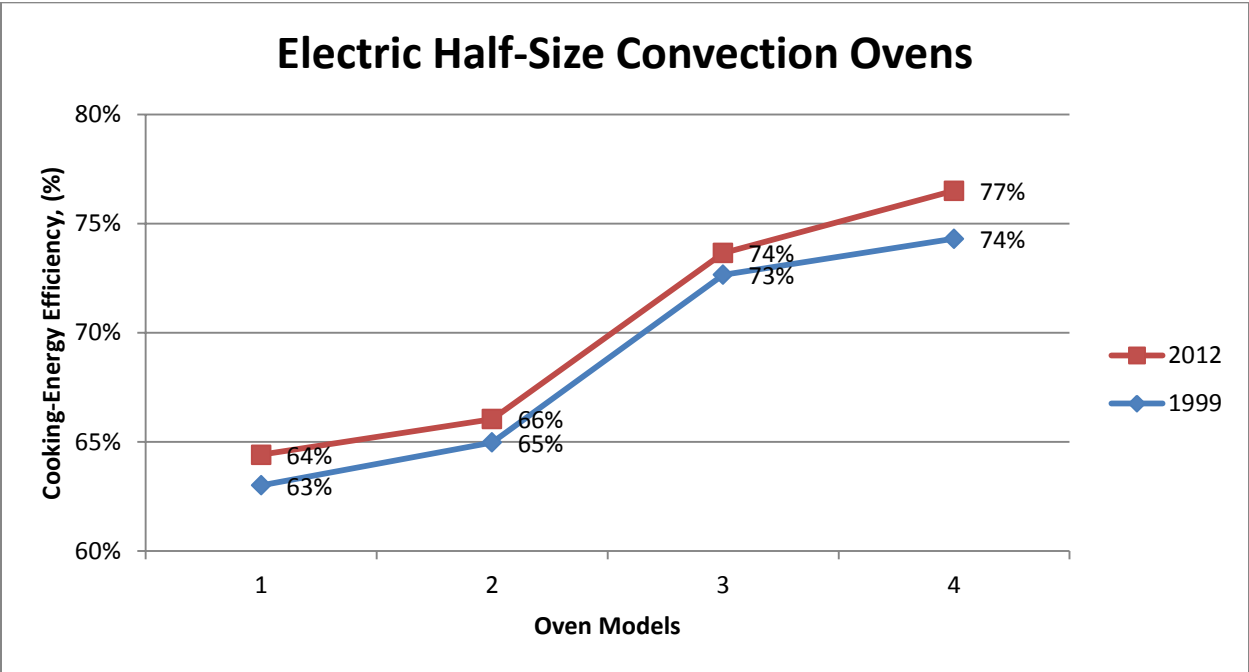


Figure 2. Electric Half-Size Convection Ovens.

**Electric Full-Size**

The more robust electric full-size oven dataset presented in figures 3 and 4, below, presents the same level of consistency, with a total average absolute efficiency difference of 1.1%, which translates into a 0.8% average increase. The increases range from 0.4% to 2.2%. Efficiency gains across most of these models are due to consideration of the energy absorbed by the pans, with the exception of the two last units which also had an increase in load of one and three pans of product, respectively.

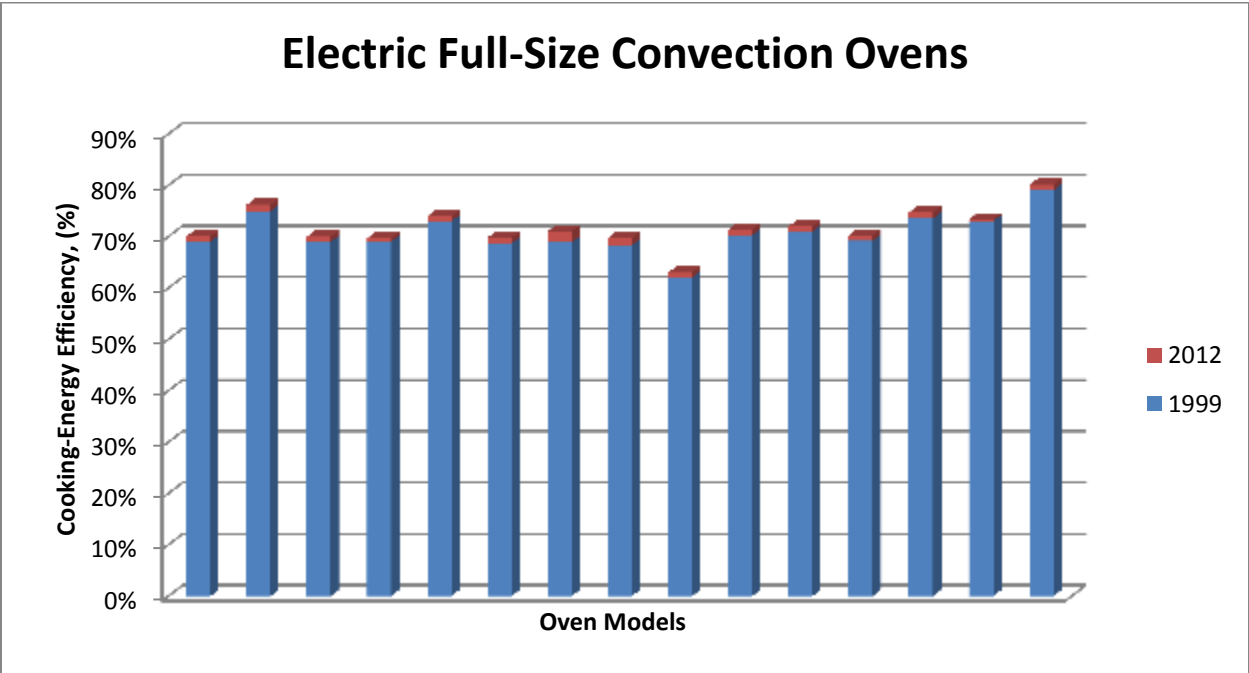


Figure 3. Electric Full-Size Convection Ovens.

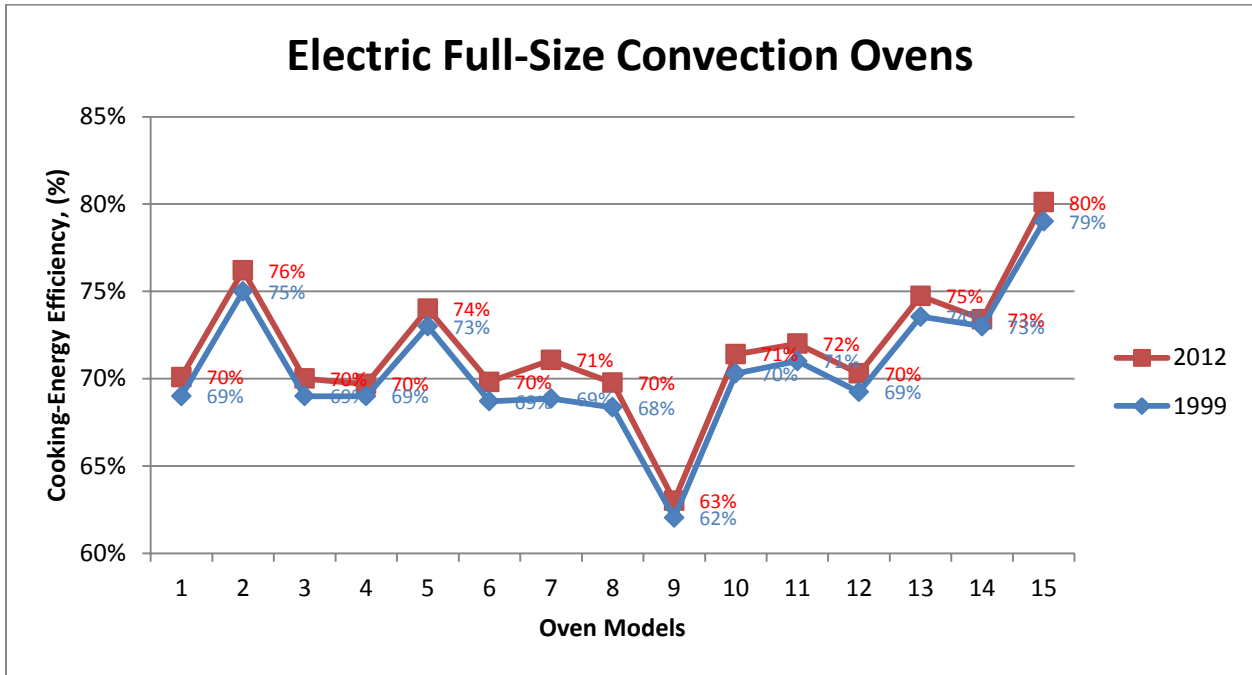


Figure 4. Electric Full-Size Convection Ovens.

### Gas Full-Size

Four of the twenty-four gas full-size ovens represented in figures 5 and 6, below, were re-tested with additional pans to maximize their capacity (greater than five). In those four instances, the ovens performed greater than those that could only accommodate five pans or fewer. That, coupled with consideration of the energy absorbed by the pans, yielded an average absolute efficiency increase of 1.0%, which translates into a 0.4% average increase. The increases range from 0.4% to 3.0%.

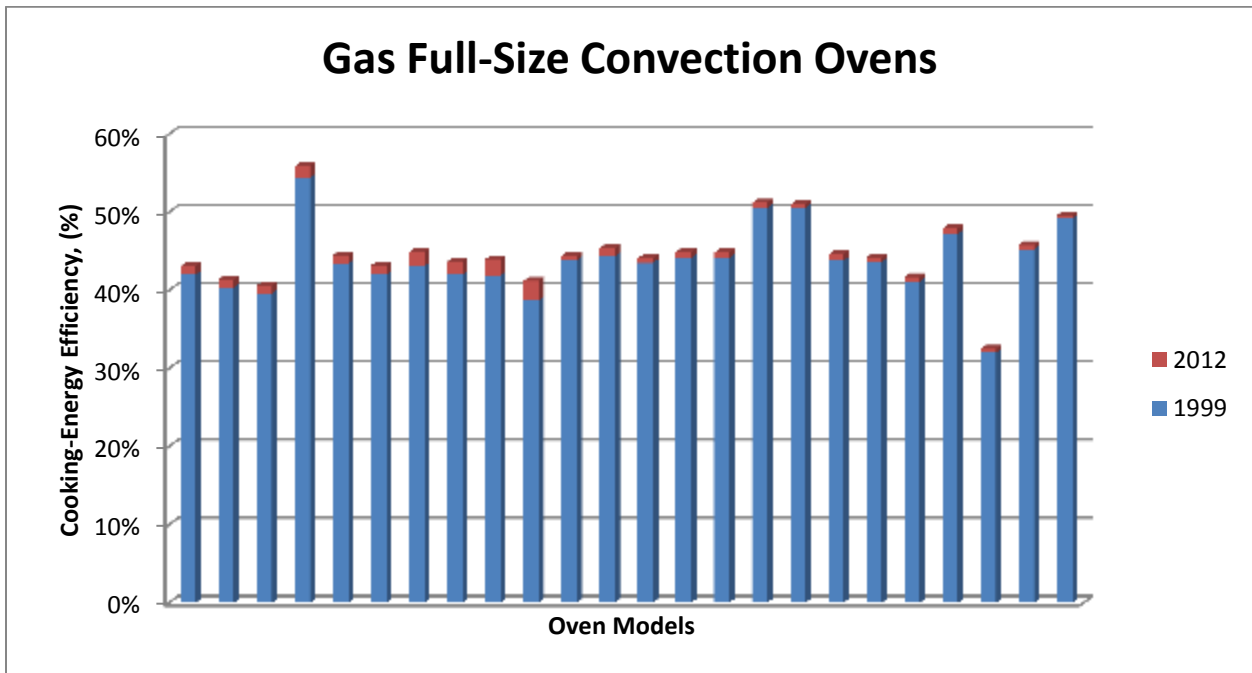


Figure 5. Gas Full-Size Convection Ovens.

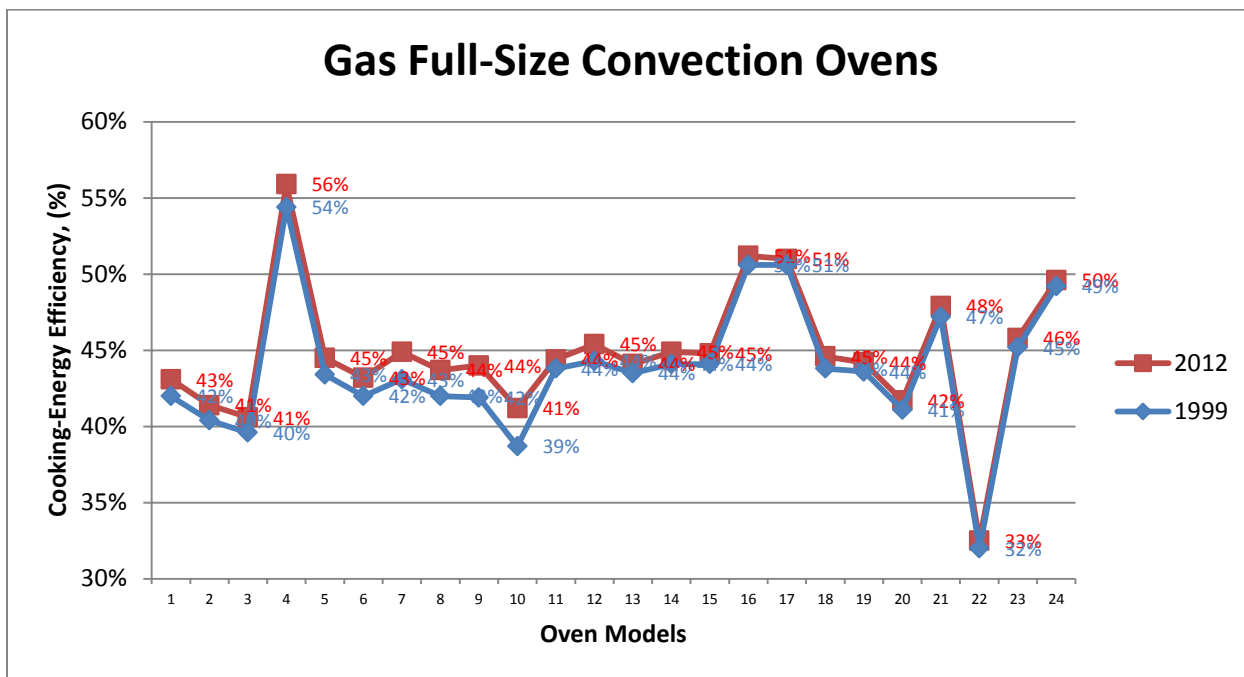


Figure 6. Gas Full-Size Convection Ovens.

#### Conclusion

Based on the comparative analysis, EPA is proposing new cooking-energy efficiency levels that are 2% higher than current Version 1.2 levels for convection ovens which accounts for the efficiency gains from the revised test method as well as address the increased market penetration of ENERGY STAR qualified products from Version 1.2.

#### Proposed Draft 3 Levels: Version 2.0

Table 1: Energy Efficiency Requirements for Convection Ovens		
<b>Gas</b>		
<b>Oven capacity</b>	<b>Idle Rate, Btu/h</b>	<b>Cooking-Energy Efficiency, %</b>
Full-Size	≤ 13,000	≥ 46
<b>Electric</b>		
<b>Oven capacity</b>	<b>Idle Rate, kW</b>	<b>Cooking-Energy Efficiency, %</b>
Half-Size	≤ 1.0	≥ 72
Full-Size	≤ 1.6	

#### Current Levels: Version 1.2

Table 1: Energy Efficiency Requirements for Convection Ovens		
<b>Gas</b>		
<b>Oven capacity</b>	<b>Idle Rate, Btu/h</b>	<b>Cooking-Energy Efficiency, %</b>
Full-Size	≤ 13,000	≥ 44
<b>Electric</b>		
<b>Oven capacity</b>	<b>Idle Rate, kW</b>	<b>Cooking-Energy Efficiency, %</b>
Half-Size	≤ 1.0	≥ 70
Full-Size	≤ 1.6	