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80 PLUS Market Progress Evaluation Report #5

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Final

80 PLUS Market Progress Evaluation Report #5

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EXECUTIVE SUMMARY

The Northwest Energy Efficiency Alliance (NEEA) is a non-profit organization that works to accelerate the innovation and adoption of energy-efficient products, services, and practices in the Pacific Northwest. Since 2004, NEEA has sponsored the 80 PLUS Initiative with the goal of transforming the market for energy efficient internal power supplies for desktop PCs and servers. 80 PLUS certifies power supplies at five efficiency levels ranging from 80% efficient (“80 PLUS”) to about 90% efficient (“80 PLUS Platinum”).

This report is the fifth market progress evaluation report (MPER) and contains three primary components:

- ➔ A characterization of the trends, status and dynamics of the PC and laptop market
- ➔ An update of key assumptions related to market penetration, baselines, and costs for the program’s ACE model
- ➔ An assessment of the market progress indicators associated with the 80 PLUS initiative

INITIATIVE DESCRIPTION AND BACKGROUND

The 80 PLUS Initiative seeks to drive adoption of these higher-efficiency power supplies. Efficiency program efforts to increase power supply efficiency began in 2002 when the California Energy Commission, Pacific Gas & Electric Company (PG&E), and the U.S. Environmental Protection Agency (EPA) commissioned Ecos Consulting (now Ecova) and the Electric Power Research Institute (EPRI) to develop a methodology for testing personal computer (PC) power supply efficiency. NEEA began funding 80 PLUS in 2004 as a way to encourage PC manufacturers to install highly efficient power supplies. NEEA continues to support 80 PLUS but stopped providing incentives for sales of PCs with qualifying power supply units in 2010. Ecova continues to implement the 80 PLUS program and their activities include managing the Electric Power Research Institute (EPRI) in their work testing power supplies, posting testing results, and processing incentive payments.

RESEARCH OBJECTIVES

MPER #5 responds to five key goals identified by NEEA:

- ➔ Update 80 PLUS market data to determine current 80 PLUS market share, trends in market share, and future changes to market share relative to ENERGY STAR specification changes;



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- ➔ Update Initiative output data to allow NEEA to assess the output of the Initiative, including the number of participants of various types, the number of certified power supply units, and trends and projections therein.
- ➔ Collect end-user data to quantify the rate of adoption of ENERGY STAR desktop PCs (and thus 80 PLUS Bronze power supply units) among commercial non-government entities.
- ➔ Identify lessons learned to understand what NEEA could have done differently with the Initiative, for example, should NEEA have acted differently regarding alignment of 80 PLUS with ENERGY STAR or Climate Savers.

EVALUATION ACTIVITIES

Table 1 summarizes the five data collection activities that informed MPER#2.

Table 1: MPER #2 Data Collection Activities

Activity	Source of Data	Sample Size
Program Data Review	80 PLUS program documents	N/A
	MPERS #1-#4	
	Plug load solutions website	
	Interviews with Ecova and NEEA staff	
Literature Review	IDC PC shipment data	N/A
	Popular press articles	
	Trade journal articles	
	Manufacturers' websites	
In-Depth Interviews	Initiative Staff	2
	Industry experts (e.g. EPA ENERGY STAR staff)	4
	Desktop PC OEMs	5
	System integrators	5
	Power supply manufacturers	5
Online Survey of IT Decision-Makers	Small/medium businesses (50-999 employees)	68
	Large businesses (1,000 or more employees)	51



KEY FINDINGS

MPER#5 yielded six key findings about the Initiative's progress relative to the research objectives:

- ➔ ***Finding #1: System integrators (SI) and power supply manufacturers (PSM) value the 80 PLUS brand.*** SIs value the 80 PLUS brand as a symbol of power supply quality as well as efficiency, and PSMs use their 80 PLUS product offerings to demonstrate their market leadership. The 80 PLUS brand may be less meaningful to OEMs, who respond to low end-user awareness of the brand by focusing their marketing on ENERGY STAR energy efficiency more generally.
- ➔ ***Finding #2: For general purpose PCs (70 to 90% of the market) ENERGY STAR drives adoption of efficient power supplies. For power PCs, non-energy benefits and the 80 PLUS brand drive adoption.*** The drivers of 80 PLUS adoption differ depending on whether the destination PC model is a general purpose or power PC, and these differences impact market actors' approaches to power supply efficiency. In the case of general purpose PCs, EPA's inclusion of power supply efficiency requirements and a test procedure modeled on 80 PLUS in the desktop PC ENERGY STAR specification played an important role in motivating 80 PLUS adoption. In power PCs, the non-energy benefits of efficient power supplies and the 80 PLUS brand itself play a more important role. As a result of this distinction, market actors with a stronger focus on general purpose PCs approach 80 PLUS differently than those with a stronger focus on power PCs.
- ➔ ***Finding #3: Evidence suggests demand for 80 PLUS in the supply chain will remain constant and continue to have many drivers.*** Interview and survey findings show changes to the ENERGY STAR specification will have little impact on 80 PLUS demand. While the number of power supply SKUs certified as 80 PLUS may decline and then plateau due to other market factors, market demand for 80 PLUS power supplies should remain steady because the demand has two constant drivers: ENERGY STAR and power PCs. ENERGY STAR will continue to be the primary driver of demand for 80 PLUS because it requires an 80 PLUS Bronze-equivalent power supply and more than 70% of commercial desktop PC sales are ENERGY STAR qualified.
- ➔ ***Finding #4: Cost is the only remaining barrier to 100% adoption of 80 PLUS supplies.*** For the approximately 20% of desktop PCs sold annually without an 80 PLUS power supply, cost is the primary barrier at every level of the supply chain: PSMs, OEMs, SIs, and end-users. OEM's incremental cost for 80 PLUS power supplies, although small and decreasing, is still a barrier to adoption. SI's face a much higher incremental cost than OEMs, and for some customers it remains a barrier. And among commercial end-users, 16% of the respondents to this study's online survey reported experiencing a higher cost for ENERGY STAR desktop PCs. The survey also showed significant firmographic differences between IT decision-makers, who reported that 91% or more of their PC



purchases were ENERGY STAR qualified, and those who reported buying a smaller proportion. The latter (buyers of a smaller proportion of ENERGY STAR desktop PCs) showed less organizational commitment to sustainability and were more likely to buy off-the-shelf PCs vs. custom PCs.

- ➔ **Finding #5: Large organizations (1,000 or more employees) differ from small/medium organizations in many ways relevant to the 80 PLUS program.** The online survey of IT decision-makers showed notable and meaningful differences between larger organizations (those with more than 1,000 employees) and small/medium organizations (those with few than 1,000 employees). Larger organizations exhibited greater awareness of 80 PLUS, however the adoption rate was similar to small/medium organizations. Larger organizations also exhibited greater sophistication in IT-related purchasing decisions. The survey also showed that large organizations are more likely to have purchasing requirements for ENERGY STAR PCs.
- ➔ **Finding #6: System integrators are an important partner for the 80 PLUS program but the remaining potential in the SI market is unclear.** There are synergies between the 80 PLUS brand and the SI business model. 80 PLUS has brand recognition for high quality products and SIs aim to offer their customers both quality equipment and better support (than OEMs). The 80 PLUS brand supports SIs' efforts to demonstrate the higher quality and reliability of the PCs they produce. Using 80 PLUS certified power supplies may also allow SIs to demonstrate that the PCs they manufacture are energy efficient without ENERGY STAR qualification.

CONCLUSIONS AND RECOMMENDATIONS

This MPER has three key conclusions, each with associated recommendations.

- ➔ **Conclusion #1: The 80 PLUS brand has value in Desktop PC supply chain and continues to contribute to PC efficiency.** The role of the 80 PLUS brand has shifted as 80 PLUS power supplies have achieved widespread adoption, but 80 PLUS remains valuable to market actors. Rather than using their adoption of 80 PLUS power supplies to differentiate themselves from their competitors, SIs now view 80 PLUS as a symbol of high-quality power supplies and use the brand to support their value proposition, which is based on PC quality and support. Similarly, PSMs can no longer use their 80 PLUS offerings to set themselves apart from their competition. Instead, PSMs risk falling behind their competition if they do not produce power supplies at the highest 80 PLUS efficiency tiers. The 80 PLUS brand allows SIs to demonstrate the efficiency of PCs that may not receive other efficiency certifications and allows PSMs to promote efficiency as a feature of their high-end power supplies.
 - **Recommendation: Continue to support the 80 PLUS brand and certification process.**



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➔ **Conclusion #2: 80 PLUS market penetration is approaching 85%, NEEA's estimate of maximum potential, but opportunities remain to increase market share beyond this threshold.** There is opportunity to further accelerate 80 PLUS adoption and achieve market penetration levels that exceed NEEA's current estimated potential of 85%. Market actor interviews showed that incremental cost is the only barrier that prevents OEMs and SIs from installing 80 PLUS power supplies in 100% of the PCs they sell. The study identified three areas in which the Initiative could engage to increase 80 PLUS market share and/or desktop PC energy efficiency: ENERGY STAR specifications; low-cost, general purpose PCs; and system integrators.

- **Recommendation: Continue advocating for increased power supply efficiency in the ENERGY STAR desktop PC specification to further increase efficiency among qualified units; Advocate that ENERGY STAR include power supply efficiency requirements equivalent to 80 PLUS Gold in its next specification.**
- **Recommendation: Address incremental cost barriers to increase 80 PLUS penetration among low-cost PCs; Consider mid- and upstream incentive approaches designed to target the lowest-priced PCs.**
- **Recommendation: Conduct further research to determine the potential for increased 80 PLUS adoption in the SI market.**

➔ **Conclusion #3: 80 PLUS does not currently collect certification data in a format that allows for analysis of trends in model certification by 80 PLUS tier.** The 80 PLUS program's database of certified power supplies currently does not include a field for the date each model was certified as 80 PLUS compliant. As a result, it is not possible to identify trends in power supply certification by efficiency tier. Tracking these trends would provide the program with useful information about 80 PLUS adoption by PSMs and the influence on 80 PLUS certifications of factors like the inclusion of increased power supply efficiency requirements in ENERGY STAR specifications.

- **Recommendation: Expand data collection to support more detailed tracking of 80 PLUS certification.**





1

INTRODUCTION

The Northwest Energy Efficiency Alliance (NEEA) is a non-profit organization that works to accelerate the innovation and adoption of energy-efficient products, services, and practices in the Pacific Northwest. Since 2004, NEEA has sponsored the 80 PLUS Initiative with the goal of transforming the market for energy efficient internal power supplies for desktop PCs and servers. 80 PLUS certifies power supplies at five efficiency levels ranging from 80% efficient (“80 PLUS”) to about 90% efficient (“80 PLUS Platinum”).

This report is the fifth market progress evaluation report (MPER) and contains three primary components:

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- ➔ An assessment of the market progress indicators associated with the 80 PLUS initiative

INITIATIVE DESCRIPTION AND BACKGROUND

More than 207 billion kWh of electricity pass through internal and external power supplies each year in the U.S. The internal power supplies in desktop PCs and servers have traditionally been between 65% and 70% efficient, although the most efficient models now on the market can exceed 90% efficiency. The 80 PLUS Initiative seeks to drive adoption of these higher-efficiency power supplies.

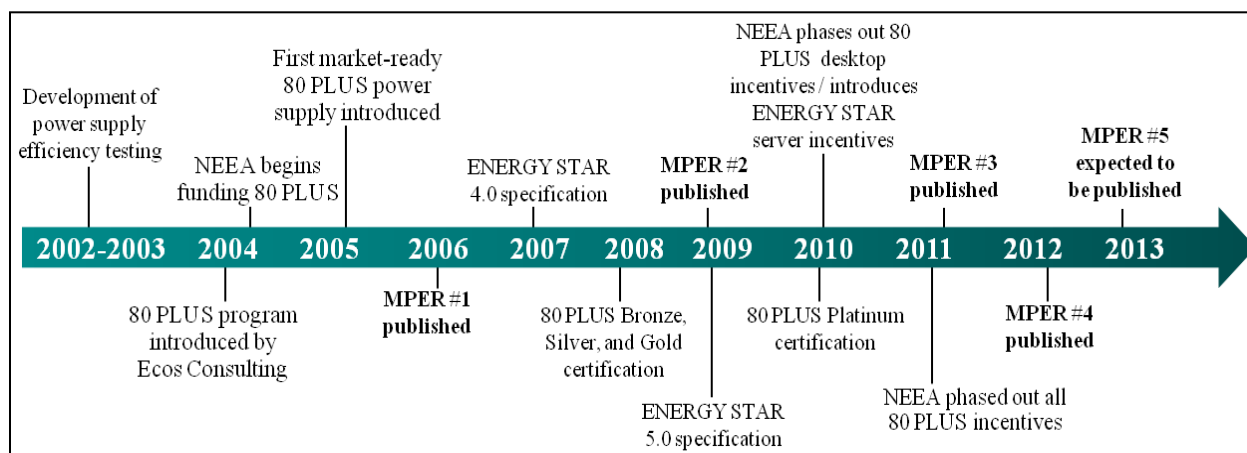
Efficiency program efforts to increase power supply efficiency began in 2002 when the California Energy Commission, Pacific Gas & Electric Company (PG&E), and the U.S. Environmental Protection Agency (EPA) commissioned Ecos Consulting (now Ecova) and the Electric Power Research Institute (EPRI) to develop a methodology for testing personal computer (PC) power supply efficiency. Based on this methodology, in 2004, Ecos developed the 80 PLUS certification program to recognize power supplies that were at least 80% efficient. NEEA began funding the 80 PLUS Program in its first year as a way to encourage PC manufacturers to install highly efficient power supplies. Ecova continues to implement the 80 PLUS program and their activities include managing the Electric Power Research Institute (EPRI) in their work testing power supplies, posting testing results, and processing incentive payments.

Since its launch in 2004, NEEA and Ecova have adapted the 80 PLUS Initiative’s approach in response to changes in the PC and power supply markets. Figure 1 illustrates key milestones in the Initiative’s implementation and important changes in its approach to the market.



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Figure 1: Initiative Timeline, 2002 - 2013



Source: NEEA.

Two events have been particularly significant in the 80 PLUS Initiative's efforts to transform the market for power supplies:

- ➔ ***Inclusion of power supply efficiency requirements in ENERGY STAR specifications:***
The ENERGY STAR Version 4.0 specification for desktop PCs, which took effect in 2007 and required power supplies to achieve efficiency levels equivalent to 80 PLUS, was the first ENERGY STAR specification to include power supply efficiency requirements. The Version 5.0 ENERGY STAR desktop PC specifications, which took effect in 2009, increased power supply efficiency requirements to a level equivalent to 80 PLUS Bronze. NEEA, Ecova, and other 80 PLUS program sponsors played a key role in motivating EPA to include and then strengthen power supply efficiency requirements in the ENERGY STAR specification.
- ➔ ***Development of higher 80 PLUS efficiency tiers (bronze, silver, gold, and platinum):***
As 80 PLUS became more prominent in the market, in 2008 the program added higher certification levels to encourage market actors to adopt higher efficiency power supplies and allow manufacturers to better differentiate their products in the marketplace.

NEEA initially offered incentives to PC OEMs and SIs for sales of all PCs with 80 PLUS power supplies in the Northwest. However, as the market penetration of efficient power supplies increased, NEEA began increasing the stringency of its incentive requirements and ultimately phasing out incentives. In January of 2010, NEEA stopped incentivizing 80 PLUS PCs that did not meet ENERGY STAR, but began offering incentives for ENERGY STAR servers in addition to PCs. NEEA offered incentives for ENERGY STAR qualified desktops and servers sold in the Northwest region through 2010. In January 2011, NEEA phased out incentives altogether.



PROGRAM THEORY AND LOGIC MODEL

The Initiative originally employed an “upstream buy-down” approach with a goal of offering incentives to PC manufacturers to offset the incremental costs that could deter end-users and manufactures from adopting new technologies. Figure 2 (next page) shows the Initiative’s logic model, a graphical representation of activities, their outputs, and expected outcomes.



Figure 2: 80 PLUS Logic Model

Situation The context and need that gives rise to an initiative	Inputs The resources, contributions, & investments made in response to the situation	Activities What you do with your inputs (lead to outputs)	Outputs The desired outputs (tools, materials, plans, etc.) from your activities (lead to outcomes)	Outcomes		Impact Changes in the market resulting from the preceding outcomes
				Short Term The results and benefits	Longer Term The results and benefits	
Barriers: <ul style="list-style-type: none"> Desktop computer power supplies are treated as a commodity, differentiated by price instead of performance. No supply of more efficient power supplies. No testing protocol to verify power supply efficiency. Likely cost differential between conventional and efficient power supplies. Existing ENERGY STAR efficiency standard for power supplies sets a very low bar for industry. 	Initiative Lead (Ecos Consulting) for: <ul style="list-style-type: none"> Project administration Marketing Incentive processing and tracking Budget for: <ul style="list-style-type: none"> Marketing Incentives Incentive administration Evaluation 	Develop and Implement Marketing Plan, including: <ul style="list-style-type: none"> General outreach to media outlets serving OEMs, SIs, power supply manufacturers, and prospective purchasers Providing content for manufacturers' communication channels Developing materials for outreach by regional utilities Develop and manage national initiative beginning in August 2004, including: <ul style="list-style-type: none"> Meet with OEMs and SIs to explain benefits of 80 PLUS Recruit power supply manufacturers 	Marketing: <ul style="list-style-type: none"> Marketing plan. Website is active. Marketing collateral developed for manufacturers, purchasers, and utilities. Initiative: <ul style="list-style-type: none"> Power supply testing protocols are developed. \$5 incentive is offered to help bridge price differential between conventional and 80 PLUS power supplies. At least two OEMs and SIs contacted to participate in initiative. Power supply manufacturers submit units for testing and approval. 	Marketing: <ul style="list-style-type: none"> Marketing materials generate inquiries from: <ul style="list-style-type: none"> Power supply manufacturers OEMs and SIs Electric utilities Large consumers (awareness) Website usage increases over time (awareness). Initiative Management: <ul style="list-style-type: none"> Contractor posts and maintains power supply testing protocol on website. Contractor reimburses OEMs and SIs \$5 for each qualifying PC sold in NW (\$10 for each desktop server). Response from Computer Industry: <ul style="list-style-type: none"> At least one major desktop PC OEM participates (availability). At least one more power supply manufacturer offers and supplies qualifying product (availability). 	<ul style="list-style-type: none"> 75% or higher market share of 80 PLUS equipped PCs by 2010. Industry will continue to embrace ENERGY STAR as a significant marketing advantage. 	<ul style="list-style-type: none"> All PCs meet ENERGY STAR specification. NEEA and/or utility support not needed.

Continued...

Situation The context and need that gives rise to an initiative	Inputs The resources, contributions, & investments made in response to the situation	Activities What you do with your inputs (lead to outputs)	Outputs The desired outputs (tools, materials, plans, etc.) from your activities (lead to outcomes)	Outcomes		Impact Changes in the market resulting from the preceding outcomes
				Short Term The results and benefits	Longer Term The results and benefits	
<ul style="list-style-type: none"> Commercial sector computer purchasers are unaware of power supply energy use. Opportunities: <ul style="list-style-type: none"> Power supplies that are at least 80% efficient can provide 82 kWh/yr of cost-effective savings. Participate in a national initiative that can help influence an upgrade to the ENERGY STAR specification for desktop computers. 		<ul style="list-style-type: none"> Develop a test protocol for power supplies. Test and certify power supplies. Receive and pay invoices of participating computer manufacturers. Secure participation of at least one other utility or energy organizations in the initiative. Update information on the initiative website. Share production and sales data with EPA. Evaluate progress of initiative. 	<ul style="list-style-type: none"> At least one additional potential initiative sponsor contacted. At least one power supply manufacturer contacted. ENERGY STAR: <ul style="list-style-type: none"> Participate in public process for developing revised specification. Assess need for any additional support once specification goes into effect. Evaluation: <ul style="list-style-type: none"> RFP for evaluation contractor. Select contractor. Conduct MPERs. 	<ul style="list-style-type: none"> OEMs and SIs deliver sales of at least 70,000 qualifying units before end of 2005 (market share/penetration). Participating OEMs and SIs receive \$5 incentive (\$10 for desktop servers) for each qualifying unit sold in NW. Buy-down spurs OEM and SI sales of qualifying PCs. Support from other interested parties: <ul style="list-style-type: none"> At least one other major utility or energy efficiency organization provides greater than \$1 million in support (availability). ENERGY STAR <ul style="list-style-type: none"> EPA includes at least an optional power supply in its proposed revision to ENERGY STAR for computers by early 2005 (awareness). EPA finalizes the revised standard, to take effect in early 2006 (market share/penetration). 		

Source: NEEA. OEM: Original equipment manufacturer (PCs); SI: systems integrator; PSM: power supply manufacturer

RESEARCH OBJECTIVES

MPER #4 reported that the Initiative had addressed all but two of the six key barriers to market adoption of 80 PLUS power supplies. The two remaining barriers were:

- ➔ Incremental cost of energy-efficient power supplies compared to standard power supplies
- ➔ Lack of customer awareness of power supply energy use

In MPER #5, NEEA and the research team sought to determine the extent to which these barriers remained relevant, what opportunities remain to address them, and whether it would be appropriate for NEEA to sunset the Initiative. To address these issues, NEEA identified four high-level data collection goals and, in collaboration with Research Into Action, 23 more specific research objectives. Table 2 lists each goal and the associated key research question(s) or objective(s) and the section of the MPER that addresses them.

Table 2: MPER #5 Key Research Questions

Goals	Specific Research Objectives	Relevant MPER Section
Update 80 PLUS market data to determine current 80 PLUS market share, trends in market share, and future changes to market share relative to ENERGY STAR specification changes.	<ul style="list-style-type: none"> What is the market share of the smallest OEMs, and is their share shrinking? 	Section 3: Market Characterization
	<ul style="list-style-type: none"> Do OEMs prefer fewer power supply SKUs and, if so, how does this affect adoption of 80 PLUS power supplies? 	Appendix C: In-depth Interview Findings
	<ul style="list-style-type: none"> How did PSMs and SIs promote 80 PLUS? 	Section 5: Key Finding #1 Section 5: Key Finding #2 Section 5: Key Finding #6
	<ul style="list-style-type: none"> How much did the incremental cost of 80 PLUS power supplies decrease? 	Section 4: Assumption #5 Section 5: Key Finding #4
	<ul style="list-style-type: none"> Were 80 PLUS specification included in ENERGY STAR specifications? 	Section 4: Assumption #3 Section 5: Key Finding #2
	<ul style="list-style-type: none"> How, if at all, will the market share of 80 PLUS will change when the ENERGY STAR 6.0 specification goes into effect? 	Section 5: Key Finding #3
	<ul style="list-style-type: none"> What happens to the market penetration of former ENERGY STAR specifications, after IDC and EPA no longer track them? 	Not addressed in MPER #5
	<ul style="list-style-type: none"> What is the percentage of OEMs are not planning to move to ENERGY STAR 6.0, and the reasons? 	Section 5: Key Finding #3

Continued



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Goals	Specific Research Objectives	Relevant MPER Section
Update Initiative output data to allow NEEA to assess the output of the Initiative, including the number of participants of various types, the number of certified power supply units, and trends and projections therein.	<ul style="list-style-type: none"> • Number of 80 PLUS program sponsors 	Section 5: Overview
	<ul style="list-style-type: none"> • Number of sales of 80 PLUS PCs 	
	<ul style="list-style-type: none"> • Number of participating system integrators 	
	<ul style="list-style-type: none"> • Number of computer OEMs with certified units 	
	<ul style="list-style-type: none"> • Number of power PSMs with certified units 	
	<ul style="list-style-type: none"> • Number of certified power supply units 	
	<ul style="list-style-type: none"> • Number of power supply units being tested for certification 	
	<ul style="list-style-type: none"> • What is the percentage of the commercial desktop market that are built by value added resellers (VARs) or system integrators, and out of those, the percentage that are using 80 PLUS or better products? 	Section 6: Conclusion #2
	<ul style="list-style-type: none"> • Is there is a slowdown in certification of 80 PLUS or better power supplies through Ecova, in order to determine which, if any, of the 80 PLUS levels are plateauing or continuing to grow? 	Section 5: Key Finding #3
	<ul style="list-style-type: none"> • Is there an incremental cost for 80 PLUS power supplies, at each increasing efficiency level? 	Section 4: Assumption #5 Section 5: Key Finding #4
	<ul style="list-style-type: none"> • What is the role of non-energy benefits in motivating adoption of 80 PLUS power supplies by OEMs? 	Section 5: Key Finding #1
Collect end-user data to quantify the rate of adoption of ENERGY STAR desktop PCs (and thus 80 PLUS Bronze power supply units) among commercial non-government users, and obtain a qualitative understanding of the reasons for adoption and non-adoption.	<ul style="list-style-type: none"> • What was end-users' awareness of and request for 80 PLUS? 	Section 5: Key Finding #5
	<ul style="list-style-type: none"> • What percentage of desktop computers are custom built, and of those that are custom built, what percentage are not 80 PLUS? 	Not addressed in MPER #5
	<ul style="list-style-type: none"> • What percentage of non-government purchasing departments purchases only ENERGY STAR desktops, including the reasons for purchasing ENERGY STAR desktops? 	Section 5: Key Finding #2

Continued



Goals	Specific Research Objectives	Relevant MPER Section
Identify lessons learned to understand what NEEA could have done differently with the Initiative, for example, should NEEA have acted differently regarding alignment of 80 PLUS with ENERGY STAR or Climate Savers.	<ul style="list-style-type: none">• What could NEEA have done differently with the Initiative, for example, should NEEA have acted differently regarding alignment of 80 PLUS with ENERGY STAR or Climate Savers?	Section 5: Key Finding #3 Section 6: Conclusion #2



2

EVALUATION ACTIVITIES

Four data collection activities informed the evaluation: program data review, review of literature relevant to the PC market, in-depth interviews, and an online survey of non-government IT decision-makers. A summary of the activities appears below. The appendices contain additional details, including the interview guides.

PROGRAM DATA REVIEW

To assess current program data and update 80 PLUS market progress indicators, Research Into Action:

- ➔ Reviewed 80 PLUS program documents provided by Ecova,
- ➔ Reviewed previous MPERs for 80 PLUS,
- ➔ Visited Ecova's plug load solutions website; and
- ➔ Conducted in-depth interviews with Ecova staff.

These activities allowed the evaluation team to assess the number of program sponsors, OEMs, PSMs and SIs currently participating in 80 PLUS as well as assess whether there was a slowdown in certifications of 80 PLUS power supplies.

80 PLUS does not record unit certification by tier (base, bronze, silver, or gold) *and* certification date in a format that can be easily aggregated and analyzed. This limited the evaluation team's ability to analyze whether there were any differences in certifications by tier across time.

LITERATURE REVIEW

In order to characterize the PC market and provide context for findings from other data collection activities, Research Into Action reviewed literature related to PC sales, technologies, and the PC supply chain. Sources consulted in this review included market research findings, IDC's PC shipment data, popular press articles, articles in trade and other more specialized publications, manufacturers' websites, and publications by PC manufacturers.

IN-DEPTH INTERVIEWS

In-depth interviews were an important data collection activity for this MPER. They provided a primary source of data on the way key market actors, including power supply manufacturers, OEMs, and SIs make decisions about power supply efficiency and interact with the 80 PLUS program. In order to ensure that these interviews provided the most complete sense of the market possible, Research Into Action sought to interview a diverse range of market actors with distinct



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perspectives, including market leaders. To this end, Research Into Action interviewed OEMs that together account for 63% of all PC sales and two of the five leading SIs by number of systems built, in addition to smaller and more specialized SIs.

Table 3: In-Depth Interviews

Population	Proposed Completes (from Work Plan)	Interviews Completed
NEEA and Ecova staff	4	3
Industry experts (e.g. EPA ENERGY STAR staff)	4	2
Desktop PC OEMs	5	4
System integrators	5	5
Power supply manufacturers	5	4
Total	23	18

Research Into Action conducted the majority of the in-depth interviews by telephone. With respondents' permission, interviewers recorded the interviews and used the recordings to supplement notes taken during the interview. Due to time zone differences and language barriers, Research Into Action provided questions in a Word document to staff at two PSMs located in Asia, and these contacts provided written responses. Research Into Action used NVivo qualitative analysis software to organize and analyze data from all interviews.

SURVEY OF IT DECISION-MAKERS

In order to gain insight into the remaining potential for 80 PLUS adoption, this MPER included more extensive data collection from end-users than in previous MPERs. Research Into Action conducted an online survey of non-government IT decision-makers in the Northwest. This survey targeted two segments of the population: small and medium-sized commercial end-users (those with 50 to 999 employees) and large or enterprise businesses (those with 1,000 or more employees). The survey sought to reach IT decision-makers who met the following criteria:

- ➔ Worked in the for-profit or non-profit sector (respondents in government or education were not eligible).¹
- ➔ Represented organizations that regularly use desktop PCs and purchased at least one new desktop PC in 2012.
- ➔ Made IT purchasing decisions either as the sole decision-maker, with input from staff, or as part of a group or committee.

¹ Under NEEA's guidance, Research Into Action limited the survey sample such that non-profits would represent no more than 10% of the total respondents from either segment.



- ➔ Held responsibility for IT purchasing decisions for at least one year.

Research Into Action used a third-party panel provider to gain access to IT decision-makers. Market researchers frequently use panels as a cost-effective way to reach targeted populations. Panel providers carefully screen and profile respondents to ensure high-quality responses and more effective targeting than a traditional business contact list allows. Research Into Action fielded the survey from February 14 to March 6, 2013. Table 4 summarizes the sample of IT decision-makers surveyed for this MPER.

Table 4: IT Decision-Maker Survey

Segment	Estimated Population Size	Sample Size	Confidence/Precision
Small/medium businesses (50-999 employees)	11,000 – 12,000	68	90/10
Large businesses (1,000 or more employees)	500 – 600	51	80/10

Research Into Action sought to achieve high levels of confidence and precision for both small/medium business respondents and large businesses. However, doing so required an over-sample of large businesses. As a result, Research Into Action weighted survey results for both populations to obtain estimates for the market as a whole that reflect the composition of the underlying population.



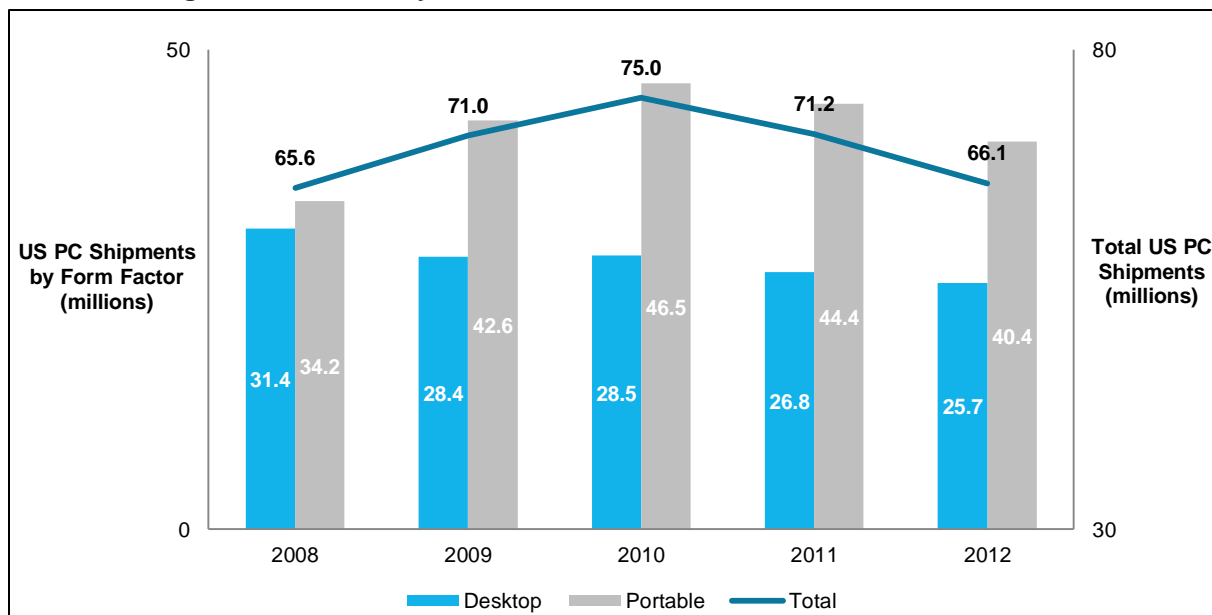


TRENDS IN U.S. SALES OF DESKTOP AND PORTABLE PCS

U.S. desktop PC sales declined 1% in 2012, a much smaller decrease than laptops, which declined 4% in 2012. Analysts attribute the decrease in desktop sales to weak interest in the newly released Windows® 8 platform and increased interest in portable computing products like tablets. Analysts further suggest tablets and smartphones are stifling demand for laptops. A recent study found 37% of those who once accessed online content via a PC are now using tablets and smartphones.²

Portable PC sales drive trends in total PC sales. In 2012, portable PCs sales accounted for 40% of total U.S. PC sales and as a result sales trends in PCs overall followed the trend in portable sales, falling sharply from 2010 to 2012. However, sales trends in desktop PCs have differed substantially, remaining nearly stable (Figure 3).³

Figure 3: PC Sales by Form Factor and Total PC Sales from 2008 to 2012



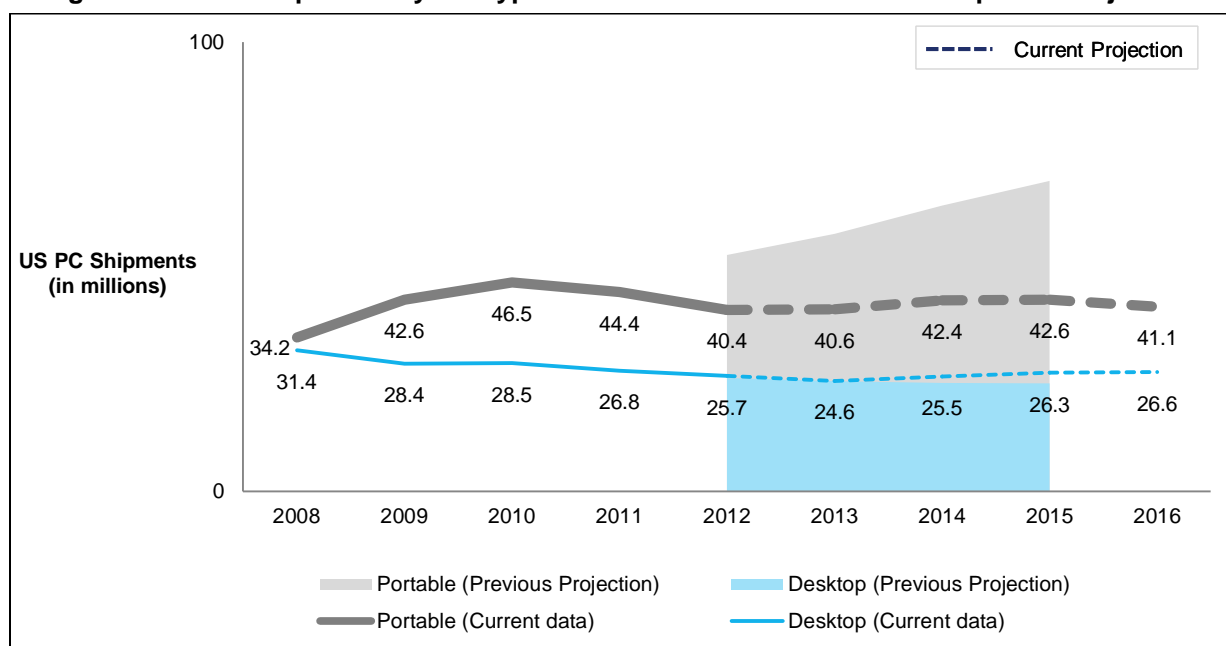
Source: IDC. *Worldwide Quarterly PC Tracker*.

² Doug Olenick. February 7, 2013. "PC Losing Ground to Tablets, Smartphones" TWICE. Retrieved from <http://www.twice.com/articletype/news/pc-losing-ground-tablets-smartphones/10493>.

³ IDC. March, 2013. *Worldwide Quarterly PC Tracker*.

IDC predictions for 2012 sales overestimated sales of portable PCs, but accurately forecast sales of desktop PCs. IDC predictions, as published in MPER #4, accurately predicted desktop sales would drop to 25 million units in 2012. The IDC forecast of a steady increase in sales of portable PCs was not borne out. Actual 2012 portable PC sales were 40.4 million units, nearly 25% lower than the projected 52.6 million units. In light of this occurrence, IDC adjusted its projections for both desktop and portable PCs. Current IDC predictions suggest both desktop and portable PC sales will remain steady with negligible increases in 2013 and beyond (Figure 4). Analysts suggest that the PC market may see new messaging and product features in 2013, which could result in an increase in sales.⁴

Figure 4: US PC Shipments by PC Type with Previous and Current PC Shipment Projections



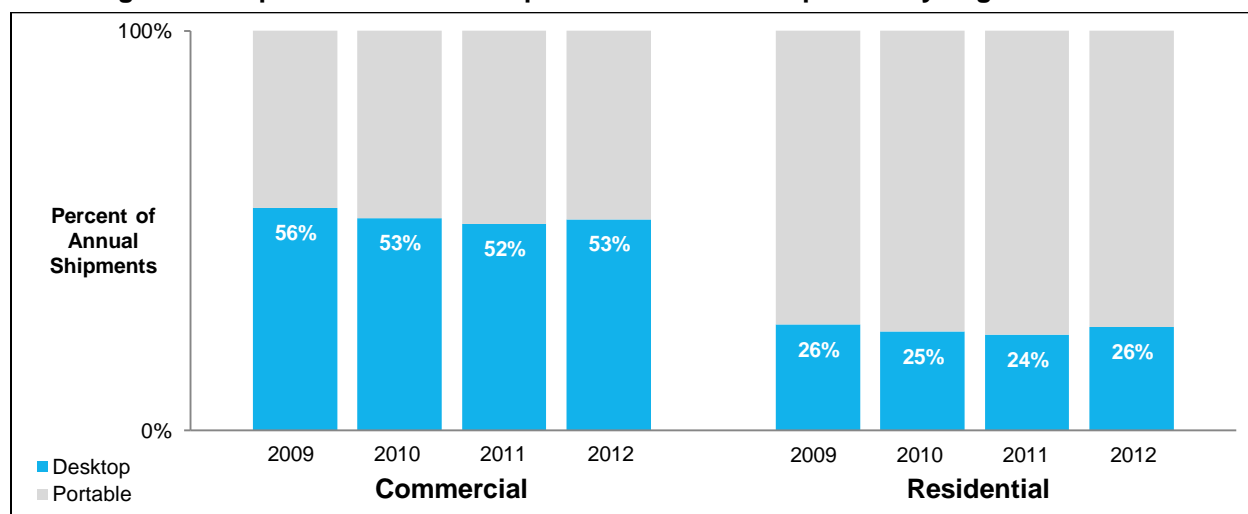
Source: IDC. *Worldwide Quarterly PC Tracker*. IDC. “Soft PC Shipments in Fourth Quarter.”

The proportion of commercial desktop shipments are consistently double that of residential desktop shipments. Over half of commercial PC shipments are desktops, while only a quarter of residential PC shipments are desktops. This pattern has remained stable over the last four years (Figure 5).⁵

⁴ IDC. January 10, 2013. “Soft PC Shipments in Fourth Quarter Lead to Annual Decline as HP Holds Onto Top Spot, According to IDC” Press release. Retrieved from <http://www.idc.com/getdoc.jsp?containerId=prUS23903013#.UPcoFvLwrwO>.

⁵ IDC. *Worldwide Quarterly PC Tracker*.

Figure 5: Proportion of PC Desktop and Portable PC Shipments by Segment and Year

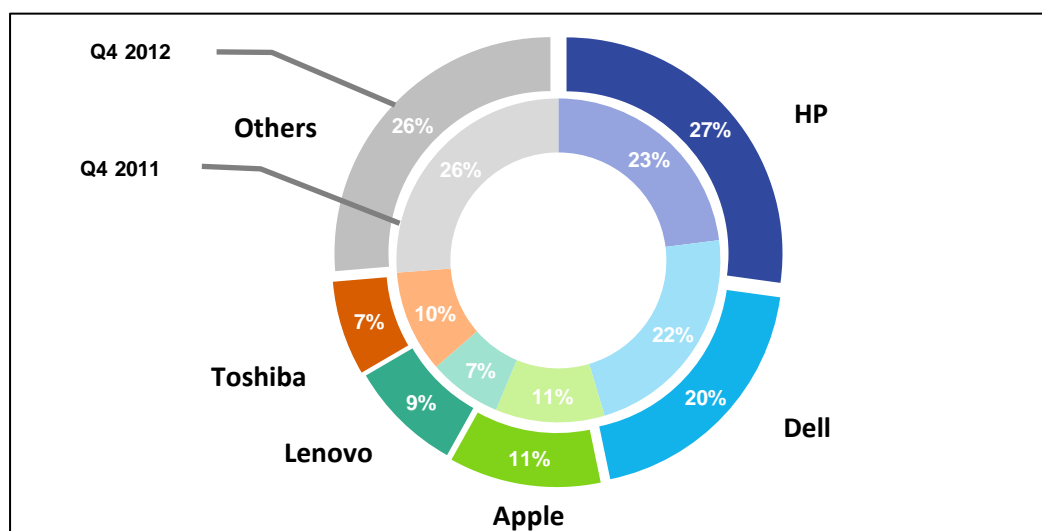


Source: IDC. *Worldwide Quarterly PC Tracker*.

The Q4 2012 market share of the top five PC brands changed very little over Q4 2011

(Figure 6). IDC reports quarterly market share data for the top five PC brands.⁶ Overall, HP remains the leader in U.S. PC market share (27%), followed by Dell (20%), and Apple (11%). In the fourth quarter of 2012, compared to 2011, HP and Lenovo gained market share while Dell and Toshiba lost market share.

Figure 6: Q4 US PC Sales Market Share by OEM, 2011 and 2012



Source: IDC. "Soft PC Shipments in Fourth Quarter."

⁶ IDC. "Soft PC Shipments in Fourth Quarter."



TRENDS BY FORM FACTOR

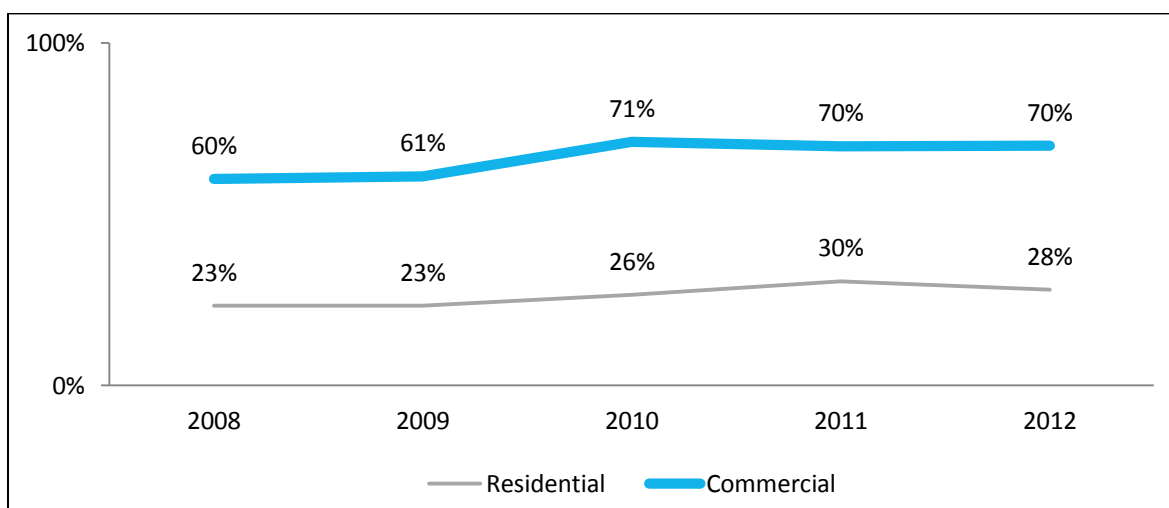
In 2012, ownership of laptops among U.S. adults surpassed desktops for the first time. In April 2012, 61% of U.S. adults owned a laptop and 58% owned a desktop. These figures reflect a rapid increase in penetration for laptops, up from 30% in April 2006, but a much slower decrease in penetration for desktops, down from 68% over the same period.⁷

All-in-one PCs continue to be a growing market segment. In 2012, manufacturers released a range of new all-in-one PC models. The desirability of these products may be driven by features, like the increasing prevalence of touch-screens or the availability of lower cost models.⁸

EFFICIENCY STANDARDS

Residential desktop PCs have much lower ENERGY STAR penetration than commercial PCs. In 2012, ENERGY STAR desktop PCs had a residential market penetration of 28%, compared to 70% for commercial desktop PCs (Figure 7). From 2008 to 2012, ENERGY STAR penetration among commercial desktop PCs increased by 10%. During the same period, the penetration rate in the residential sector increased only 5%.⁹

Figure 7: ENERGY STAR Qualification by Market Segment (Desktop PCs Only)



Source: IDC. *Worldwide Quarterly PC Tracker*.

⁷ Joanna Brenner. December 4, 2012. "Pew Internet: Mobile." Retrieved from <http://pewinternet.org/Commentary/2012/February/Pew-Internet-Mobile.aspx>.

⁸ John Morris. May 29, 2012. "The all-in-one PC is alive and well." Retrieved <http://www.zdnet.com/blog/computers/the-all-in-one-pc-is-alive-and-well/8099>.

⁹ IDC. *Worldwide Quarterly PC Tracker*. Low ENERGY STAR penetration in the residential desktop PC segment may indicate a potential opportunity for future Initiative activity.



OTHER TRENDS

- ➔ **Original design manufacturers (ODMs) are losing market share.** Top PC brands are bringing the desktop PC design process back in-house, shifting the design away from the use of ODMs to their own internal teams. Analysts suggest this shift is due to declining PC sales, increasing demand for “Made in the USA” products, and commercial customers’ increasing need for customized products.¹⁰ As a result, ODMs are looking to expand their presence in the growing server market.¹¹
- ➔ **Intel, a major supplier of desktop PC circuit boards, recently announced that it would wind down production of these components over the next three years.** Intel indicated that it was shifting production capacity away from desktop PC components to focus on “higher end” components for ultrabooks, as well as smartphones and tablets.¹² This is a further indication that demand in the PC market is moving toward portable form factors.
- ➔ **Most PC purchases are at the low end of the price continuum.** In 2012, just 6% of computer sales took place at the high end of the market, units priced above \$1,000. Instead, most consumers purchased “mainstream” or “value-priced” PCs, which together accounted for 94% of all PCs sold. “Mainstream” PCs were defined as units priced about \$500 to \$1,000 and with up-to-date but not highest performing technology. “Value-priced” PCs retailed for less than \$500 and used older technology.¹³
- ➔ **Dell announced it would go private starting in 2014.** Dell’s move will be supported by a private equity firm and Microsoft. This is significant news coming from a company that was once the leading worldwide PC brand, but is currently second to HP. Analysts suggested that because Microsoft is involved in the deal, Dell will likely remain in the PC industry and not move into IT infrastructure, as have other brands.¹⁴

¹⁰ Brooke Crothers. December 7, 2012. “HP to Apple: Hey, We Already Make PCs in the U.S.” Cnet. Retrieved from http://news.cnet.com/8301-1001_3-57557885-92/hp-to-apple-hey-we-already-make-pcs-in-the-u.s/.

¹¹ Tam Harbert. January 7, 2013. “As PC Market Shrinks, ODMs Seek Greener Pastures: Server Farms” EBN. Retrieved from http://www.ebnonline.com/author.asp?section_id=1084&doc_id=256885.

¹² Brooke Crothers. January 22, 2013. “Intel to Wind Down Desktop Circuit Board Business” Cnet. Retrieved from http://news.cnet.com/8301-1001_3-57565196-92/intel-to-wind-down-desktop-circuit-board-business.

¹³ Doug Olenick. November 8, 2012. “Low-Priced Computers Continue to Dominate” TWICE. Retrieved from <http://www.twice.com/articletype/news/low-priced-computers-continue-dominate/103892>.

¹⁴ Brian Barrett. February 5, 2013. “Dell’s Going Private. Now What?” Gizmodo. Retrieved from <http://gizmodo.com/5981746/dells-going-private-now-what>.





4

ACE MODEL REVIEW

This chapter summarizes Research Into Action’s assessment of the ACE model for consistency with other sources of market information. We evaluated eight key assumptions identified by NEEA. Of these, we recommended that NEEA further investigate and consider revising five assumptions, indicated in **bold** below.

- ➔ Assumption #1: Employment is a proxy for desktop PC market share
- ➔ **Assumption #2: Maximum potential penetration is 85%**
- ➔ **Assumption #3: The “take-off” year for the NOBMS calculation is 2013**
- ➔ **Assumption #4: Typical duty cycle of commercial desktops**
- ➔ Assumption #5: Incremental cost of 80 PLUS is \$5; ENERGY STAR is \$20
- ➔ **Assumption #6: The “take-over” period is three years**
- ➔ Assumption #7: Market size projections made by IDC are accurate
- ➔ **Assumption #8: Penetration of network power management is 5-8%**

ASSUMPTION #1: EMPLOYMENT IS A PROXY FOR DESKTOP PC MARKET SHARE

Finding: Data collected in the email survey with non-governmental businesses in NEEA territory are not conclusive, but do not provide a commanding reason to change the use of employment as a proxy for desktop PC market share.

Recommendation: Continue using employment as a proxy for desktop PC market share.

NEEA calculates the number of desktop PCs sold in its territory because measured data are not available. The calculation uses the NEEA region’s share of total national employment in professional and non-farm sectors (education, health, finance, etc.) as a proxy for market share of desktop PC sales. The calculation is:

$$\text{PCs sold in NEEA region} = \frac{\text{Total U.S. desktop PC sales, obtained from IDC}}{\text{Total U.S. non-farm employment}} \times \frac{\text{NEEA non-farm employment}}{\text{Total U.S. non-farm employment}}$$

The use of non-farm employment as a proxy for desktop PC market share assumes certain similarities in computer use between businesses in NEEA and non-NEEA territory. Findings that show differences between NEEA territory and the U.S. as a whole could invalidate this assumption, including differences in:



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- a) Computers per employee
- b) Annual computer replacement rate
- c) Proportion of desktop and laptop PC purchases

Email survey data *do not* address potential difference (a) because the number of employees per business was collected in ranges (for example, “50 to 99 employees”) and thus cannot be used to produce accurate ratios.

Email survey data *do* address potential differences (b) and (c). Both show businesses in NEEA territory to be in line with national data.

To address potential difference (b), we calculated the PC replacement rate for all computers (desktops and laptops) by dividing respondents’ open-ended submissions for total number of PCs purchased in 2012 by their open-ended submissions for total number of PCs in use. Our population shows an average replacement rate of 24% and a median replacement rate of 22%. Among small/medium businesses, the replacement rate was slightly lower, with an average of 23% and a median of 20%. One caveat: this calculation approach assumes that all new computer purchases replaced existing computers.

The replacement rate of the study population is similar to the computer replacement rate in the general population (residential and commercial) of 20% in 2007, prior to the mass adoption of smart phones and tablets, a trend commonly held as responsible for the declining replacement rate in the years since 2007.¹⁵ It seems probable to us that businesses are less likely to shift new device purchases to smart phones and tablets, and thus we might expect the replacement rate in the commercial sector to have declined less rapidly since 2007, perhaps even holding steady.

Further, the replacement rate of 20% can be used to calculate a typical computer’s effective life ($1 / \text{replacement rate}$), yielding an effective life of four to five years. This is nearly identical to published statements of PC effective life averaging 4.4 years and topping out at five years.¹⁶

We assessed potential difference (c) by comparing our sample population’s proportion of desktop PC purchases in 2012 to national data reported by IDC for 2012. We calculated the sample’s desktop PC purchase proportion in two steps. First we needed to calculate the number of desktop PCs purchased by each respondent (percentage of desktop PCs * total number of PCs purchased), because respondents supplied desktop PC purchases as a proportion not a number of units. Then we calculated the proportion of desktop PC purchases for the entire population (total # desktop PC purchases / total # PC purchases). The proportion of desktop PCs purchased by our sample was 50%, for both all respondents (completes and screen-outs) and completes only. Our

¹⁵ Stephanie Mlot. September 18, 2012. “Smart phone, tablet sales slowing PC replacement rates.” *PCMag.com*. Retrieved from: <http://www.pcmag.com/article2/0,2817,2409873,00.asp>

¹⁶ Leslie Meredith. July 18, 2010. “How often should company computers be replaced?” *Business News Daily*. Retrieved from: <http://www.businessnewsdaily.com/65-when-to-replace-the-company-computers.html>



sample population's desktop PC purchase rate is similar to the national commercial desktop PC purchase rate reported by IDC as 53%.

ASSUMPTION #2: MAXIMUM POTENTIAL PENETRATION IS 85%

Finding: Data provided by computer OEMs suggest the maximum potential penetration of 80 PLUS is 100% and that NEEA's ACE model *underestimates* potential penetration.

Recommendation: NEEA should investigate whether the barriers that prevented 100% penetration of 80 PLUS power supplies remain relevant and, if not, consider increasing maximum potential penetration.

NEEA estimates the maximum potential penetration of 80 PLUS power supplies at 85%, meaning that some barrier(s) prevent 15% of desktop PCs sold annually from including 80 PLUS power supplies. The interviewed PC OEMs stated that the incremental cost of an 80 PLUS power supply is the primary barrier to adoption. All three of the interviewed OEMs who provided data indicated that they would use exclusively 80 PLUS power supplies if the incremental cost were eliminated.

ASSUMPTION #3: THE "TAKE-OFF" YEAR FOR THE NOBMS CALCULATION IS 2013

Finding: Interviews with Ecova, supported by previous evaluation findings, show the adoption of 80 PLUS by ENERGY STAR as the primary influence on the 80 PLUS take-off year. Interviews with EPA staff confirm that 80 PLUS accelerated the inclusion of power supply efficiency requirements in ENERGY STAR specifications. Nonetheless, given the increasing focus on efficiency in consumer electronics in the second half of the 2000s, ENERGY STAR likely would have included power supply efficiency requirements for PCs between 2009 and 2011. Thus, NEEA may be *overestimating* the NOBMS take-off year by two to four years.

Recommendation: Consider changing the NOBMS take-off year to 2009, 2010, or 2011.

In calculating the NOBMS, NEEA assumes that the 80 PLUS take-off would have been delayed five years absent NEEA intervention. Past MPERs found, and interviews conducted for MPER #5 confirm, that the inclusion of 80 PLUS power supplies in ENERGY STAR specifications beginning with Version 4.0 in 2007 was a key driver of the accelerated adoption of 80 PLUS. As a result, the timing with which adoption of 80 PLUS would have accelerated absent the program depends on when EPA would have included equivalent power supply requirements in its desktop PC specifications.

EPA ENERGY STAR staff report that 80 PLUS played a critical role in the inclusion of power supply efficiency requirements in the Version 4.0 specification. EPA staff stated that 80 PLUS presented them with a complete proposal for power supply requirements, including test procedures and estimates of the potential energy savings. According to one EPA staff member,



“this had not been something we had put together. It really was a whole package that was put together by the 80 PLUS program, so it was easy for us to put into the computer specification.” EPA staff also noted that, when they were first proposed, the power supply requirements received a great deal of pushback from computer manufacturers, and 80 PLUS and its funders’ involvement in the stakeholder process helped EPA justify maintaining the requirements.

Given the role 80 PLUS played in the development of the Version 4.0 specification, EPA staff speculated that the specification would not have included power supply efficiency requirements in absence of the program. Interviewed EPA staff members were unable to speculate on when ENERGY STAR might have included power supply requirements in its PC specifications in the absence of 80 PLUS. Efficiency advocates’ focus on the energy use of consumer electronics greatly increased in the second half of the 2000s. As a result of this increased focus, ENERGY STAR likely would have included power supply efficiency requirements in a subsequent specification revision, likely between 2009 and 2011.

ASSUMPTION #4: TYPICAL DUTY CYCLE OF COMMERCIAL DESKTOPS

Finding: NEEA’s duty cycle of commercial desktops assumption differs substantially from other recent studies and may *overestimate* time spent in high power states, thus *overestimating* savings.

Recommendation: NEEA should revisit the assumption in light of more recent studies and market shifts in operating and power management software.

NEEA bases its duty cycle assumptions on a 2004 LBNL study, which is also the source for PG&E’s 2009 desktop PC work paper. The strength of the LBNL study is the size of its sample; LBNL metered 33-times more PCs than the largest study we identified. However, the findings of more recent studies regarding duty cycle differ substantially from LBNL. Duty cycle estimates from five studies published between 2006 and 2011 show PCs spent at least 50% of their time in *low power* states typical of “standby” and “off” modes. Four of the five studies found PCs spent a majority of time in “standby” and “off” modes. LBNL found nearly the opposite: PCs spent about two-thirds of their time in *high power* states typical of “active” or “idle” modes (Table 5). If these more recent studies are correct, then NEEA’s ACE model assumption overestimates the time spent in high power states and thus energy savings resulting from the 80 PLUS Initiative. Ecova, in a phone conversation with RIA, recommended that NEEA revisit their duty cycle assumptions in 2013.



Table 5: NEEA's Duty Cycle Estimates, Compared to Others

Study	Source Study Details			Duty Cycle	
	Source Data Date	Number of PCs	Building Type ¹	Standby/Off	Active/ Idle
NEEA's ACE Model ²	2004	1,453	C, E	33%	67%
Cadmus ³	2011	314	C, G, E	55%	45%
ENERGY STAR Computer Specification v6 Draft 1 ⁴	2010	>500	C	50%	50%
ENERGY STAR Computer Specification v5 ⁵	2008	75, 331	?	60%	40%
Ecos ⁶	2008	61	C	58%	43%
Ecos ⁷	2006	43	R	65%	35%

¹ C=commercial G=government E=education R=residential

² NEEA's ACE Model duty cycle assumptions are based on Table 6 in a 2009 PG&E Work Paper. PG&E Customer Energy Efficiency Department. June 19, 2009. "Desktop Computers, Measure Codes M95 and M96: Work Paper PGECOCOM102, Revision # 1."

³ Cadmus Group. February 2011. *PSE PC Power Management Results*. PowerPoint presentation. "Standby/Off" proportion includes states defined by Cadmus as "unplugged," "off," and "sleep." The Cadmus study is cited by the Regional Technical Forum as the basis for its PC duty cycle assumptions.

⁴ ECMA International. December 2010. Standard ECMA-383. 3rd Edition. "Measuring the Energy Consumption of Personal Computing Products." Annex B.

⁵ Microsoft Power Transitions Report. Available at the ENERGY STAR website: http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/computer/Microsoft_PowerTransitionReport.pdf?f0fe-40d2

⁶ Ecos. 2011. *Office Plug Load Field Monitoring Report*. California Energy Commission Public Interest Energy Research Program.CEC-500-06-07. Data cited above originally published in 2008, unchanged in the revised 2011 report. "Standby/Off" proportion includes states defined by Ecos as "sleep," "standby," and "disconnect."

⁷ Ecos. 2006. *Residential Field Research Report*. California Energy Commission Public Interest Energy Research Program.CEC-500-04-030.



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ASSUMPTION #5: INCREMENTAL COST OF 80 PLUS IS \$5; ENERGY STAR IS \$20

Finding: NEEA’s assumption of a \$5 incremental cost is reasonable for PC OEMs’ purchases of 80 PLUS Base power supplies, but incremental costs may be considerably higher for other market actors.

Recommendation: Consider using a weighted average incremental cost based on the proportion of desktop PCs sold through various channels.

NEEA estimates the incremental cost to OEMs is \$5 for an 80 PLUS power supply and \$20 to manufacture an ENERGY STAR-qualified desktop PC. These estimates are based on interviews conducted by Navigant Consulting for MPER #4. Interviews conducted for MPER #5 confirm that \$5 is a reasonable estimate for the incremental cost of 80 PLUS Base power supplies to PC OEMs.

Interviews further suggest that PC OEMs most often install 80 PLUS power supplies at the Bronze level. All three OEMs specified that nearly all of their 80 PLUS PCs meet ENERGY STAR requirements, and thus use, at a minimum, 80 PLUS Bronze power supplies. Estimates of the incremental cost by the three OEMs providing data were \$2, \$5, and \$10, with the \$10 incremental cost provided by an OEM that uses exclusively 80 PLUS Gold power supplies.

System integrators typically reported a higher incremental cost for 80 PLUS power supplies than PC OEMs. System integrators estimated an incremental cost of \$10 to \$20 for 80 PLUS, with an additional premium of \$20 to \$30 for the 80 PLUS Silver and Gold efficiency levels. These estimates are more consistent with incremental power supply costs at retail.

Many respondents to the email survey of non-governmental businesses in NEEA territory reported the cost of 80 PLUS and ENERGY STAR PCs to be about the same as non-80 PLUS or non-ENERGY STAR units with similar features. About half reported the cost of an 80 PLUS computer to be similar to a baseline unit, and about two-thirds reported the same for ENERGY STAR computers.

Data collected from multiple sources support the findings that there is little difference between incremental cost between 80 PLUS base and bronze, and between 80 PLUS silver and gold.

ASSUMPTION #6: THE “TAKE-OVER” PERIOD IS THREE YEARS

Finding: Interview data show that the take-over period varies by OEM. While OEMs that prioritize efficiency as a key product design element may have reached their maximum penetration of 80 PLUS (100%) in three years, it will likely take longer to reach maximum penetration in the market as a whole. As a result, NEEA may be *underestimating* the take-over period for the market as a whole.

Recommendation: Consider increasing the take-over period.



In calculating the NOBMS, NEEA assumes that the 80 PLUS take-over period is three years. Consistent with this assumption, a majority of business IT decision-makers surveyed for MPER #5 (55%) reported that it typically takes three to five years for new features or components to penetrate the market, becoming common even on low-end PCs. Market actors interviewed for MPER #5 were largely unable to provide estimates of the typical length of time required for newly introduced efficient power supplies to reach full penetration.

However, program experience suggests that the take-over period for efficient power supplies is longer than three years and depends on characteristics of individual PC manufacturers. Take-off for 80 PLUS power supplies occurred in 2008, when ENERGY STAR incorporated 80 PLUS into its desktop PC specification. Four years later, as of 2012, only one of the four interviewed OEMs had reached maximum penetration, installing 80 PLUS in 100% of their desktop computers. Two other PC manufacturers reported 60-80% penetration of 80 PLUS in their products and anticipated that penetration would continue to increase. The fourth reported 20-30% penetration of 80 PLUS.

ASSUMPTION #7: MARKET SIZE PROJECTIONS MADE BY IDC ARE ACCURATE

Finding: Primary and secondary sources agree with NEEA's current ACE model projections (created by IDC), showing a slight decline in future desktop PC sales.

Recommendation: NEEA should continue to use IDC projections, and expect a relatively slight decline in the number of annual shipments to 2017.

IDC makes five-year projections for total desktop PC sales. NEEA uses IDC's projections to estimate future savings. Current IDC predictions suggest desktop PC shipments will remain steady with negligible increases in 2013 and beyond. Industry analysts and interviews with OEMs support IDC's predictions, indicating that desktop PC sales will remain steady over the next few years, with the possibility of a slight decline.

ASSUMPTION #8: PENETRATION OF NETWORK POWER MANAGEMENT IS 5-8%

Finding: Preliminary results from the email survey of non-governmental organizations in NEEA territory show that NEEA may be *significantly underestimating* the penetration of network power management software, and thus *overestimating* energy savings.

Recommendation: NEEA should revisit the assumption in light of the email survey results.

NEEA estimates the penetration of network power management was 5% in 2012 and will be 8% in 2013. The email survey conducted in February 2013 as part of the 80 PLUS MPER #5 found penetration to be much higher. Among non-governmental businesses, 47% of small/medium



businesses and 75% of large businesses reported employing network power management in their organizations. The difference between the two business sizes is significant.





5

MARKET PROGRESS ASSESSMENT

This chapter contains two sections:

- ➔ An overview of 80 PLUS program data regarding program sponsors, participants, and qualifying power supply units
- ➔ A discussion of the six key findings that speak to the achievements of the 80 PLUS program, projections for future market demand for 80 PLUS power supplies, and the substantial opportunity that remains in the commercial desktop PC market

OVERVIEW OF 80 PLUS PROGRAM DATA

Evaluators reviewed several Market Progress Indicators (MPIs) and the following sections describe the progress of the Initiative on two sets of related MPIs: the participation of Initiative sponsors and market actors, and the number of certified and tested power supply units.

Participation of Sponsors and Market Actors

In 2012, the 80 PLUS program had four program sponsors: Energy Trust of Oregon, Efficiency Vermont, New Jersey Clean Energy Program, and Xcel Energy. Sponsorship has been declining since 2008 when the number of sponsors peaked at 13. However, in 2012 Xcel Energy expanded its 80 PLUS offering to two new states, Colorado and New Mexico. MPER #3, published in 2011, noted that Ecos (now Ecova) believed sponsorship would rise again due to utilities' growing interest in consumer electronics (CE) programs. The expected increase did not occur and the abundance of new television-focused efficiency programs suggests this product category captured program managers' interest, and CE dollars.

The number of participating OEMs decreased from five in MPER #3 to three in 2012: Dell, HP, and Lenovo (Table 6). Business changes caused MPC and Gateway to leave the program. MPC went out of business; and Gateway was purchased by Acer and now sells PCs primarily to the retail channel.

The number of participating SIs decreased dramatically, from 37 in MPER #3 to four in 2012: CTL, Equus, Nortech, and Reason. The program's shift to incentivizing only ENERGY STAR-qualified desktop PCs likely caused the decline in SI participation, as few SIs qualify their custom-built products with ENERGY STAR.

The number of PSMs with at least one 80 PLUS-certified power supply increased from 216 in MPER #3 to 252 in 2012. The program tally is cumulative, showing a continuous increase in PSM engagement since MPER #1.



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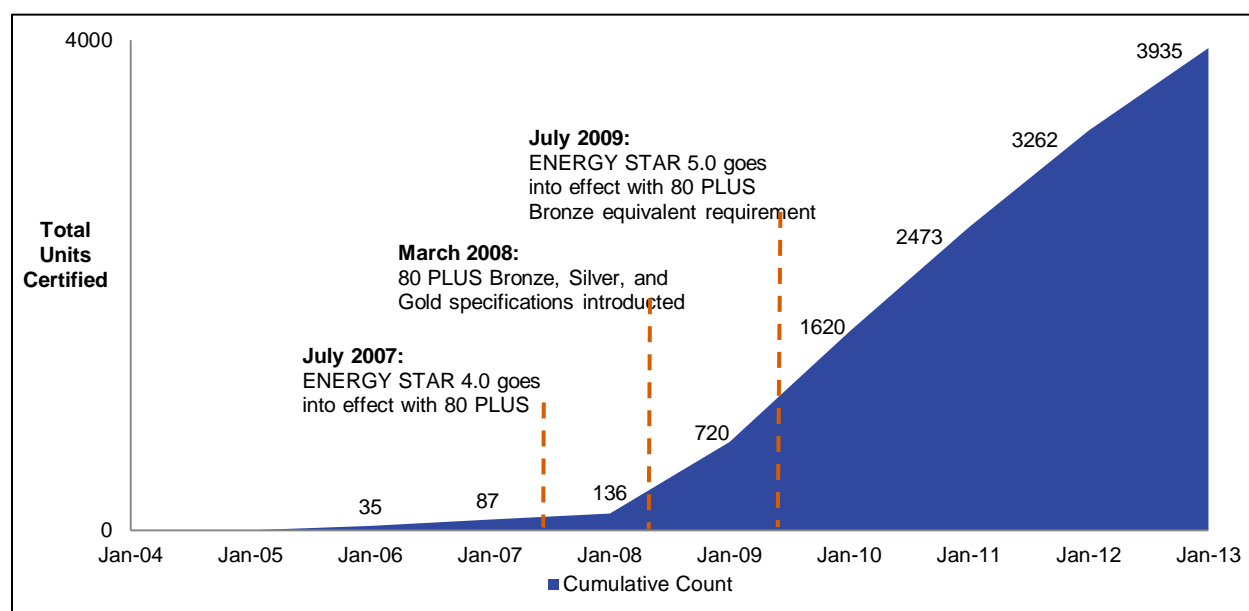
Table 6: Market Progress Indicators: Participation

Market Progress Indicator	MPER #1	MPER #2	MPER #3	Current MPER #5
Number of 80 PLUS program sponsors	12	13	6	4
Computer OEMs with certified units	0	2	5	3
Participating SIs	10	51	37	4
Power supply manufacturing firms with certified units	19	65	216	252

Sources: MPERs #1, #2, and #3; Plug Load Solutions website; and Ecova staff interviews.

Counts of Tested and Certified 80 PLUS Power Supply SKUs

The cumulative number of certified power supply SKUs has continued to increase since the program's first MPER in 2006, with a total of 3,935 units certified as of January 2013 (Figure 8).

Figure 8: Cumulative Number of Certified 80 PLUS Units, with Key Market Changes

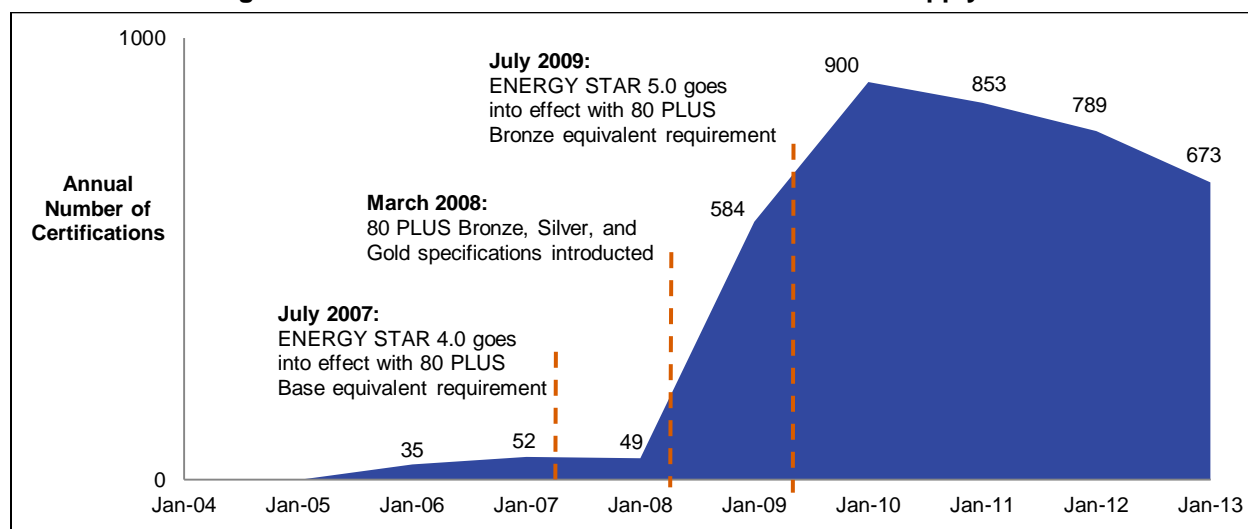
Source: Ecova. 80 PLUS program data.

Annual unit certifications rose sharply from 2008 to 2010 but have decreased every year since with increasing severity. From January 2010 to January 2013, the number of certified units dropped 5.3%, 7.5%, and 15% annually (Figure 9).¹⁷ Finding #3 below provides an interpretation of the causes and relevance of this decline.

¹⁷ The annual certification rate by 80 PLUS tier was not evaluated because the data were not available in an analyzable format.



Figure 9: Annual Number of Certified 80 PLUS Power Supply Units



Source: Ecova. 80 PLUS program data.

KEY FINDINGS

Key Finding #1: SIs and PSMs value the 80 PLUS brand.

In-depth interviews with OEMs, SIs, and PSMs suggest desktop PC market actors value the 80 PLUS brand. SIs value the 80 PLUS brand as a symbol of power supply quality as well as efficiency, and PSMs use their 80 PLUS product offerings to demonstrate their market leadership. The 80 PLUS brand may be less meaningful to OEMs, who respond to low end-user awareness of the brand by focusing their marketing on ENERGY STAR energy efficiency more generally.

SIs associate the 80 PLUS brand with high-quality power supplies

Energy efficient power supplies typically have higher overall quality than less efficient models. One SI described demonstrating this difference in quality to a customer by putting an efficient and a standard power supply in each of the customer's hands to show the difference in weight. According to this SI, "They just get this very tangible sense of the quality of the higher-end one...It's more than just energy efficiency; it's the quality of the construction, it's all the materials, everything else."

In addition to the quality of the power supply unit itself, PSMs typically include other desirable features in efficient power supplies, like modular connections, a higher quality fan, better voltage regulation, and the ability to operate at higher temperatures. One PSM reported his company would be unlikely to include these features in a power supply that was not 80 PLUS-certified. Two SIs also reported that 80 PLUS power supplies typically come from "reputable" power



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supply manufacturers, while a third said that non-80 PLUS power supplies typically come from “pretty low-end manufacturers.”

Because of the inherent quality of efficient power supplies, their bundling with other high-end features, and the strong reputations of the manufacturers offering them, the 80 PLUS brand has come to symbolize quality as well as efficiency for SIs. One SI illustrated this connection, saying, “80 PLUS is on all the high-quality equipment. Seeing that on all the stuff our class of user would use... From a system builder standpoint, if I saw something that wasn’t 80 PLUS, I would just assume it was crap quality.” Interview findings suggest that PSMs also recognize this association between the 80 PLUS brand and power supply quality. According to one PSM, 80 PLUS “is a good tool to communicate to consumers that what we have here is a good power supply.”

Reflecting the value SIs place on 80 PLUS power supplies, one PSM reported that the 80 PLUS label contributes to the higher sales price of efficient power supplies. This contact reported that, while wattage had traditionally driven power supply prices, 80 PLUS added “a second dimension.” This contact explained, “You could have a 500 watt 80 PLUS Gold power supply that is more expensive than a 700 watt 80 PLUS Base power supply. It never happened like that before, but you have a higher 80 PLUS rating.” According to this contact, the increased cost to produce efficient power supplies accounts for only part of the price difference. He noted, “You want a higher 80 PLUS rating to differentiate them... it could be the other features that are added in.”

PSMs produce power supplies at the highest 80 PLUS tier to demonstrate industry leadership because adoption of the lower 80 PLUS tiers has become so widespread that it no longer serves as a differentiating factor

All interviewed PSMs reported they were motivated to produce 80 PLUS power supplies in order to position their companies at the forefront of power supply technology. One PSM noted their company produces 80 PLUS Platinum units, even though they did not expect these units to sell in high volumes. Rather, their motivation is a desire to avoid falling behind their competitors. In fact, this PSM argued that this is true of most PSMs, commenting, “80 PLUS Platinum - none of the manufacturers sell a lot of those. They just use that as a brand image, ‘we can build 80 PLUS Platinum; we have the high technology.’”

PSMs and SIs also discussed how widespread market adoption of efficient power supplies, and attention to PC efficiency generally, have limited their ability to use energy efficiency to differentiate their offerings and had further pushed them towards higher 80 PLUS tiers. According to one interviewee, “[80 PLUS] used to be a lot more of a differentiating feature, but now, unfortunately, most of our competitors are using 80 PLUS power supplies... The industry as a whole has stepped up and taken advantage of making computers run more efficiently.”



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Due to low end-user awareness, the 80 PLUS brand may be less valuable to OEMs

While 80 PLUS brand awareness is high among SIs and OEMs – market actors who purchase power supplies – it is low among end-users, most of who seem to pay little consideration to details of the individual PC components. Both OEMs and SIs reported relatively low levels of 80 PLUS awareness among end-users. According to one SI, “I think [the] 80 PLUS [brand] is well known in the PC industry and by technical people, really technical end-users. But the average consumer buying a PC, they don’t know a lot about what’s going on inside.” IT decision-maker survey findings support this assessment, with only 19% of IT decision-makers reporting they are somewhat or very familiar with 80 PLUS.

Nonetheless, SIs and OEMs reported end-users are increasingly considering energy efficiency in their PC purchases. Interview findings suggest that SIs and OEMs respond to end-user interest in efficiency in different ways. SIs reported efforts to educate end-users about 80 PLUS as they promote the quality and efficiency of their products (this is discussed further in Key Finding #6). OEMs typically have less interaction with end-users than SIs. Rather than educating end-users about 80 PLUS, OEMs more often promote energy efficiency generally or use the ENERGY STAR brand, which has very high end-user awareness. As a result, power supply efficiency is important to OEMs, but the 80 PLUS brand may be less important to OEMs than it is to SIs, and PSMs.

PSMs are more likely to certify efficient power supplies with the 80 PLUS program and promote the 80 PLUS brand when selling to SIs and the retail market than to OEMs

PSMs that focus on sales to OEMs place less emphasis on 80 PLUS certification than those who focus more heavily on sales through distributors, SIs, or at retail. PSM interviews suggest that 80 PLUS power supplies are more profitable when sold at retail than when sold to OEMs. PSMs focused on the OEM market stated that competition for OEMs’ business did not allow them to charge high enough prices on efficient power supplies to compensate for the added production costs. In contrast, PSMs focused on the retail market reported that higher sales prices made efficient power supplies more profitable.

PSMs focused on the OEM market also reported producing power supply models that are at least 80% efficient, but that they had not submitted for 80 PLUS certification. Both contacts noted that their OEM customers drive this decision and stated that not submitting models allows them to offer lower prices by avoiding the costs and delays associated with testing. Although interview data do not indicate how OEMs use these efficient-but-not-certified power supplies, a PC could qualify as ENERGY STAR even if its power supply is not certified by the 80 PLUS program, as long as the power supply meets the specified efficiency requirements.¹⁸ PSMs focused on the

¹⁸ ENERGY STAR specifications require that power supplies achieve efficiency levels equivalent to 80 PLUS Bronze and specify that power supply efficiency be tested according to the same test procedure that the 80 PLUS program uses. However, ENERGY STAR specifications do not require power supplies to be tested by Ecova and certified as 80 PLUS.



retail market reported that all of their efficient power supplies for sale in the U.S. market had received 80 PLUS certification. Consistent with these findings, the interviewed PSMs focused on the OEM market reported that a smaller proportion of the power supply models they produce were 80 PLUS certified than did PSMs focused on the retail market (Table 7).

Table 7: Proportion of Models Certified as 80 PLUS, by PSM Distribution Channel Focus

PSM's Distribution Channel Focus	Percent of Power Supply Models Certified as 80 PLUS
Retail/SI	PSM 1: 100%
	PSM 2: 91%
OEM	PSM 3: 56%*
	PSM 4: 18%

* Interview contact refused to provide a proportion. The proportion listed is based on power supply models listed on PSM website.

PSMs focused on the retail market also promote 80 PLUS more heavily than those focused on direct sales to OEMs. One PSM reported that their product detail web pages, retail boxes, and advertisements all featured the 80 PLUS logo. In contrast, PSMs focused on the OEM market primarily respond to OEMs' requests for bids on power supplies that meet specified requirements. OEMs and large SIs reported receiving little marketing information from PSMs.

Key Finding #2: For general purpose PCs (70 to 90% of the market) ENERGY STAR drives adoption of efficient power supplies. For power PCs, non-energy benefits and the 80 PLUS brand drive adoption.

The drivers of 80 PLUS adoption differ depending on whether the destination PC model is a general purpose or power PC, and these differences impact market actors' approaches to power supply efficiency. In the case of general purpose PCs, EPA's inclusion of power supply efficiency requirements and a test procedure modeled on 80 PLUS in the desktop PC ENERGY STAR specification played an important role in motivating 80 PLUS adoption. In power PCs, the non-energy benefits of efficient power supplies and the 80 PLUS brand itself play a more important role. As a result of this distinction, market actors with a stronger focus on general purpose PCs approach 80 PLUS differently than those with a stronger focus on power PCs.

ENERGY STAR drives 80 PLUS adoption in general purpose PCs

The majority of desktop PCs are general purpose models that businesses and consumers purchase from a major computer brand. The top five computer brands accounted for 72% of PC shipments in 2012 (IDC 2013), and models at the middle and low end of the price continuum (below \$1,000) made up 94% of all PC purchases (Olenick 2012). Survey findings confirm the prominence of general purpose PCs among purchases by IT decision-makers in the Pacific Northwest. Over three-quarters of the PCs that IT decision-makers reported purchasing in 2012 were for general business tasks such as word processing, financial software, email, and internet



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use. Further, IT decision-makers reported purchasing three-quarters of their computers directly from major brands.

ENERGY STAR is a more prominent designation than 80 PLUS for end-users purchasing general purpose PCs. Survey findings suggest that nearly all IT decision-makers (94%) are familiar with ENERGY STAR, but few (19%) are aware of 80 PLUS. While OEMs estimated higher awareness of 80 PLUS than survey results suggest, they also recognized that ENERGY STAR awareness was greater. According to one OEM, ENERGY STAR “crosses over into [an end-user’s] job because of the marketing [ENERGY STAR has] done on the consumer side” in appliances and other markets. Further demonstrating the prominence of the ENERGY STAR label, 35% of the large businesses and 20% of the small/medium businesses surveyed reported having procurement requirements for PCs that specify ENERGY STAR. None of the surveyed businesses had procurement requirements specifically for 80 PLUS power supplies.

OEMs’ desktop PC design and marketing efforts reflect the prominence of ENERGY STAR among end-users. All of the interviewed OEMs reported producing few, if any, general purpose PCs that *include* an 80 PLUS power supply but are *not* ENERGY STAR qualified. In addition to responding to consumers’ demand for ENERGY STAR, one OEM contact explained that, as other components – particularly processors – have become more efficient, PCs with 80 PLUS power supplies have become increasingly likely to meet the remaining ENERGY STAR requirements. Consistent with this focus on ENERGY STAR, OEMs do not typically promote 80 PLUS directly to end-users. Instead, OEMs promote energy efficiency as a PC feature generally through discussions of total cost of ownership and as part of their messaging around broader sustainability initiatives.

Non-energy benefits drive 80 PLUS adoption in power PCs

In the power PC market, the non-energy benefits of an 80 PLUS power supply drive demand rather than ENERGY STAR. In fact, contacts reported that many, if not most, power PCs would fail to qualify for ENERGY STAR because of their high power requirements. Contacts explained that it is often not possible for power PCs to both achieve the functionality the end-user seeks *and* meet ENERGY STAR specifications. One SI that specializes in power PCs explained, “it’s something that even our extremely tech-savvy audience would understand – that we are in the market for a fast PC first. We understand this will burn more power.” Even if a power PC model may qualify for ENERGY STAR, OEMs and SIs reported that it was impractical to submit custom-built or low-volume units to ENERGY STAR for qualification.

In the general-purpose PC market, non-ENERGY STAR PCs are unlikely to include an 80 PLUS power supply. In contrast, in the power PC market non-ENERGY STAR PCs are *very likely* to include 80 PLUS power supplies, and often 80 PLUS Silver and above. Contacts cited two factors that contribute to the prevalence of 80 PLUS power supplies in non-ENERGY STAR power PCs.



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First, the non-energy benefits of 80 PLUS power supplies – notably noise and heat reduction – are particularly relevant for power PC users. According to one SI, “A lot of people don’t realize how aware they are of their older computer that sounds like a dishwasher running under their desk. The impression they get with a new system is great.” Another SI described the benefits of efficient power supplies from the end-users’ perspective, stating that they “notice the fan noise, and they notice if it is getting hot; if...the PC in their office is heating up their office.” An OEM noted that, especially in power PCs with a small footprint, efficient power supplies may be necessary to manage heat and prevent damage to other components.

Relative price insensitivity among power PC buyers is the second factor that contributes to the prevalence of 80 PLUS power supplies in these PCs. SIs, who primarily sell custom-built and power PCs, cited performance, reliability, and the support available after purchasing the PC as the factors most important to their customers. According to one SI, “If the customer is kind of price insensitive anyway because they are buying a higher-end system, they would be more likely to want a higher-end power supply.” A second SI, who stated the PCs his company builds have an average sales price of \$3,500, noted that when selecting power supplies “for us, saving \$10 is not a big deal.” However, this contact also noted that, at one wattage level, his company had chosen to stock a lower-tier 80 PLUS power supply due to the incremental cost, suggesting that while power PC buyers may be less sensitive to incremental cost, some sensitivity remains.

Key Finding #3: Evidence suggests demand for 80 PLUS in the supply chain will remain constant and continue to have many drivers.

One objective of this evaluation was to examine trends in 80 PLUS certifications, particularly whether a slowdown in certifications had occurred, as well as possible changes to 80 PLUS demand when the ENERGY STAR 6.0 specification goes into effect in October 2013. A review of program data confirmed a drop in certifications year-over-year, but in-depth interviews suggest that this decline does not reflect a drop in 80 PLUS market share or in demand for 80 PLUS by OEMs and SIs. Further, interview and survey findings show changes to the ENERGY STAR specification will have little impact on 80 PLUS demand. While the number of power supply SKUs certified as 80 PLUS may decline and then plateau, market demand for 80 PLUS power supplies should remain steady because the demand has two constant drivers: ENERGY STAR and power PCs.

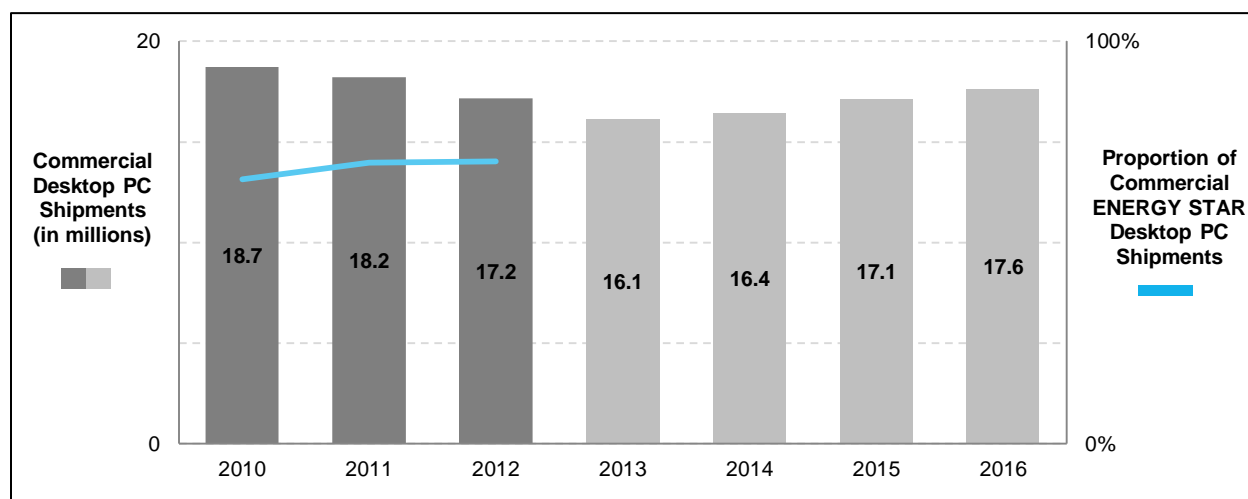
ENERGY STAR will continue to be the primary driver of demand for 80 PLUS

The power supply efficiency requirements included in ENERGY STAR specifications have been a major driver of demand for 80 PLUS power supplies in general purpose PCs, which make up the majority of the PC market.



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Figure 10: IDC Commercial Desktop Shipments and ENERGY STAR Proportions, 2010 to 2016



Note: Dark gray indicates actuals; light gray indicates projections.

Source: IDC. *Worldwide Quarterly PC Tracker*.

Consistent with these projections, findings from the survey of IT decision-makers indicated demand for ENERGY STAR PCs will remain strong. Among IT decision-makers who purchased at least one ENERGY STAR PC in 2012, about half (53%) had a procurement requirement to purchase ENERGY STAR computers. Further, over half of IT decision-makers (59%) said they expected their share of ENERGY STAR qualified PCs to stay the same over the next one to two years, and over one-third (37%) said they expected the share to increase.

All OEMs reported they plan to continue to design PCs to meet the ENERGY STAR specification, with one noting specifically that they anticipate continued demand for ENERGY STAR PCs from business customers. Two OEMs noted they continuously seek to improve the efficiency of their PC offerings, suggesting that they will be unlikely to revert to lower-efficiency power supplies for PC models qualified under the current ENERGY STAR Version 5.2 specification, but which fail to meet the new Version 6.0 standards.

Given the current number of annual 80 PLUS certifications and evidence that 80 PLUS and ENERGY STAR market share should remain stable, the research team estimates 80 PLUS certifications will remain constant at around 600 to 700 SKUs per year from 2013 to 2015, unless technological breakthroughs require power supply changes or EPA increases power supply efficiency requirements in the ENERGY STAR specification.

A decline in annual unit certifications does not indicate a decline in 80 PLUS market share

As noted above and depicted above in Figure 9, annual 80 PLUS unit certifications rose sharply from 2008 to 2010 but have declined every year since with increasing severity. The decline in



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certifications has several likely causes, none of which is a drop in demand for 80 PLUS power supplies. Instead, the slower pace of 80 PLUS certifications likely reflects a decline in the pace of change in the power supply market and static ENERGY STAR power supply efficiency requirements. Until either of these factors change, PSMs will likely continue to manufacture previously certified models rather than designing large numbers of new power supply models, and thus future certifications will likely come from re-certification of updated models.

Interviews with SI and OEM contacts suggest one possible cause of a decline in 80 PLUS power supply certifications. These contacts reported that, between 2008 and 2010, rapid changes in CPUs and other PC components drove development of new power supply models designed to be compatible with the changing components. According to one SI, power supply units “were getting changed around pretty quickly. Part of that was, in 2006-2010, motherboards and video cards were changing so power supplies had to change to accommodate. Things have been calmer the last two or three years, so there hasn’t been as much need for them to change.” Since CPU advances leveled off in 2010¹⁹, corresponding changes to power supply units have leveled off as well.

The stasis in the ENERGY STAR requirement for desktop PC power supplies may be another cause of the decline in certifications. Historical certification data show that when ENERGY STAR added a new power supply requirement to the desktop PC specification, in 2007 and again in 2009, the result was a flurry of certification activity. However, ENERGY STAR has not changed its power supply requirement since 2009, while during this period 80 PLUS added three tiers above Bronze. If ENERGY STAR moves its certification to a higher 80 PLUS tier, 80 PLUS certifications will likely accelerate again.

The current data collection process does not support analysis of certifications by 80 PLUS tier over time

80 PLUS does not track unit certification tier level *and* date in a format that can be easily aggregated, tabulated, and analyzed. Consequently, the research team was unable to investigate trends in 80 PLUS certifications by tier.

Key Finding #4: Cost is the only remaining barrier to 100% adoption of 80 PLUS supplies.

Market data suggest 75-80% of commercial desktop PCs sold today include an 80 PLUS power supply. This estimate is arrived at by summing ENERGY STAR penetration in the commercial market, which has been at or above 70% since 2010, and power PC penetration (because the vast majority of power PCs carry efficient power supplies), which OEM contacts and secondary sources estimated at 5-10% of annual unit sales. Findings from this study suggest that for the remaining 20% of desktop PCs sold annually *without* an 80 PLUS power supply, cost is the

¹⁹ Article: “Why CPUs aren’t getting any faster” (<http://www.technologyreview.com/view/421186/why-cpus-arent-getting-any-faster/>)



primary barrier to energy efficiency at every level of the supply chain: PSMs, OEMs, SIs, and end-users.

OEMs' incremental cost is small and decreasing, yet still a barrier

OEMs reported they face a great deal of competition on price. Even though the current \$2 to \$10 incremental cost of an 80 PLUS power supply may appear small to efficiency program implementers and has even declined in recent years, it is large enough that OEMs will not specify an 80 PLUS power supply unless it is necessitated by one of three factors: the PC model will be built to ENERGY STAR specifications; the PC model is a power PC in which functionality requires an efficient power supply; or the end-user specifically requests 80 PLUS (for example, a Dell PC configured by the buyer). One OEM stated that customers whose PC purchases do not fit into one of these three categories are not willing to pay a higher cost for an 80 PLUS power supply. Another said they expect their company's 80 PLUS penetration to increase as incremental costs decrease. A third noted that without an incremental cost difference, all of their company's PCs would include an 80 PLUS power supply.

Further, findings from the OEM and PSM interviews suggest the incremental cost of 80 PLUS power supplies does not increase equally as efficiency tiers rise. Rather, respondents reported a nearly equal incremental cost for base and Bronze power supplies, and a higher but again nearly equal incremental cost for Silver and Gold power supplies.

SIs pay a higher incremental cost for 80 PLUS than OEMs

SIs buy 80 PLUS power supplies in much lower volumes than OEMs and pay a greater incremental cost. SI respondents estimated their incremental cost at \$10 to more than \$80 over a baseline unit, a considerably higher incremental cost than reported by OEMs. This high incremental cost was the only barrier to greater adoption of 80 PLUS noted by SIs.

As noted above in Finding #2, SIs may be less sensitive to upfront costs when buying power supplies than OEMs. However, interview findings suggest price remains a consideration for SIs and their customers. According to one SI, "For most companies, price is the first consideration." Another SI contact reported choosing to stock an 80 PLUS Base power supply rather than 80 PLUS Silver because he judged customers would be unwilling to pay the additional \$25 cost. A third SI described how his company had recently stopped offering 80 PLUS power supplies due to customers' unwillingness to pay the higher cost after the economic downturn.

For a small but significant group of commercial end-users, cost is still a barrier to efficiency

Many commercial desktop PC buyers face few, if any, barriers to energy-efficient PCs. The email survey of IT decision-makers showed nearly all were aware of ENERGY STAR, about 20% worked for organizations with procurement requirements to purchase ENERGY STAR PCs, and about two-thirds reported they observed no incremental cost for ENERGY STAR PCs.



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Yet barriers to efficiency remain for the commercial buyers of the 20% of desktop PCs that *do not* meet ENERGY STAR specifications and *are also unlikely to* include an 80 PLUS power supply. Cost appears to be the key barrier to efficiency among commercial buyers of these low-efficiency PCs. Approximately 16% of IT decision-makers reported experiencing a higher cost for ENERGY STAR PCs, compared to similar units that were not ENERGY STAR qualified. OEMs and SIs explained non-ENERGY STAR PCs are likely to be the lowest-cost general purpose PCs available, with power supplies that are only 60 to 70% efficient. As such, buyers of these PCs are likely sensitive to first cost, and buying the lowest-cost unit that meets their qualifications. Buyers may choose low-cost desktop PCs for several reasons. The buyers may have restricted budgets. One OEM suggested K-12 school districts fall into this category as they are aware of and would like to purchase ENERGY STAR PCs but cannot afford to do so. Some buyers may privilege first cost over lifecycle cost, either because the decision maker is unaware of lifecycle costs or unable to successfully justify the larger first cost to higher-level decision-makers in their organization. Or, as one OEM suggested, PC lifecycle cost may not be as significant a concern for businesses operating fewer computers.

What types of organizations buy low-efficiency PCs? Responses to the email survey of IT decision-makers showed “low efficiency” PC buyers – those who reported that 90% or fewer of their 2012 purchases were ENERGY STAR qualified, differ in substantial ways from “high efficiency” PC buyers – those who reported that 91% or more of their PC purchases were ENERGY STAR qualified:

- ➔ **Low efficiency buyers showed less organizational commitment to sustainability.** They were less likely to have a corporate “social responsibility” statement and less likely to have specific goals to reduce their organization’s resource consumption.
- ➔ **Low efficiency buyers’ PC purchasing practices differed from high efficiency buyers.** Low efficiency buyers were less likely to buy custom-built PCs, more likely to buy off-the-shelf PCs, and more likely to buy PCs built by an SI.

Key Finding #5: Large organizations (1,000 or more employees) differ from small/medium organizations in many ways relevant to the 80 PLUS program.

Two objectives of this evaluation were to understand IT decision-makers’ awareness of and request for 80 PLUS power supplies, and to gain greater insight into purchasing decisions for ENERGY STAR desktop PCs. The findings show notable and meaningful differences between larger organizations (those with more than 1,000 employees) and small/medium organizations (those with few than 1,000 employees). Three areas where large and small/medium organizations differ are:

- ➔ IT decision-makers’ awareness of 80 PLUS
- ➔ ENERGY STAR purchasing behaviors and decisions
- ➔ Sophistication of IT-related purchasing decisions



Larger organizations exhibit greater awareness of 80 PLUS, however the adoption rate is similar to small/medium organizations

Overall, awareness of 80 PLUS was low among IT decision-makers, with less than one-fifth (18%) of all decision-makers reporting that they were “somewhat” or “very” familiar with 80 PLUS. Larger organizations were more likely to be aware of 80 PLUS compared to small/medium organizations (29% and 18%, respectively). None of the IT decision-makers who were aware of 80 PLUS reported having specific procurement requirements for 80 PLUS power supplies. Interestingly, this has not deterred these organizations from purchasing PCs with 80 PLUS power supplies. Among those organizations whose IT decision-makers were aware of 80 PLUS, nearly all of both large (13 of 15) and small/medium organizations (9 of 9) reported purchasing at least one PC in 2012 that had an 80 PLUS power supply.

Adoption of ENERGY STAR desktop PCs is high, and a large proportion of non-government organizations have purchasing requirements for ENERGY STAR PCs

Among organizations with procurement requirements, IT decision-makers at larger organizations were more likely to report having purchasing requirements for ENERGY STAR PCs compared to small/medium organizations (62% and 53% respectively). The none-too-surprising result is a high purchase rate for ENERGY STAR PCs among both large and small organizations. The majority of IT decision-makers that were aware of ENERGY STAR reported that over half of the PCs their organizations purchased in 2012 were ENERGY STAR qualified. Only one IT decision-maker who was aware of ENERGY STAR reported not purchasing any ENERGY STAR qualified PCs in 2012. In addition to procurement requirements, the low perceived incremental costs associated with these PCs may be contributing to high adoption rates. Of IT decision-makers who purchased at least one ENERGY STAR desktop PC in the past 12 months, approximately three-quarters (71%) reported the cost of an ENERGY STAR qualified PC is the same or less than a non-ENERGY STAR PC. IT decision-makers from larger organizations were more likely to report ENERGY STAR qualified PCs cost the same or less than those at small/medium organizations (86% and 70%, respectively).

Larger organizations exhibit greater sophistication in IT-related purchasing decisions

Overall, large organizations were more likely to report having PC procurement requirements (57% of large, 38% of small/medium organizations). Large organizations also vary from small/medium organizations in the factors IT decision-makers consider in purchasing decisions. IT decision-makers in both large and small/medium organizations frequently consider performance, reliability, and upfront cost when making PC purchasing decisions. However, IT decision-makers at large organizations were more likely to report the total cost of ownership as “always” or “sometimes” factoring into their decision-making process, compared to small/medium organizations (94% and 81%, respectively). Similarly, IT decision-makers at larger organizations are more likely to report “always” or “sometimes” considering energy efficiency than those at small/medium organizations (76% and 60%, respectively).











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Key Finding #6: System integrators (SIs) are an important partner for the 80 PLUS program but the remaining potential in the SI market is unclear.

There are synergies between the 80 PLUS brand and the SI business model

SIs cannot compete against OEMs on price. Instead, the value proposition they offer to their customers is based on providing higher quality equipment and better support than is available from OEMs. One SI contact summarized this value saying, “the common denominator [among our customers] is that they are looking for high-end quality and good service.” Consistent with this finding, the interviewed SIs were more likely to report that their customers consider performance, reliability, and support when buying a PC, while the interviewed OEMs were more likely to cite upfront costs and total cost of ownership as customer considerations (Table 8). However, SIs understand that, at a certain price point, the increased quality and support does not outweigh the higher upfront cost. So while cost is less of a consideration for SIs and their customers, it remains relevant.

Table 8: Factors IT Decision-Makers Consider in PC Purchases, Reported by OEMs and SIs

Factor	Group	Sample Size	Count	Proportion
Upfront cost	OEM	3	3	
	SI	5	2	
Total cost of ownership	OEM	3	2	
	SI	5	0	
Energy efficiency	OEM	3	1	
	SI	5	0	
Performance	OEM	3	1	
	SI	5	4	
Reliability	OEM	3	0	
	SI	5	3	
Warranty/Maintenance/Support	OEM	3	0	
	SI	5	3	

Source: In-depth Interviews. Question text: “Thinking of your commercial customers, what factors would you say are most important to them when they’re buying desktop PCs?”

The 80 PLUS brand supports SIs’ efforts to demonstrate the higher-quality and reliability of the PCs they produce. According to one SI contact, his customers “want a custom-built machine, they want service...And when you can also market these power supplies as being higher quality, because they tend to be name brand, or have name recognition, there is that element.” SIs also noted that 80 PLUS power supplies increase the reliability of PCs and improve end-users’ experience with the PC by reducing the heat and noise the PC generates.

Using 80 PLUS certified power supplies may also allow SIs to demonstrate that the PCs they manufacture are energy efficient without ENERGY STAR qualification. A large proportion of the PCs SIs produce are custom-built or substantially customized from common configurations.



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The interviewed SIs reported that it would be impractical to qualify these PCs for ENERGY STAR, particularly given ENERGY STAR's third-party testing requirements. One SI reported using 80 PLUS power supplies when customers ask for an efficient PC because 80 PLUS power supplies are "the only quantifiable component of the computer, or part, that is marketed as energy efficient." Similarly, another SI stated, "We don't have full systems [ENERGY STAR] certified. When [energy efficiency] comes up, we do the research and tell [customers] that the individual components are [efficient]."





6

CONCLUSIONS AND RECOMMENDATIONS

This evaluation resulted in three conclusions and their accompanying recommendations.

CONCLUSION #1

The 80 PLUS brand has value in Desktop PC supply chain and continues to contribute to PC efficiency.

The role of the 80 PLUS brand has shifted as 80 PLUS power supplies have achieved widespread adoption, but 80 PLUS remains valuable to market actors. Rather than using their adoption of 80 PLUS power supplies to differentiate themselves from their competitors, SIs now view 80 PLUS as a symbol of high-quality power supplies and use the brand to support their value proposition, which is based on PC quality and support. Similarly, PSMs can no longer use their 80 PLUS offerings to set themselves apart from their competition. Instead, PSMs risk falling behind their competition if they do not produce power supplies at the highest 80 PLUS efficiency tiers. The 80 PLUS brand allows SIs to demonstrate the efficiency of PCs that may not receive other efficiency certifications and allows PSMs to promote efficiency as a feature of their high-end power supplies.

- ➔ **Recommendation: Continue to support the 80 PLUS brand and certification process.** It is important that the 80 PLUS program continue to certify power supplies, and to establish “reach” efficiency standards like the Platinum tier. Further, the widespread support for and value of 80 PLUS in the supply chain suggests the current 80 PLUS sponsors could consider engaging industry partners in its ongoing management and funding.

CONCLUSION #2

80 PLUS market penetration is approaching 85%, NEEA’s estimate of maximum potential, but opportunities remain to increase market share beyond this threshold.

The findings from this evaluation suggest there is opportunity to further accelerate 80 PLUS adoption and achieve market penetration levels that exceed NEEA’s current estimated potential of 85%. Market actor interviews showed that incremental cost is the only barrier that prevents OEMs and SIs from installing 80 PLUS power supplies in 100% of the PCs they sell.






Increasing 80 PLUS market share will require NEEA and the 80 PLUS program to take distinct approaches to three key market segments. Figure 11 shows the three areas of opportunity and



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their defining characteristics. The following sections describe the evaluation team's conclusions about each target and our recommendations for approaches the initiative should consider increasing uptake.

Figure 11: Three Opportunities for Increased 80 PLUS Adoption*

Target	Opportunity	Power Supply Determinants	Commercial Market Share
ENERGY STAR	Continue advocating for increased power supply efficiency in ENERGY STAR desktop PC specification to further increase efficiency		 70%
Low-cost, general purpose PCs	Address incremental cost barriers to increase 80 PLUS penetration	\$	 15-20%
SIs	Conduct additional research to understand the remaining potential	 & NEBs	 2-10%

* Dark colors indicate confirmed market share; light colors indicate estimated market share.

Source: In-depth interviews; IDC. *Worldwide Quarterly PC Tracker*.

ENERGY STAR PCs

Continue advocating for increased power supply efficiency in the ENERGY STAR desktop PC specification to further increase efficiency among qualified units

An opportunity remains for NEEA to further improve the efficiency of ENERGY STAR qualified PCs by advocating for increased power supply efficiency requirements in future specification revisions. The power supply efficiency requirements in ENERGY STAR specifications have been a major driver of 80 PLUS adoption in general purpose PCs for the business market, the majority of which are ENERGY STAR qualified. The 80 PLUS program played an important role in advocating for these requirements in the ENERGY STAR Version 4 PC specification and their increased stringency in Version 5, and their inclusion in both specifications was a success for the program. However, EPA did not increase power supply efficiency requirements in its most recent PC specification revision (Version 6.0), although it added an allowance for PCs with higher efficiency power supplies to incentivize manufacturers for using power supplies at the 80 PLUS Silver or Gold tiers. EPA will likely consider increased power supply efficiency requirements in future specification revisions. As in previous revision processes, the 80 PLUS program and its sponsors have the potential to play an important role in supporting these requirements.



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- ➔ **Recommendation: Advocate that ENERGY STAR include power supply efficiency requirements equivalent to 80 PLUS Gold in its next specification.** In addition to participating in discussions and submitting comments on draft specifications, the 80 PLUS program and its sponsors have a unique ability to provide EPA with data on incremental costs and the market penetration of efficient power supplies that could help justify increased efficiency standards. For example, PSMs reported little incremental cost difference between 80 PLUS Silver and Gold, a finding that could help justify increasing requirements to the Gold level.

Low-Cost PCs

Address incremental cost barriers to increase 80 PLUS penetration among low-cost PCs

The portion of the market focused on providing PCs at the lowest possible price is most sensitive to the incremental cost among the three segments and is least likely to use efficient power supplies. The added cost for an efficient power supply makes up a larger proportion of the total sales price for these low-priced models, and OEMs and SIs reported that cost is the primary consideration for PC buyers in this segment. However, incremental cost is the only barrier to adoption of efficient power supplies that OEM and SI contacts cited. Without a difference in cost, OEMs reported they would use efficient power supplies in all of their PCs.

Incremental costs of 80 PLUS power supplies have declined over the past few years, and may have reached a level at which targeted upstream incentives could effectively offset them. OEMs, which produce the majority of low-priced PCs, currently pay a premium of only \$2 to \$10 for efficient power supplies.

- ➔ **Recommendation: Consider mid- and upstream incentive approaches designed to target the lowest-priced PCs.** For example, offering manufacturers incentives for sales of PCs with 80 PLUS power supplies up to a set wattage could help avoid incentivizing power PCs that would likely use an efficient power supply regardless of NEEA's intervention. In targeting low priced PCs, it may also be beneficial to separate incentives for 80 PLUS power supplies from ENERGY STAR, since other ENERGY STAR requirements may raise the cost of the PC. Coordination with midstream and upstream consumer electronics programs may provide an effective way to deliver these types of incentives.

PCs Sold by SIs

More research is needed to understand the remaining potential in this segment

SIs, who primarily sell custom-built PCs, associate the 80 PLUS brand with quality, and this association allows them to use the 80 PLUS brand to support their value proposition of increased quality and improved service. The non-energy benefits of 80 PLUS power supplies, especially noise and heat reduction, are also particularly relevant to power PCs, which are often custom-



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built. Consistent with these benefits, PSMs focused on the retail and SI markets also see value in the 80 PLUS brand, certifying a high proportion of the power supply models they produce and reporting that certified models are more profitable. Given the synergies between the 80 PLUS brand and the SI business model, as well as the non-energy benefits of 80 PLUS power supplies in power PCs, there is high potential for 80 PLUS adoption among SIs.

However, this study was unable to confirm the current 80 PLUS market share among desktop PCs sold by SIs. The interviewed SIs reported high 80 PLUS penetration in the PCs they sell, but the sample of five SIs is not sufficient to draw conclusions about penetration in the market as a whole. Further, one SI, who did not ultimately complete an interview, reported that his company no longer offers 80 PLUS power supplies as a result of increased price pressure following the recession, suggesting that high 80 PLUS penetration may not be universal.

- ➔ ***Recommendation: Conduct further research to determine the potential for increased 80 PLUS adoption in the SI market.*** NEEA could use an email or phone survey with a representative sample of SIs in the Northwest to assess 80 PLUS market penetration among these supply chain players in order to guide design of the program's next activities.

CONCLUSION #3

80 PLUS does not currently collect certification data in a format that allows for analysis of trends in model certification by 80 PLUS tier.

The 80 PLUS program's database of certified power supplies currently does not include a field for the date each model was certified as 80 PLUS compliant. As a result, it is not possible to identify trends in power supply certification by efficiency tier. Tracking these trends would provide the program with useful information about 80 PLUS adoption by PSMs and the influence on 80 PLUS certifications of factors like the inclusion of increased power supply efficiency requirements in ENERGY STAR specifications.

- ➔ ***Recommendation: Expand data collection to support more detailed tracking of 80 PLUS certification.*** 80 PLUS can improve the potential for analysis if the program tracks the date of a unit's certification in the same format that it currently tracks model number, form factor, efficiency ratings, and tier on the Plug Load Solutions website.



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APPENDIX B: DATA COLLECTION INSTRUMENTS

80-PLUS EMAIL SURVEY

Introduction

Thank you for taking this survey about the desktop computer purchasing practices at your organization. Your experience is unique, and your answers will help us better understand IT decision-making in the Pacific Northwest! Please click "next" to begin your survey.

F1 Which of the following best describes your organization?

- ☐ For-profit business (1)
- ☐ Non-profit organization (2)
- ☐ Higher education or K-12 school (3)
- ☐ Government (4)

If Higher education or K-12 school is Selected, Then Skip To Unfortunately you are not eligible to...
If Government is Selected, Then Skip To Unfortunately you are not eligible to...

F2 Please select the classification that best describes your organization

- ☐ Agriculture (1)
- ☐ Mining (2)
- ☐ Utilities (3)
- ☐ Construction (residential and commercial) (4)
- ☐ Manufacturing (including food, alcohol, textiles, clothing, paper, building materials, machinery, electronics) (5)
- ☐ Wholesale (B2B sales in any industry) Retail trades (B2C sales in any industry) (6)
- ☐ Transportation and Warehousing (7)
- ☐ Information (Newspaper/book publishers) (8)
- ☐ Movie/video/music production (9)
- ☐ TV/radio/cable/satellite programming and broadcasting (10)
- ☐ Telecommunications (11)
- ☐ Data processing/hosting (12)
- ☐ Finance and Insurance (13)
- ☐ Real estate and rentals/leasing (14)
- ☐ Professional, scientific and technical services (for example: lawyers, architects, engineers, IT systems design) (15)
- ☐ Computer programming (16)



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- ☐ Management consulting (17)
- ☐ Public relations (18)
- ☐ Advertising (19)
- ☐ Health care (20)
- ☐ Arts, entertainment, and recreation (21)
- ☐ Accommodation and food services (22)
- ☐ Other (please specify): (23) _____

F3 How many employees are there in your organization?

- ☐ Less than 50 (1)
- ☐ 50-99 (2)
- ☐ 100-499 (3)
- ☐ 500-749 (4)
- ☐ 750-999 (5)
- ☐ 1,000-1,499 (6)
- ☐ 1,500-1,999 (7)
- ☐ 2,000-2,499 (8)
- ☐ 2,500-4,999 (9)
- ☐ 5,000-9,999 (10)
- ☐ 10,000 or more (11)

If Less than 50 Is Selected, Then Skip To Unfortunately you are not eligible to ...

F4 In which of the following states does your organization have at least one employee?

- ☐ California (1)
- ☐ Arizona (2)
- ☐ Utah (3)
- ☐ Oregon (4)
- ☐ Colorado (5)
- ☐ Washington (6)
- ☐ Idaho (7)
- ☐ Texas (8)
- ☐ Montana (9)
- ☐ None of the above (10)

Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected



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F5 How many computers does your organization use on a regular basis - desktops AND laptops (but NOT including tablets or servers)?

If How many computers does you... Is Equal to 0, Then Skip To Unfortunately you are not eligible to ...

Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

F6 What percent of these computers are . . .

_____ Desktops or workstations (1)

_____ Laptops (2)

If Desktops or workstations Is Equal to 0, Then Skip To Unfortunately you are not eligible to ...

Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

Q86 Does your organization use networking power management software? Networking power management allows an IT administrator to configure features for the computers on the network in order to reduce energy use. One of the most common features is "Wake on LAN" or "WoL."

☐ Yes (4)

☐ No (5)

☐ Don't know (6)

Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

F7 How many new computers did your organization buy in 2012?

If How many new computers did ... Is Equal to 0, Then Skip To Unfortunately you are not eligible to ...



Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

F8 What percent of the new computers purchased were . . .

_____ Desktops or workstations (1)

_____ Laptops (2)

If Desktops or workstations Is Equal to 0, Then Skip To Unfortunately you are not eligible to ...

Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

F9 Which of the following sustainable or "green" practices does your organization follow?
Does your organization . . .

	Yes (1)	No (2)	Don't Know (3)
Maintain an employee "green team" (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have a corporate "social responsibility" or "environmental responsibility" statement (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have specific goals to reduce consumption of energy, paper, or other resources, or to reduce waste (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prioritize purchase of environmentally sustainable products for office use (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take specific steps to "green" its supply chain (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Collaborate with outside environmental organizations or consultants to improve its own sustainability or that of its products (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

Q98 Please describe any other sustainable or "green" practices that your organization follows:



Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

F10 What is your title?

Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

F11 What are your responsibilities related to IT purchasing? Select the option that best describes your role.

- ☐ I am the sole decision maker (4)
- ☐ I make the final decision with input from staff/management (3)
- ☐ I help reach the final decision as part of a group/committee (2)
- ☐ I provide input toward the final decision (1)

If I provide input toward the ... Is Selected, Then Skip To Unfortunately you are not eligible to...

Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

F12 How many years have you had these responsibilities (even if at a different organization)?

- ☐ Less than one year (1)
- ☐ 1 year (2)
- ☐ 2 years (3)
- ☐ 3 years (4)
- ☐ 4 years (5)
- ☐ 5 years (6)
- ☐ 6 years (7)
- ☐ 7 years (8)
- ☐ 8 years (9)
- ☐ 9 years (10)
- ☐ 10 years (11)
- ☐ 11 years (12)



- ☐ 12 years (13)
- ☐ 13 years (14)
- ☐ 14 years (15)
- ☐ 15 years (16)
- ☐ 16 years (17)
- ☐ 17 years (18)
- ☐ 18 years (19)
- ☐ 19 years (20)
- ☐ 20 years or more (21)

If Less than one year Is Selected, Then Skip To Unfortunately you are not eligible to...

Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

F13 Please describe any energy efficiency training you've received in the last three years.

Answer If In which of the following states does your organization h... Oregon Is Selected Or In which of the following states does your organization h... Washington Is Selected Or In which of the following states does your organization h... Idaho Is Selected Or In which of the following states does your organization h... Montana Is Selected

F14 Are you or your organization a member of Green Grid or Climate Savers?

- ☐ Yes (1)
- ☐ No (2)
- ☐ Don't know (3)

Answer If Are you or your organization a member of Green Grid or Cl... Yes Is Not Selected And Are you or your organization a member of Green Grid or Cl... No Is Not Selected And Are you or your organization a member of Green Grid or Cl... Don't know Is Not Selected

Exit Unfortunately you are not eligible to complete this survey. Thank you for your time.

Q80 The remainder of this survey asks about desktop computers. When answering the questions, please consider ONLY your purchase and use of desktop computers, not laptops or servers.



PC1 In 2012, from which of these sources - if any - did your organization purchase its desktop computers? Please provide the percentage of desktop computers purchased from each source, your best guess is fine. Please ensure that your responses total 100%. If you are not aware of the source of some or all of your computer purchases, enter a number up to 100% for "Don't know." This row is included in your total.

- _____ Direct from a major PC brand (for example, Dell, HP, Apple, Lenovo, Acer) (1)
 _____ From a system integrator (for example, Equus) (2)
 _____ From a retailer (for example, Best Buy) (3)
 _____ Custom-built by someone other than a system integrator (4)
 _____ Other (please specify): (5)
 _____ Don't know (6)

PC2 Thinking about the desktop computers your organization purchased in 2012, about what percent were: off-the-shelf, meaning they were configured by the manufacturer versus custom-built to your company's specifications? Include all desktop computers made by a major brand like Dell or HP as "off-the-shelf." Please ensure that your responses total 100%.

- _____ Off-the-shelf (1)
 _____ Custom built (2)
 _____ Don't know (3)

Answer If From whom did your organization buy its PCs in 2012? Plea... From a system Integrator (for example, Equus) Is Not Equal to 0 And Thinking about the PCs your organization purchased in 201... Custom built Is Not Equal to 0

PC3 Thinking about the desktop computers your organization purchased from a system integrator in 2012, about what percent were custom-built by the system integrator (i.e. not from a major brand like HP)?

- ☐ 0% (1)
☐ 1-10% (2)
☐ 11-20% (3)
☐ 21-30% (4)
☐ 31-40% (5)
☐ 41-50% (6)
☐ 51-60% (7)
☐ 61-70% (8)
☐ 71-80% (9)
☐ 81-90% (10)
☐ 91-99% (11)



- ☐ 100% (12)
- ☐ Don't know (13)

PC4 Thinking about the desktop computers your organization purchased in 2012, about what percent were general purpose computers (meaning they are primarily used for basic business-related tasks like word processing, finance software, internet, email) versus power PCs (meaning they are used for advanced multimedia or data processing, digital imaging, or 3D design)? Please ensure that your responses total 100%. If you are not aware whether some or all of your desktop computer purchases were general purpose computers or power PCs, enter a number up to 100% for "Don't know." This row is included in your total.

- _____ General purpose computers (1)
 _____ Power PCs (2)
 _____ Don't know (3)

PC5 When your organization is deciding which desktop computers to buy, how often do you consider each of the following factors in your decision-making process? Please identify which are "always a consideration," "sometimes a consideration," "not usually a consideration," or "never a consideration."

	Always (1)	Sometimes (2)	Not usually (3)	Never (4)	Don't know (5)
Upfront cost (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Total cost of ownership (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reliability (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy Efficiency (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Brand (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Performance (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q99 Please describe any other considerations that enter into your organization's decision-making process for desktop computer purchases:

PC6 When your organization buys desktop computers, do you have written procurement requirements that you must follow? For example, obtaining competitive bids or getting approvals if the total dollar value is over a certain amount.

- ☐ Yes (1)
- ☐ No (2)
- ☐ Don't know (3)



- EEA Which of the following energy efficiency certifications are you familiar with? Please select the option that best reflects your experience.
- EEA1 80 PLUS 80 PLUS is a certification for power supplies for desktop computers, workstations, and servers. 80 PLUS certification means that the power supply is at least 80% efficient. This is the 80 PLUS logo
- ☐ Never heard of it (1)
 - ☐ Heard of it but not familiar (2)
 - ☐ Somewhat familiar (3)
 - ☐ Very familiar (4)
- EEA2 ENERGY STAR ENERGY STAR is a certification for many products, including desktop computers. ENERGY STAR certification means that the computer is one of the most energy efficient on the market. This is the ENERGY STAR logo
- ☐ Never heard of it (1)
 - ☐ Heard of it but not familiar (2)
 - ☐ Somewhat familiar (3)
 - ☐ Very familiar (4)
- EEA3 EPEAT is a comprehensive environmental rating system that helps customers identify greener computers and other electronic equipment This is the EPEAT logo
- ☐ Never heard of it (1)
 - ☐ Heard of it but not familiar (2)
 - ☐ Somewhat familiar (3)
 - ☐ Very familiar (4)
- PS1 Please answer these questions based on your current knowledge of desktop computers - you do not need to do any additional research to respond! Do you agree or disagree with the following statement? "Some internal power supplies for desktop computers are more energy efficient than others."
- ☐ Agree (1)
 - ☐ Disagree (2)
 - ☐ Don't know (3)
- PS2 Some power supplies ARE more efficient than others. How much money do you think a desktop computer with an efficient power supply will save every year?
- ☐ \$1.60 (1)
 - ☐ \$6.40 (2)
 - ☐ \$24.00 (3)
 - ☐ \$40.00 (4)



☐ Don't know (5)

Q105 Each PC with an energy efficient power supply saves about 80 kWh per year, saving about \$6.40 in energy costs.

C1 Just a few more questions. From your experience buying desktop computers over the past several years, how long does it typically take for new features or components that are only included on the highest end computers you buy to become common in mid-range computers?

☐ 1 - 2 years (1)

☐ 3 - 5 years (2)

☐ More than 5 years (3)

☐ Don't know (4)

C2 What about low-end computers- how long does it take for new or typically high-end features or components to become common on low-end computers?

☐ 1 - 2 years (1)

☐ 3 - 5 years (2)

☐ More than 5 years (3)

☐ Don't know (4)

C3 How, if at all, has the amount of time it takes for new features or components to move from high end to mid-range and low-end computers changed? Compared to a few years ago, now it takes . . .

☐ More time (1)

☐ Less time (2)

☐ The same amount of time (3)

☐ Don't know (4)

End Those are all the questions we have, thank you very much for your time! Please click "next" to finish your survey.

Q106 Thinking about all the desktop computers your organization purchased in 2012, about what percent had each of the following certifications?

Answer If 80 PLUS 80 PLUS is a certification for power supplies fo... Somewhat familiar Is Selected Or 80 PLUS 80 PLUS is a certification for power supplies fo... Very familiar Is Selected



- Q104 80 PLUS Note: All ENERGY STAR desktop computers use 80 PLUS power supplies.
- ☐ 0% (1)
 - ☐ 1-10% (2)
 - ☐ 11-20% (3)
 - ☐ 21-30% (4)
 - ☐ 31-40% (5)
 - ☐ 41-50% (6)
 - ☐ 51-60% (7)
 - ☐ 61-70% (8)
 - ☐ 71-80% (9)
 - ☐ 81-90% (10)
 - ☐ 91-99% (11)
 - ☐ 100% (12)
 - ☐ Don't know (13)

Answer If ENERGY STAR ENERGY STAR is a certification for many prod... Somewhat familiar Is Selected
Or ENERGY STAR ENERGY STAR is a certification for many prod... Very familiar Is Selected

- Q102 ENERGY STAR
- ☐ 0% (1)
 - ☐ 1-10% (2)
 - ☐ 11-20% (3)
 - ☐ 21-30% (4)
 - ☐ 31-40% (5)
 - ☐ 41-50% (6)
 - ☐ 51-60% (7)
 - ☐ 61-70% (8)
 - ☐ 71-80% (9)
 - ☐ 81-90% (10)
 - ☐ 91-99% (11)
 - ☐ 100% (12)
 - ☐ Don't know (13)



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Answer If EPEAT EPEAT is a comprehensive environmental rating syst... Somewhat familiar Is Selected
Or EPEAT EPEAT is a comprehensive environmental rating syst... Very familiar Is Selected

- Q103 EPEAT
- ☐ 0% (1)
 - ☐ 1-10% (2)
 - ☐ 11-20% (3)
 - ☐ 21-30% (4)
 - ☐ 31-40% (5)
 - ☐ 41-50% (6)
 - ☐ 51-60% (7)
 - ☐ 61-70% (8)
 - ☐ 71-80% (9)
 - ☐ 81-90% (10)
 - ☐ 91-99% (11)
 - ☐ 100% (12)
 - ☐ Don't know (13)

Answer If 80 PLUS 80 PLUS is a certification for power supplies fo... Somewhat familiar Is Selected Or 80 PLUS 80 PLUS is a certification for power supplies fo... Very familiar Is Selected

- Q94 How have you learned about 80 PLUS? Please select all of the sources from which you have received information about 80 PLUS.
- ☐ System integrator (1)
 - ☐ Power supply manufacturer (2)
 - ☐ Computer brand (3)
 - ☐ Friend or someone else (i.e. word of mouth) (4)
 - ☐ Professional organization (5)
 - ☐ Colleague at my company (6)
 - ☐ Website(s) (7)
 - ☐ Other (please specify): (8) _____

Answer If 80 PLUS 80 PLUS is a certification for power supplies fo... Somewhat familiar Is Selected Or 80 PLUS 80 PLUS is a certification for power supplies fo... Very familiar Is Selected

- Q101 Which source of information about 80 PLUS was most influential? Please select one source.



If How have you learned about 80 PLUS, and what was the most... System integrator (please specify company): Is Selected

☐ System integrator (1)

If How have you learned about 80 PLUS, and what was the most... Power supply manufacturer (please specify brand): Is Selected

☐ Power supply manufacturer (2)

If How have you learned about 80 PLUS, and what was the most... Computer brand (please specify brand): Is Selected

☐ Computer brand (3)

If How have you learned about 80 PLUS, and what was the most... Friend or someone else (i.e. word of mouth) Is Selected

☐ Friend or someone else (i.e. word of mouth) (4)

If How have you learned about 80 PLUS, and what was the most... Professional organization Is Selected

☐ Professional organization (5)

If How have you learned about 80 PLUS, and what was the most... Colleague at my company Is Selected

☐ Colleague at my company (6)

If How have you learned about 80 PLUS, and what was the most... Website(s) (please specify website) Is Selected

☐ Website(s) (7)

If How have you learned about 80 PLUS, and what was the most... Other (please specify): Is Selected

☐ Other: \${q://QID94/ChoiceTextEntryValue/8} (8)

Answer If 80 PLUS 80 PLUS is a certification for power supplies fo... Somewhat familiar Is Selected Or 80 PLUS 80 PLUS is a certification for power supplies fo... Very familiar Is Selected

Q95 You indicated that a \${q://QID101/ChoiceGroup/SelectedChoices} was your most influential source of information about 80 PLUS. Which of these 80 PLUS benefits - if any - did the \${q://QID101/ChoiceGroup/SelectedChoices} mention? Please select all that apply.



- ☐ Energy cost savings (1)
- ☐ Lower building cooling loads (2)
- ☐ Peak demand reduction (3)
- ☐ Improved power quality (allows more computers on each branch circuit) (4)
- ☐ Construction savings by preventing need for electrical system upgrades (5)
- ☐ Increased system reliability (6)
- ☐ Decreased system maintenance costs (7)
- ☐ Lower warranty cost (8)
- ☐ Lower total cost of ownership (9)
- ☐ Quieter office environment (10)
- ☐ Environmentally friendly (11)
- ☐ Other, specify: (12) _____

Answer If 80 PLUS 80 PLUS is a certification for power supplies fo... Somewhat familiar Is Selected Or 80 PLUS 80 PLUS is a certification for power supplies fo... Very familiar Is Selected

Q96 Did any of the following offer your organization a special promotion or price discount for purchasing desktop computers with an 80 PLUS certified power supply?

	Yes (1)	No (2)	Don't know (3)
System integrator (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Power supply manufacturer (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Original equipment manufacturer (OEM) (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Answer If Thinking about all the desktop computers your organizatio... 100% Is Selected

8PAP1 Thinking about your organization's desktop computer purchasing practices in 2012, did your organization have a procurement requirement that all desktop computers purchased include an 80 PLUS power supply?

- ☐ Yes (1)
- ☐ No (2)
- ☐ Don't know (3)

Answer If Thinking about your organization's desktop computer purch... Yes Is Selected



8PAP2 Please identify the three most important reasons why your organization required the purchase of desktop computers with an 80 PLUS power supply. Please select three items.

- ☐ Energy cost savings (1)
- ☐ Lower building cooling loads (2)
- ☐ Peak demand reduction (3)
- ☐ Improved power quality (allows for more PCs on each branch circuit) (4)
- ☐ Construction savings by preventing need for electrical system upgrades (5)
- ☐ Increased system reliability (6)
- ☐ Decreased system maintenance costs (7)
- ☐ Lower warranty cost (8)
- ☐ Lower total cost of ownership (29)
- ☐ Quieter office environment (9)
- ☐ Environmentally friendly (10)
- ☐ Other (please specify): (11) _____

Answer If Thinking about your organization's PC purchasing practice... Yes Is Selected

8PAP3 Please describe any other reasons your organization required the purchase of desktop computers with an 80 PLUS power supply.

8PAP4 Thinking about the 80 PLUS desktop computers your organization purchased in 2012, please tell us about what percent met each 80 PLUS efficiency level. 80 PLUS certification includes five efficiency levels: Please ensure that your responses total to 100%. If you are not aware of the 80 PLUS level of some or all of your computer purchases, enter a number up to 100% for "Don't know." This row is included in your total.

- _____ 80 Plus Base 80% Efficient (1)
- _____ 80 Plus Bronze 85% Efficient (2)
- _____ 80 Plus Silver 88% Efficient (3)
- _____ 80 Plus Gold 90% Efficient (4)
- _____ 80 Plus Platinum 92% Efficient (5)
- _____ Don't know (6)

Answer If Thinking about the desktop computers your organization pu... Custom built Is Greater Than 0
And Thinking about all the desktop computers your organizatio... 100% Is Not Selected

8PAP5 Thinking about your organization's purchase of custom built desktop computers, about what percent had an 80 PLUS power supply?

- ☐ 0% (1)
- ☐ 1-10% (2)



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- ☐ 11-20% (3)
- ☐ 21-30% (4)
- ☐ 31-40% (5)
- ☐ 41-50% (6)
- ☐ 51-60% (7)
- ☐ 61-70% (8)
- ☐ 71-80% (9)
- ☐ 81-90% (10)
- ☐ 91-99% (11)
- ☐ 100% (12)
- ☐ Don't know (13)

Answer If Thinking about all the desktop computers your organizatio... 100% Is Not Selected

- 8PAP6 Do you expect the share of your desktop computer purchases with an 80 PLUS power supply in the next 1 to 2 years to...
- ☐ Increase (1)
 - ☐ Decrease (2)
 - ☐ Stay the same (3)
 - ☐ Don't know (4)

Answer If Thinking about all the desktop computers your organizatio... 100% Is Selected

- Q84 Do you expect the share of your desktop computer purchases with an 80 PLUS power supply in the next 1 to 2 years to...
- ☐ Decrease (1)
 - ☐ Stay the same - will continue to purchase 100% 80 PLUS (2)
 - ☐ Don't know (3)
- 8PAP6.1 Why do you expect your share of 80 PLUS desktop purchases to increase over the next few years?
- 8PAP6.2 Why do you expect your share of 80 PLUS desktop purchases to decrease over the next few years?
- 8PAP7 Thinking about your experience buying desktop computers in 2012, how did the cost of a computer with an 80 PLUS power supply compare to a computer with similar features but a less efficient power supply? The 80 PLUS computer cost . . .
- ☐ More (1)
 - ☐ The same (2)
 - ☐ Less (3)



☐ Don't know (4)

8PAP7.1 About how much more was the cost of the computer with an 80 PLUS power supply?

☐ Enter amount: \$ (1) _____

☐ Don't know (2)

8PAP7.2 About how much less was the cost of the computer with an 80 PLUS power supply?

☐ Enter amount: \$ (1) _____

☐ Don't know (2)

Answer If ENERGY STAR 100% Is Selected

ESAP1 Now a question about ENERGY STAR: In 2012, did your organization have a procurement requirement that all desktop computers purchased meet the ENERGY STAR standard?

☐ Yes (1)

☐ No (2)

☐ Don't know (3)

Answer If Thinking about your organization's desktop computer purch... Yes Is Not Selected

ESAP2 Please identify the three most important reasons why your organization purchased ENERGY STAR desktop computers. Please select three items.

☐ Energy cost savings (1)

☐ Lower building cooling loads (2)

☐ Peak demand reduction (3)

☐ Improved power quality (allows for more PCs on each branch circuit) (4)

☐ Construction savings by preventing need for electrical system upgrades (5)

☐ Increased system reliability (6)

☐ Decreased system maintenance costs (7)

☐ Lower warranty cost (8)

☐ Lower total cost of ownership (9)

☐ Quieter office environment (10)

☐ Environmentally friendly (11)

☐ Other (please specify): (12) _____

ESAP3 Please describe any other reasons your organization purchased ENERGY STAR desktop computers.

Answer If ENERGY STAR 100% Is Not Selected



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- ESAP4 Now a question about ENERGY STAR: Keeping in mind that the ENERGY STAR specification will become more stringent in October 2013, do you expect the share of ENERGY STAR desktop computers you purchase in the next 1 to 2 years to...
- ☐ Increase (1)
 - ☐ Decrease (2)
 - ☐ Stay the same (3)
 - ☐ Don't know (4)

Answer If ENERGY STAR 100% Is Selected

- Q85 Keeping in mind that the ENERGY STAR specification will become more stringent in October 2013, do you expect the share of ENERGY STAR desktop computers you purchase in the next 1 to 2 years to...
- ☐ Decrease (1)
 - ☐ Stay the same - will continue to purchase 100% ENERGY STAR (2)
 - ☐ Don't know (3)
- ESAP5 Thinking about your experience buying desktop computers in 2012, how did the cost of an ENERGY STAR desktop computer compare to a desktop computer with similar features that was not ENERGY STAR? The ENERGY STAR PC cost is. . .
- ☐ More (1)
 - ☐ The same (2)
 - ☐ Less (3)
 - ☐ Don't know (4)
- ESAP5.1 About how much more was the cost of the ENERGY STAR desktop computer?
- ☐ Enter amount: \$ (1) _____
 - ☐ Don't know (2)
- ESAP5.2 About how much less was the cost of the ENERGY STAR desktop computer?
- ☐ Enter amount: \$ (1) _____
 - ☐ Don't know (2)
- 8PANP1 Why didn't your organization buy any desktop computers with 80 PLUS power supplies in 2012? Please select all that apply.
- ☐ Higher cost than we were willing/able to pay (1)
 - ☐ Not available from our supplier (2)
 - ☐ Not available at the time we needed them (3)
 - ☐ I was not convinced of the benefits (4)
 - ☐ Someone else at our organization was not convinced of the benefits (5)
 - ☐ Couldn't get other features we wanted AND an 80 PLUS power supply (6)



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- ☐ We were focused on other energy efficiency priorities (7)
- ☐ Other (please specify): (8) _____

8PANP2 Please explain why your organization didn't buy any desktop computers with 80 PLUS power supplies.

8PANP3 Do you expect the share of your desktop computer purchases with an 80 PLUS power supply to change in the next 1 to 2 years?

- ☐ Increase (1)
- ☐ Stay the same (2)
- ☐ Don't know (3)

8PANP3.1 Why do you expect your share of 80 PLUS desktop purchases to increase over the next few years?

ESANP1 Why didn't your organization buy any ENERGY STAR desktop computers in 2012? Please select all that apply.

- ☐ Higher cost than we were willing/able to pay (1)
- ☐ Not available from our supplier (2)
- ☐ Not available at the time we needed them (3)
- ☐ I was not convinced of the benefits (4)
- ☐ Someone else at our organization was not convinced of the benefits (5)
- ☐ Couldn't get other features we wanted AND an it be ENERGY STAR certified (6)
- ☐ We were focused on other energy efficiency priorities (7)
- ☐ Other (please specify): (8) _____

ESANP2 Please explain why your organization didn't buy any ENERGY STAR desktop computers.

ESANP3 Keeping in mind that the ENERGY STAR specification will become more stringent in October 2013, do you expect the share of ENERGY STAR desktop computer purchases to change in the next 1 to 2 years?

- ☐ Increase (1)
- ☐ Stay the same (2)
- ☐ Don't know (3)



80-PLUS QUESTIONS FOR COMPUTER OEMS

Thank you for taking the time to answer these questions about the 80 PLUS program. We are conducting this research on behalf of the Northwest Energy Efficiency Alliance (NEEA), one of the sponsors of the 80 PLUS program. Our findings will help NEEA and other funders better understand the market for power supplies and support the 80 PLUS program to further increase the adoption of efficient power supplies. All of the information you provide us is confidential. In our report to NEEA, we will aggregate the information you provide us with our findings from interviews with other computer manufacturers, and we will not report anything in any way that would identify you as the source. If you have any questions about our research, please contact me at 503-287-9136 or Joe.VanClock@researchintoaction.com.

80-PLUS Market Penetration

First, we are trying to estimate market penetration for 80 PLUS power supplies. Our approach is to create an estimate based on information from computer OEMs like you.

1. What proportion of the desktop PCs you ship include an 80 PLUS power supply? What percent are ENERGY STAR? How does that break down between PCs you ship directly to commercial customers as opposed to selling through retail?

Please fill in the table below

EE Cert	% SKUs	% Shipments - Total	% Shipments - Commercial	% S - retail
80+ Base				
80+ Bronze				
80+ Silver				
80+ Gold				
80+ Platinum				
ENERGY STAR				

2. How do you think the share of 80 PLUS desktop PCs that you ship will change over the next few years?
 - a. What is driving that change?
3. How do you think the share of ENERGY STAR desktop PCs you ship will change over the next few years?



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- a. When the Version 6.0 ENERGY STAR specification comes into effect next October, the criteria will become more stringent. Do you expect that the new specification will impact the number of PCs you ship with 80 PLUS power supplies? How?

Commercial Customers and Energy Efficiency

Next we have a few questions about how your commercial customers approach their PC purchases. If you do not have enough interaction with commercial customers to answer these questions, skip to the next section.

4. Thinking of your commercial customers, what factors would you say are most important to them when they're buying desktop PCs?
 - a. Is energy efficiency a consideration?
 - b. [If so,] What do your commercial customers value about energy efficient PCs? That is, what type of benefits are they expecting when they buy efficient PCs?
5. What about Acer, do you actively market energy efficiency to your customers?
 - a. [If so,] What benefits of efficiency do you include in your marketing?
 - b. [If so,] Are the benefits of 80 PLUS power supplies other than energy savings important enough that you could sell PCs with 80 PLUS power supplies without mentioning energy savings?
6. What proportion of your commercial customers are aware of 80 PLUS? All, most, some, only a few, none
7. What proportion of your commercial customers are aware of ENERGY STAR? All, most, some, only a few, none
8. About what percent of commercial customers include energy efficiency requirements or specifications along with their technical specs when they buy desktop PCs from you?
 - a. Of the customers who specify efficiency, what percent require ENERGY STAR?
 - b. What percent require 80 PLUS, if any?
 - i. What 80 PLUS level do they typically require? Base, bronze, silver, gold, platinum



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- c. What types of customers typically specify energy efficient PCs generally?
- d. What types of customers typically specify 80 PLUS specifically?

Computer OEMs and Energy Efficiency

We have a few questions about how your business works in relation to energy efficiency and power supplies.

- 9. Does Acer have a preference for the number of power supply SKUs that you use? For example, do you try to deal with as few total power supply SKUs as possible, and thus use the same power supply in multiple PC models?
- 10. Do power supply manufacturers use 80 PLUS as a selling point when they are promoting power supplies to Acer?
 - a. [If so,] What types of benefits do they mention regarding 80 PLUS?
- 11. What about Acer – how, if at all, do you benefit when you use energy efficient power supplies in your PCs?
 - a. Which benefits are most important?
- 12. How much more do 80 PLUS power supplies cost you to buy than standard power supplies, on a per-unit basis? How does that cost vary with the different 80 PLUS levels? How much of that cost is passed on to the consumer?

Please fill out the table below:

80 Plus Level	Incremental Cost to Acer	Incremental Cost to End-User
Base		
Bronze		
Silver		
Gold		
Platinum		

- a. Do you buy enough 80 PLUS power supplies to receive a volume discount from the manufacturer?



13. How has the cost of 80 PLUS power supplies changed relative to standard power supplies over the last few years?
 - a. What influenced that change?
 - b. Did that change apply to all 80 PLUS levels?
14. What changes are you seeing in the market share of computer OEMs?
15. Are we correct in assuming that when a new, energy efficient power supply is introduced, it typically goes into high-end PCs first?
 - a. [If so,] How long does it take for the cost of a new power supply to decrease enough that it becomes common in mid-range computers?
 - b. How long after it is introduced would you expect the cost of a new power supply to become common in low-end computers?
 - c. How, if at all, has the amount of time it takes for new, efficient power supplies to move from high-end to mid-range and low-end PCs changed over the past few years?

General/Closing

Finally, we just have a few general questions for you about 80 PLUS.

16. What else can the 80 PLUS program do to increase adoption of efficient power supplies?
17. Looking back, is there anything you think the program could have done differently that would have helped increase adoption of efficient power supplies?
18. According to our records, Acer does not participate in the 80 PLUS program, meaning you don't report sales of desktop PCs with 80 PLUS power supplies to Ecova for a per-unit incentive. The incentive is offered in Oregon, Colorado, Minnesota, and New Mexico. Why aren't you reporting 80 PLUS sales?
19. What would need to happen for you to report your 80 PLUS sales in the future?

Thank you for your responses. We have one more request. We are interested in finding out how many of the desktop PCs currently on the market that don't meet the current ENERGY STAR specifications (Version 5.2) would have met the previous specification (Version 4.0). Would it be possible for you to provide us with energy consumption information for all of the desktop PCs



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you produce? Also, what proportion of the desktop PCs you sold in 2012 would have met the Version 4.0 ENERGY STAR specification?



80-PLUS QUESTIONS FOR POWER SUPPLY MANUFACTURERS

Thank you for taking the time to respond to these questions about the 80 PLUS program. We are conducting this research on behalf of the Northwest Energy Efficiency Alliance, one of the sponsors of the 80 PLUS program. Our findings will help NEEA and other funders better understand the market for power supplies and support the 80 PLUS program to further increase the adoption of efficient power supplies. If you have any questions about your research, please contact me at 503-287-9136 or Joe.VanClock@researchintoaction.com.

Production of 80-PLUS Power Supplies

1. How many power supply SKUs does your company make, in total?
2. What proportion of the power supply SKUs your company manufactures are:

80 PLUS Level	Percent of Power Supply Models
Base	
Bronze	
Silver	
Gold	
Platinum	

- a. Do you make any power supplies that are at least 80% efficient, but NOT tested and certified as 80 PLUS? If so, why?
 - b. What motivates you to make efficient power supplies?
3. How has the number of power supplies you submit for 80 PLUS certification at each level changed over the last few years, and why?

80 Plus Level	Number Certified in 2012 (More, fewer, about the same)	Reason for change
Base		
Bronze		
Silver		
Gold		
Platinum		



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- a. Overall, has the number of power supply SKUs you make changed over the last few years? If so, why?
4. Now, thinking about your total sales, what percent of all the power supplies you sell are 80 PLUS certified?

80 Plus Tier	Proportion of Sales
Base	
Bronze	
Silver	
Gold	
Platinum	

5. What changes have you seen in sales of 80 PLUS power supplies relative to the other power supplies you sell, over the past few years?
 - a. What do you think is driving those trends?
6. Thinking about the power supplies you sell that are NOT 80 PLUS, why do customers chose those instead of an 80 PLUS model?
 - a. If these barriers removed, would your company produce ONLY 80 PLUS power supplies?
 - i. If not, what proportion of your power supply sales will NEVER meet the 80 PLUS standard, and why?

ENERGY STAR and Market Trends

7. How, if at all, do you think the new (Version 6.0) ENERGY STAR specification, which comes into effect in October, will impact the market for power supplies, and 80 PLUS units specifically?
8. Is your company planning to make any changes to your power supply product offerings in response to the new ENERGY STAR specifications?
9. What other factors do you anticipate will influence the power supply market over the next few years?



- a. How do you anticipate that will impact the market share of 80 PLUS power supplies?
- 10. How long does it take to bring a new power supply model to market, including design, testing, production, etc.?
- 11. How long does it typically take for a new, energy efficient power supply to become widely adopted in the market?
 - a. What influences that timing?
- 12. What changes are you seeing in the market share of computer OEMs?

Benefits and Promotion

- 13. Beyond energy efficiency, what are the benefits of 80 PLUS power supplies? Please indicate which ones are most important to you, and which ones are most important to the computer OEMs and system integrators who purchase your power supplies.

Factor	Important to Power Supply Manufacturer	Important to Computer OEMs and System Integrators
Energy cost savings		
Lower building cooling loads		
Peak demand reduction		
Improved power quality (allows for more PCs on each branch circuit)		
Construction savings by preventing need for electrical system upgrades		
Increased system reliability		
Decreased system maintenance costs		
Lower warranty cost		
Lower total cost of ownership		
Quieter office environment		
Environmentally friendly		
Other		



14. Do you use 80 PLUS certification as a selling point in promoting power supplies to your customers?
- If not, why not?
 - If so, how do you promote 80 PLUS?
 - Do you offer any special offers or special pricing?
 - Are customers receptive to your promotion of 80 PLUS?
15. Do you promote benefits of 80 PLUS power supplies OTHER THAN energy savings to computer OEMs or system integrators?
- If so, which benefits do you focus on?
 - How do you promote those benefits? (For example, in sales pitches, catalog descriptions, on websites, etc.).
16. How important are benefits other than energy savings in computer OEM and system integrators' decisions to use 80 PLUS power supplies?

Incremental Cost

17. How much more do base 80 PLUS power supplies cost you to produce than less efficient power supplies, on a per unit basis, and how much more expensive are they to your customers?

80 Plus Level	How much more they cost you to produce	How much more they cost your customers to buy
Base		
Bronze		
Silver		
Gold		
Platinum		

- Are 80 PLUS power supplies more or less profitable than other models?
 - Why is that?



18. How has the cost to produce 80 PLUS power supplies changed over the last few years?

Program Feedback

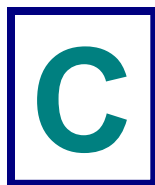
19. What else can the 80 PLUS program and sponsors like NEEA do to further influence the market to adopt more efficient power supplies?

20. Looking back, what, if anything, could the 80 PLUS program have done differently that would have helped increase adoption of efficient power supplies?



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APPENDIX C: IN-DEPTH INTERVIEW FINDINGS

We conducted interviews by phone, took detailed notes, and recorded the interviews when respondents' permitted. For our analysis of the data we used NVivo software to thematically code the interviews. The results of that process are summarized here, according to key themes that arose from the interviews with relevance to NEEA's research questions. Table 9 summarizes the completes by population.

Table 9: Completed Interviews Compared to Goal

	Completes	Goal
OEMs	4	5
PSMs	4	5
SIs	5	5
Total	13	15

FINDINGS

80-PLUS Penetration

80 PLUS penetration is high among *most* SIs and OEMs and is expected to increase. The interviewed SIs typically reported using 80 PLUS power supplies in approximately 90% of the PCs they build, although one reported that all of their PCs were 80 PLUS. OEMs reported using a slightly lower proportion of 80 PLUS power supplies – with two reporting that 60-80% of their PC sales were 80 PLUS and a third reporting 100%. Consistent with this assessment, two PSMs reported that more than 90% of the power supply models they produce are 80 PLUS and a third reported that more than half are 80 PLUS. All of the OEMs and two of the SIs expected the proportion of 80 PLUS PCs they sell to increase in the next few years. The two additional SIs expected the proportion of 80 PLUS PCs they sell to remain constant, but anticipated that the proportion of PCs they sell at higher 80 PLUS tiers would increase.

Yet a few SIs and OEMs report low 80 PLUS penetration. In contrast to the high penetration of 80 PLUS PCs that most OEMs and SIs reported, one of the two leading OEMs and one SI reported selling much lower proportions of 80 PLUS PCs. The OEM reported that only between 20% and 25% of their PC sales were 80 PLUS, while the SI reported that his company had recently stopped offering 80 PLUS power supplies due to customers' unwillingness to pay the incremental cost after the economic downturn. One PSM also reported that only 18% of their power supply models are 80 PLUS – a much lower proportion than other interviewed PSMs.

Most of the 80 PLUS power supplies sold are at the bronze level, with higher levels typically used only in power PCs. The majority of the 80 PLUS PCs that OEMs produce also



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meet ENERGY STAR, and thus use at least 80 PLUS bronze power supplies. Two SIs also reported that the majority of the 80 PLUS power supplies they use are bronze and a third reported that approximately half are bronze. Consistent with these findings, three of the four interviewed PSMs reported that the majority of their 80 PLUS power supply models were certified at the base and bronze tiers. Two OEMs and two SIs reported that they primarily use higher-level 80 PLUS power supplies in higher-end power PCs. One OEM reported using only 80 PLUS gold power supplies, stating that gold was the highest level that was cost effective given the incremental costs and energy savings available. All of the interviewed PSMs reported that, following base and bronze, the next largest number of power supplies they produce were 80 PLUS gold.

Incremental cost is the only barrier to increased adoption of 80 PLUS power supplies cited by OEMs and SIs. OEMs reported they face a great deal of competition on price, and stated that some customers are not willing to pay a higher incremental cost for 80 PLUS, even if doing so would reduce lifecycle costs. One OEM stated that as incremental costs for 80 PLUS power supplies decrease, she expects that adoption will increase. Another OEM reported that without an incremental cost difference all of their PCs would include an 80 PLUS power supply.

80-PLUS and ENERGY STAR

ENERGY STAR requirements are a driver of 80 PLUS adoption for general purpose PCs, while non-energy benefits are more important for power PCs. All of the interviewed OEMs reported that all or nearly all of the 80 PLUS PCs they sell are also ENERGY STAR qualified. One contact explained that, as other components – particularly processors – have become more efficient, PCs with 80 PLUS power supplies have become increasingly likely to meet the remaining ENERGY STAR requirements. OEMs and SIs both reported they are unlikely to seek ENERGY STAR certification for custom-built systems, but stated that non-energy benefits like cooler operation and quieter fans may nonetheless drive them to install 80 PLUS power supplies in non-ENERGY STAR custom-built power PCs.

OEMs do not anticipate a major decline in shipments of ENERGY STAR PCs when the Version 6.0 specification takes effect in October, 2013. OEMs reported that they plan to continue to design PCs to meet the ENERGY STAR specification, with one noting specifically that they anticipate continued demand for ENERGY STAR PCs from business customers.

80-PLUS Awareness and Promotion

80 PLUS awareness is highest among large business and institutional PC buyers, but all end-users have greater awareness of ENERGY STAR than 80 PLUS. Contacts at OEMs and SIs who work mostly with larger business customers stated that a majority of their commercial customers were aware of 80 PLUS, while SIs who typically work with smaller business customers reported lower end-user awareness of 80 PLUS. Consistent with end-user survey findings, both OEM and SI contacts reported that a greater proportion of end-users are aware of ENERGY STAR than 80 PLUS. According to one OEM contact, awareness of ENERGY STAR



“crosses over into their job because of the marketing [ENERGY STAR has] done on the consumer side” in appliances and other markets.

SIIs are more likely than OEMs to promote 80 PLUS directly to business end-users and use 80 PLUS logos in their marketing. OEMs described promoting energy efficiency as a PC feature generally, largely as part of their messaging around broader sustainability initiatives. OEMs do not typically post 80 PLUS logos or mention 80 PLUS by name on product detail pages on their websites, although they may mention energy efficiency generally or ENERGY STAR. In contrast, SIIs reported including 80 PLUS logos online on product detail pages and in printed marketing collateral.

Business end-user demand for efficient PCs motivates OEMs and SIIs to use 80 PLUS power supplies. One OEM contact stated that, by using 80 PLUS power supplies, “we are giving the customers the things they are asking for,” while another stated more bluntly, “If you don’t have energy efficient hardware, you don’t compete.” Consistent with this assessment, two SIIs reported that they had promoted 80 PLUS in order to differentiate themselves in the market, but were no longer able to do so as effectively because of their competitors had also begun offering 80 PLUS power supplies.

80 PLUS is a more important feature for power supplies sold through distributors or at retail than for those sold directly to the OEM, and this difference influences how PSMs approach efficient power supplies. Two of the interviewed PSMs focus more heavily on sales to OEMs, while the other two have a stronger focus on sales through retailers and distributors. These PSMs differ in their approach to efficient power supplies in a variety of ways:

- ➔ *The interviewed PSMs focused on the OEM market certify a lower proportion of their products as 80 PLUS and are more likely to produce efficient power supplies that are not certified.* As Table 10 shows, PSMs who focus on the retail and distribution channel reported that all or nearly all of their power supply models were 80 PLUS certified, while PSMs who focus on OEMs reported certifying a notably lower proportion of models. The two PSMs who primarily sell power supplies to OEMs also reported producing models that would qualify for 80 PLUS that they do not submit for testing. Both contacts noted that their OEM customers drive this decision and stated that not submitting models for testing allows them to offer lower prices by avoiding the costs and delays associated with testing.



Table 10: Proportion of Models Certified as 80 PLUS by PSM Distribution Channel Focus

PSM's Distribution Channel Focus	Percent of Power Supply Models Certified as 80 PLUS
Retail/SI	PSM 1: 100% PSM 2: 91%
OEM	PSM 3: 56%* PSM 4: 18%

* Interview contact refused to provide a proportion. The proportion listed is based on power supply models listed on PSM website.

- ➔ *PSMs focused on the retail and distributor markets promote 80 PLUS more heavily than those focused on direct sales to OEMs.* OEMs and large SIs typically specify the requirements they seek in a power supply unit and solicit bids from PSMs. As a result, the interviewed OEMs and larger SIs reported that they receive little marketing information from PSMs. However, two SIs noted that power supply manufacturers, particularly those that sell power supplies at retail, promote the 80 PLUS certification level of each of their models. Consistent with this finding, PSMs that focus more strongly on the retail market reported greater efforts to promote 80 PLUS than those focused on the OEM market.
- ➔ *80 PLUS power supplies are more profitable to PSMs when sold at retail and less profitable when sold to OEMs.* One PSM contact, who focuses on the retail market, stated that 80 PLUS power supplies, particularly those at higher 80 PLUS tiers, are more profitable for his company due to their higher sales price. In contrast, the two PSMs who focus more strongly on sales to OEMs stated that the competition for OEMs' business did not allow them to increase prices to cover the incremental costs to produce efficient units and certify them as 80 PLUS.

80 PLUS power supplies typically include other desirable features, in addition to efficiency.

Two SIs noted that power supplies that receive 80 PLUS certification, particularly at the higher efficiency tiers, are typically higher-end units that include other desirable features, in addition to efficiency. For example, one PSM contact reported that 80 PLUS Gold power supplies may have modular connections, making it possible to unclip the wires and remove the power supply, a higher quality fan, better voltage regulation, and the ability to operate at higher temperatures. This contact stated that it would be unlikely for a PSM to include these features in a model that did not qualify for higher 80 PLUS tiers. According to this contact, "It would be a hard sell, because people see the 80 PLUS base logo, and even if you have all the other features, they wouldn't consider it anymore."

SIs associate the 80 PLUS brand with quality, and this association supports the value proposition they offer to customers.

Four of the five interviewed SIs reported that the manufacturers producing 80 PLUS power supplies tend to be the most reputable and that efficient power supplies typically feature higher quality construction and materials. According to



one SI, “80 PLUS is on all the high quality equipment...if I saw something that wasn’t 80 PLUS, I would just assume it was crap quality.” Another SI noted that the high quality of 80 PLUS power supplies supports his company’s value proposition of offering customers higher quality products and better support than larger OEMs.

Power Supply Purchasing Practices

OEMs and SIs seek to simplify their power supply purchasing as much as possible. OEMs and SIs must carry a sufficient variety of power supplies to meet the needs of all the form factors and system configurations they offer. Beyond this requirement, however, respondents described efforts to simplify their power supply purchasing. For example, one OEM reported offering only 80 PLUS Gold and standard efficiency power supplies in order to simplify both their supply chain and their offerings to customers. Another SI reported purchasing a large number of units of a power supply model that the manufacturer was about to discontinue in order to delay the need to transition to a different product.






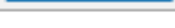

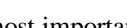
Incremental costs for 80 PLUS power supplies are higher for SIs than OEMs, but both groups report that incremental costs are decreasing. OEMs’ estimates of the incremental cost of an 80 PLUS power supply over a standard power supply ranged from \$2 to \$10, although the OEM estimating a \$10 incremental cost does not install 80 PLUS power supplies below the Gold level. SIs’ estimates of incremental cost ranged from \$10 to \$30, but contacts noted that the additional features typically bundled with higher efficiency power supplies could drive the cost as much as \$80 above a standard efficiency power supply. Consistent with this finding, PSMs who primarily sell through retail and to SIs reported charging higher prices for higher tier 80 PLUS power supplies than a PSM contact who primarily sells to OEMs. This contact reported that the PSM absorbs a portion of the incremental cost. OEMs, SIs, and PSMs reported that the incremental cost of 80 PLUS power supplies had declined recently as demand for the units grows.

Assessment of End-user Approach to PC Purchasing

OEMs and SIs differ in their assessment of the factors businesses consider when purchasing PCs in ways that reflect their distinct business models. While the three OEMs providing data most often cited upfront costs and total cost of ownership as factors customers consider, SIs more often cited performance, reliability, and the ongoing warranty, maintenance, and support services available (Table 11). This distinction is consistent with SIs’ business models. SIs reported that they seek to distinguish themselves from OEMs by offering higher performance, higher quality, and better support. According to one SI, “There is a value added, instead of going to [an OEM] and ordering a machine. Our customers tend to be more concerned about quality; they want a custom built machine, they want service. Cost isn’t a factor for some of our customers.”



Table 11: Factors Considered in PC Purchases

Factor	Group	Count	Proportion
Upfront cost	OEM (n=3)	3	
	SI (n=5)	2	
Total cost of ownership	OEM (n=3)	2	
	SI (n=5)	0	
Energy efficiency	OEM (n=3)	1	
	SI (n=5)	0	
Performance	OEM (n=3)	1	
	SI (n=5)	4	
Reliability	OEM (n=3)	0	
	SI (n=5)	3	
Warranty/Maintenance/Support	OEM (n=3)	0	
	SI (n=5)	3	

Question text: “Thinking of your commercial customers, what factors would you say are most important to them when they’re buying desktop PCs?”

OEMs and SIs identified three types of commercial customers that are likely to consider energy efficiency in PC purchases:

- ➔ *Government and education organizations*, many of which have mandates to purchase equipment that meets environmental or energy efficiency standards.
- ➔ *Large corporate customers, particularly those with sustainability policies*. One OEM reported that an increasing number of large companies have corporate sustainability policies that influence their PC purchasing decisions. Contacts also noted that companies purchasing large numbers of PCs can more easily achieve an attractive return on their investment in more efficient computers.
- ➔ *What one SI described as “more academically focused businesses” like architecture and law firms*. Contacts reported that efforts to achieve environmental certifications that could improve their position when bidding for work might motivate these customers to purchase efficient PCs.

OEMs and SIs see energy cost savings as the primary motivator for customers seeking efficient PCs, followed by environmental benefits commercial customers can use in their marketing. Both of the OEM contacts that mentioned customer motivations for purchasing efficient PCs stated that cost savings were the primary consideration. However, contacts also noted that customers often used their efficient purchasing practices in marketing to showcase their organizations’ sustainability efforts.





APPENDIX D: E-MAIL SURVEY FINDINGS

We used a third-party panel provider, Research Now, to obtain IT decision-makers. We fielded survey invitations by email and IT decision-makers completed the survey online. The survey was fielded from February 14 to March 6, 2013.

Table 12 presents a summary of data collected.

Table 12: Data Collection Summary

Business Population	Complete Surveys (% of Total Entrants)	Screen-Outs (% of Total Entrants)	Total *
Small/Medium 50-999 employees	68 (36%)	122 (64%)	190
Large 1,000 or more employees	51(34%)	97 (66%)	148
Total 50 or more employees	119 (35%)	219 (65%)	338

*All IT decision-makers to enter and exit the survey, either by completing or screening out.

BUSINESS AND IT DECISION-MAKER CHARACTERISTICS

Table 13 and Table 14 summarize characteristics of the IT decision-makers businesses.

Table 13: Business Characteristics

Population	Business Type		Most Common Industries (By NAICS Code)			
	For-profit	Non-profit	Manu-facturing	Health-care	Wholesale / Retail	Prof., Sci., & Tech. Services
Small/Medium Businesses 50-999 employees	88%	12%	18%	10%	10%	10%
Large Businesses 1,000 or more employees	86%	14%	10%	18%	14%	12%
Weighted Total 50 or more employees	88%	22%	17%	10%	10%	10%



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Table 14: Business Size

Number of Employees	Percent of Total It Decision-Makers (Weighted)
50-99	27%
100-499	55%
500-999	14%
1,000-1,999	1%
2,000-4,999	1%
5,000-9,999	1%
10,000 or more	2%
Total	100%

Table 15 summarizes characteristics of the IT decision-makers.

Table 15: IT Decision-Maker Characteristics

Population	Years In Position			IT Decision-Making Responsibilities		
	Min	Max	Mean	Sole decision-maker	Make final decision based on input	Help reach final decision as part of a group
Small/medium businesses 50-999 employees	1	20 or more	9	9%	30%	62%
Large businesses 1,000 or more employees	1	20 or more	10	20%	33%	47%
Weighted Total 50 or more employees	1	20 or more	10	9%	30%	61%

DESKTOPS VERSUS LAPTOPS

On average, businesses used more desktops than laptops, and small/medium businesses reported using a bigger proportion of desktops than large businesses. Small/medium businesses reported that nearly three-quarters (72%) of their computers were desktops or workstations (compared to 61% of computers at large businesses).

Large businesses were more likely to employ network power management than small/medium businesses. Three-quarters of large businesses reported using networking power management software, compared to half (47%) of small/medium businesses.

PC replacement rates did not differ between large and small/medium businesses. IT decision-makers reported replacing nearly a quarter (24%) of both laptops and desktop PCs in 2012. On average, small companies replaced 23% of their PCs (median of 20%) and large



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companies replaced 26% of their PCs (median of 20%). This replacement rate was higher than the national average (including both commercial and residential PCs), which was 11% in 2011.²⁰

In 2012, desktops accounted for more than half of businesses' new computer purchases, and small/medium businesses purchased more desktops than large businesses. On average, over half of PCs (57%) purchased in 2012 were desktop PCs (median of 66%). Small/medium businesses reported that 58% of their purchased PCs in 2012 were desktops (median of 67%) and large companies reported 51% of purchased PCs were desktops (median of 50%).

PC PURCHASES

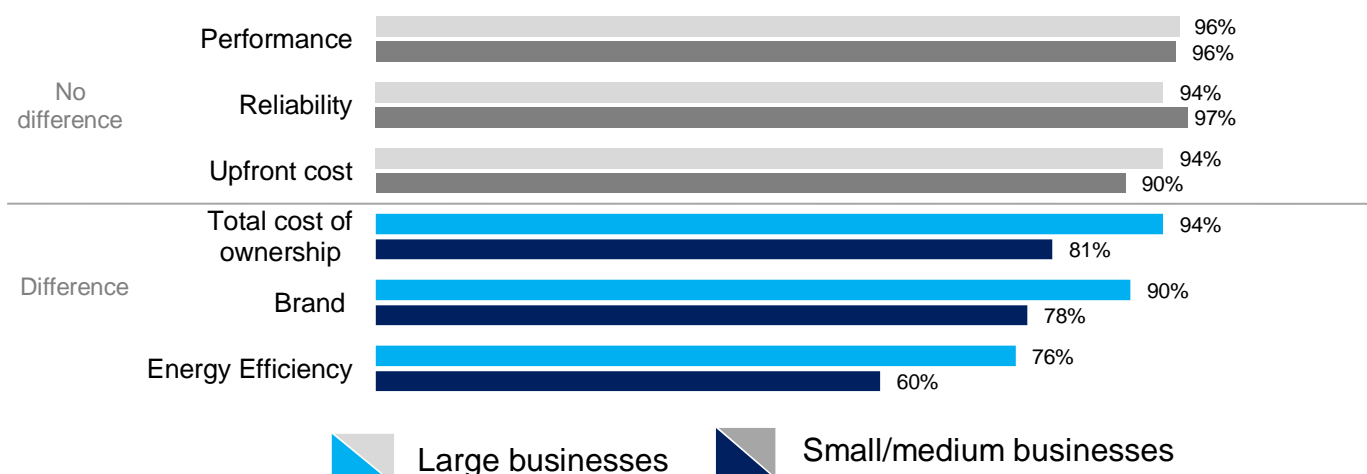
In 2012, the typical business desktop PC purchase was a general-purpose computer purchased “off-the-shelf” from a major computer brand. Over three-quarters of PCs purchased in 2012 were for general business tasks like word processing, financial software, email, and the internet. About half of the purchased PCs were “off-the-shelf” and half were customized by the buyer. Businesses purchased three-quarters of their desktop PCs direct from major brands such as Dell or HP. System integrators accounted for an average of 3% of desktop purchases and retailers accounted for 15%.

Businesses considered several factors when making desktop PC purchase decisions, including energy efficiency. Nearly all businesses reported considering performance, reliability, and upfront cost in their purchase decisions (Figure 12). Large businesses were more likely than small/medium businesses to consider total cost of ownership as a factor (94% and 81%, respectively). Energy efficiency was considered less often than the other criteria.

²⁰ Sameer Singh. February 19, 2013. “Tech-Thoughts” <http://www.tech-thoughts.net/2012/09/ios-android-pc-replacement-impact.html#.UUoZNzdOuBU>.



Figure 12: Factors IT Decision-Makers “Always” or “Sometimes” Considered in PC Purchasing Decisions

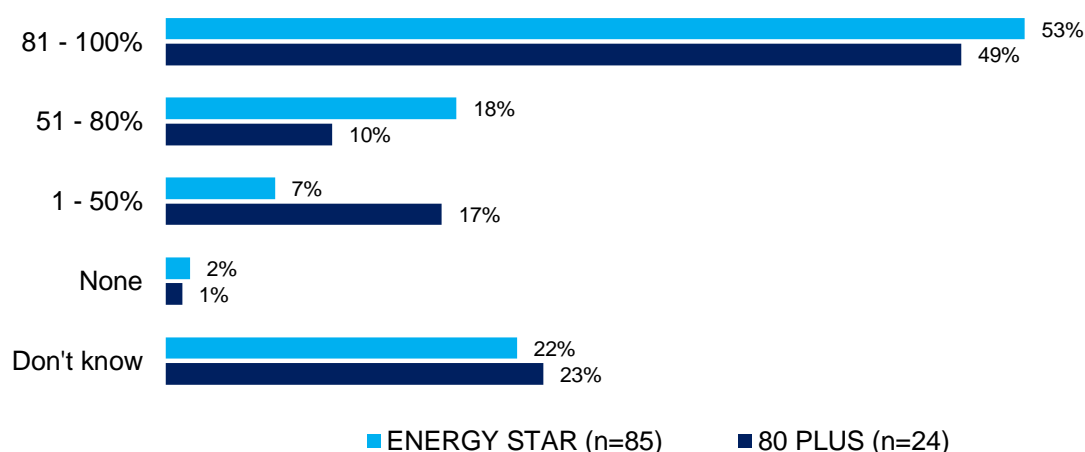


More large businesses have procurement requirements for PCs than small businesses, and more often than not this includes the requirement to purchase ENERGY STAR computers. Fifty-seven percent of large businesses have procurement requirements, compared to 38% of small/medium businesses. Of those businesses with procurement requirements and purchased at least one ENERGY STAR PC in 2012, more large businesses than small/medium businesses are required to purchase ENERGY STAR computers (62% and 53% respectively). *No businesses reported having a procurement requirement for 80 PLUS power supplies.*

Nearly all IT decision-makers who were aware of efficiency certifications reported purchasing a high proportion of PCs with those certifications. Of IT decision-makers who reported being aware of either ENERGY STAR (114 IT decision-makers) or 80 PLUS (27 IT decision-makers), only two *did not* purchase a PC with an 80 PLUS power supply and only one *did not* purchase any ENERGY STAR PCs. Approximately half of IT decision-makers reported between 81% and 100% of the computers they purchased in 2012 were 80 PLUS or ENERGY STAR qualified. However, nearly one-quarter of IT decision-makers did not know what percent of their purchases were ENERGY STAR or 80 PLUS certified (Figure 13).



Figure 13: Percent ENERGY STAR and 80 PLUS PCs Purchased by End-Users Aware of Each Certification, in 2012



IT decision-makers expected the proportion of their ENERGY STAR and 80 PLUS PC purchases to either stay the same or increase over the next few years. Over half of IT decision-makers (59%) reported that they expected their share of ENERGY STAR qualified PCs to stay the same over the next one to two years, with over one-third (37%) reporting that they expected the share to increase. Almost half of IT decision-makers (7 of 15) who had purchased 80 PLUS in 2012 said that they expect that share to increase over the next one to two years (with the remaining saying it would stay the same).

AWARENESS/KNOWLEDGE OF ENERGY EFFICIENCY, 80-PLUS, AND ENERGY STAR

Energy Efficiency

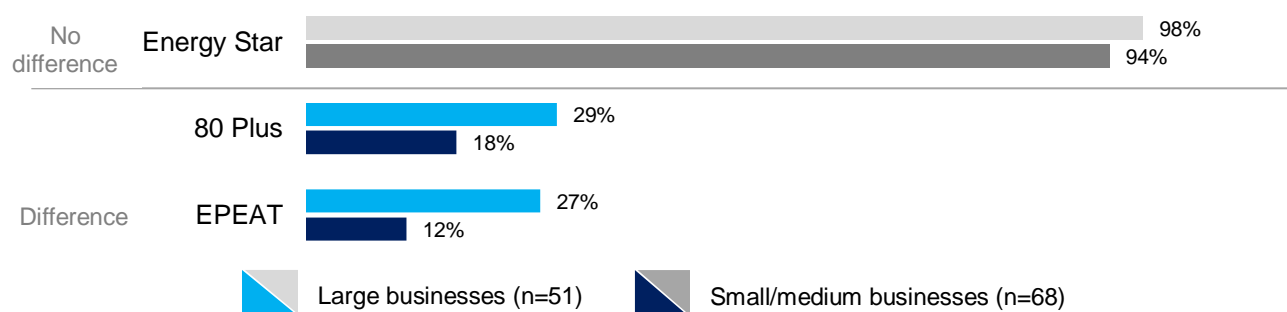
Nearly 90% of IT decision-makers correctly “agreed” with the statement that some internal power supplies are more efficient than others, but few correctly identified the annual cost savings. Large business IT decision-makers were almost twice as likely to correctly identify the annual savings from an efficient power supply as small/medium business IT decision-makers (29% compared to 15%). Most IT decision-makers *overestimated* annual savings.

The vast majority of IT decision-makers were familiar with ENERGY STAR but very few were familiar with 80 PLUS, and awareness was higher among large businesses. Nearly all large and small/medium business IT decision-makers reported being “very” or “somewhat” familiar with ENERGY STAR (98% and 94% respectively). Fewer IT decision-makers in each group had familiarity with 80 PLUS (29% and 18% respectively). Large business IT decision-makers demonstrated a higher rate of familiarity with 80 PLUS and EPEAT (Figure 14).



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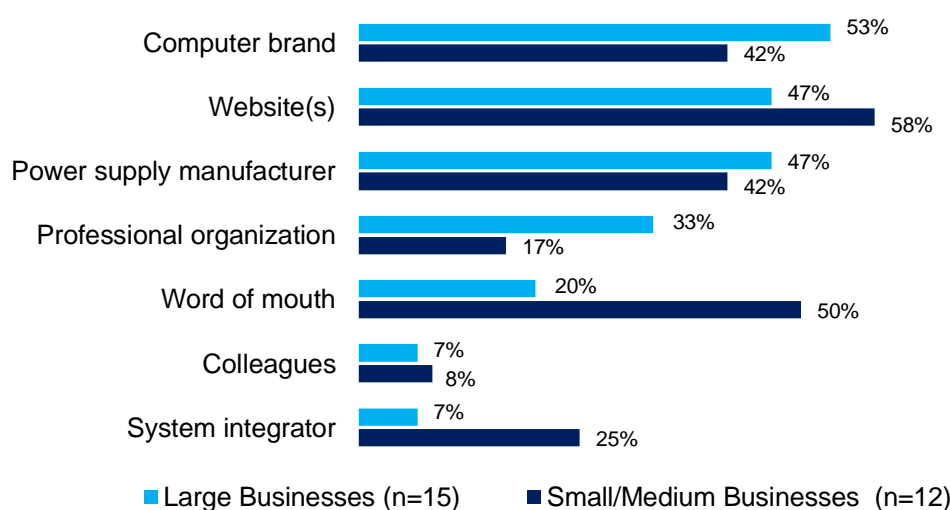
Figure 14: Percent of IT Decision-Makers Who Are “Very” or “Somewhat” Familiar with Three Energy Efficiency Certifications



80-PLUS

Websites were the most common source of awareness of the 80 PLUS program. Among IT decision-makers who reported familiarity with 80 PLUS, approximately half learned about it from a website (Figure 15). Computer brands and power supply manufacturers were the second and third most common sources of awareness. Small/medium businesses were more likely to report learning about 80 PLUS through word-of-mouth than large businesses (6 and 3 IT decision-makers respectively).

Figure 15: How IT Decision-Makers Learned About 80 PLUS (Multiple Responses Allowed)



When IT decision-makers were informed about 80 PLUS by their various sources of information, all of the benefits of 80 PLUS were noted by at least one IT decision-maker, with cost savings being the most frequently reported. Over three-quarters of both large and small/medium businesses (12 and 10 IT decision-makers, respectively) reported learning that



energy cost savings is a benefit of 80 PLUS (Table 16). The second most mentioned benefit varied between large and small/medium businesses: improved power quality for large businesses (9 IT decision-makers) and lower total cost of ownership for small/medium businesses (7 IT decision-makers).

Table 16: Benefits of 80 PLUS IT Decision-Makers Reported Learning about (Multiple Responses Allowed)

Benefits of 80 PLUS	Large (n=15)		Small/ Medium (n=12)	
	Count	Percent	Count	Percent
Energy cost savings	12	80%	10	83%
Lower total cost of ownership	7	47%	7	58%
Increased system reliability	7	47%	5	42%
Environmentally friendly	7	47%	5	42%
Quieter office environment	3	20%	5	42%
Decreased system maintenance costs	4	27%	5	42%
Improved power quality	9	60%	4	33%
Peak demand reduction	5	33%	4	33%
Lower building cooling loads	4	27%	3	25%
Lower warranty cost	6	40%	1	8%
Construction savings	5	33%	0	0%

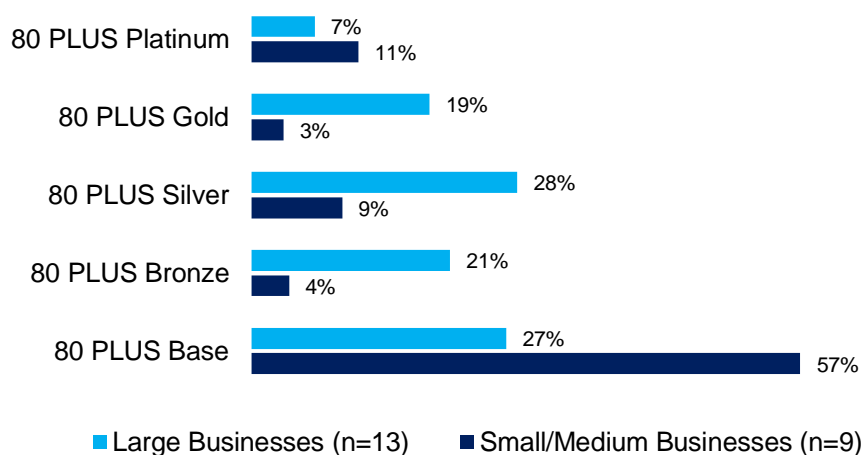
Note: Grey shading represents the factors most frequently mentioned by IT decision-makers. Statistical inferences are not advisable due to the small sample size.

Few IT decision-makers reported receiving promotional offers for PCs with 80 PLUS power supplies. Of those IT decision-makers who received promotional offers, system integrators were the most common source (4 mentions among large, 3 mentions among small/medium) followed by power supply manufacturers and computer brands (2 mention each).

Top-tier 80 PLUS power supplies make up a small proportion of PCs purchased in 2012. Among IT decision-makers who reported purchasing 80 PLUS power supplies in 2012, approximately one out of ten had a Platinum tier power supply (7% of large business PCs and 11% of small/medium business PCs). Over half of small/medium business PCs had an 80 PLUS Base power supply (compared to 27% of large businesses).



Figure 16: Average Percentage of 2012 Desktop PC Purchases, by 80 PLUS Tier (Aware IT Decision-Makers Only)



IT decision-makers did not perceive that PCs with 80 PLUS power supplies cost more.

Nearly all large businesses (85%) reported that PCs with 80 PLUS power supplies cost the same as those with less efficient power supplies. Over half of smaller businesses (56%) reported that PCs with 80 PLUS power supplies cost the same, with one-third reporting that they did not know the cost differential.

Cost savings was an important, but over-estimated factor in purchasing 80 PLUS power supplies. Nearly all IT decision-makers who were aware of 80 PLUS reported cost savings as a benefit of the certification. Half of large businesses (49%) reported that the yearly cost savings associated with a computer with an energy efficient power supply was between 24 and 40 dollars, with about one-third (29%) reporting the correct average cost savings (~\$6.40). Nearly one-third of small/medium businesses (31%) reported an average cost savings of \$40 per year (compared to 8% of large businesses), with less than one-fifth (15%) reporting the correct average savings.

ENERGY STAR

Similar to 80 PLUS, when IT decision-makers were informed about ENERGY STAR by their various sources of information, all of the benefits of ENERGY STAR were noted by at least one IT decision-maker, with cost savings being the most frequently reported. For businesses that did not have procurement requirements for ENERGY STAR, over half of large (57%) and small/medium businesses (65%) reported learning that energy cost savings is a benefit of ENERGY STAR PCs (Table 17). The second most commonly reported benefit of ENERGY STAR PCs was that they are environmentally friendly (large 43%, small 48%). Tied for second among large businesses was lower total cost of ownership (43%).



Table 17: Benefits of ENERGY STAR IT Decision-Makers Reported Learning about (Multiple Responses Allowed)

Benefits of 80 PLUS	Large (n=28)		Small/ Medium (n=31)	
	Count	%	Count	%
Energy cost savings	16	57%	20	65%
Environmentally friendly	12	43%	15	48%
Improved power quality	5	18%	11	35%
Lower total cost of ownership	12	43%	8	26%
Quieter office environment	5	18%	8	26%
Decreased system maintenance costs	5	18%	8	26%
Increased system reliability	3	11%	7	23%
Peak demand reduction	7	25%	2	6%
Lower warranty cost	4	14%	2	6%
Construction savings	1	4%	2	6%
Lower building cooling loads	8	29%	1	3%

Note: Grey shading represents the most frequently mentioned benefits by IT decision-makers. Statistical inferences are not advisable due to the small sample size.

IT decision-makers reported that that ENERGY STAR desktop PCs cost about the same to purchase as non-ENERGY STAR qualified PCs. Of IT decision-makers who purchased at least one ENERGY STAR desktop PC in the past 12 months, approximately three-quarters of large (79%) and two-thirds of small/medium businesses (68%) reported that the cost of an ENERGY STAR PC was the same compared to as a non-ENERGY STAR PC.

NOTABLE DIFFERENCES BETWEEN LARGE AND SMALL/MEDIUM BUSINESSES

Large businesses were more sophisticated in their purchasing practices and decision-making. Large businesses were more likely to report total cost of ownership as “always” or “sometimes” factoring into their decision-making process around PCs and were significantly more likely have procurement requirements (57% of large, 38% of small/medium).

Large businesses were more knowledgeable about sustainability and more likely to employ network power management. When asked which of several sustainability practices their organizations employed, large business IT decision-makers reported employing an average of four sustainability practices, compared to an average of two practices reported by small/medium businesses. Large business IT decision-makers were also significantly more likely to be aware of 80 PLUS, EPEAT, and Green Grid or Climate Savers. Finally, three-quarters of large businesses reported using network power management software compared to half (47%) of small/medium businesses. Nearly 20% of small/medium businesses did not know if they used power management software, compared to just 10% of large businesses.



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April 30, 2014

80 PLUS Desktop Computer Duty Cycle Assumptions

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80 PLUS DESKTOP COMPUTER DUTY CYCLE ASSUMPTIONS

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1 Introduction

1.1 Brief history of 80 Plus Duty Cycle Assumptions

When the 80 PLUS® Initiative was conceived in 2004, the personal computer landscape was significantly different than the one we see today. Desktop computers still held the majority of sales, the U.S. EPA’s ENERGY STAR® program had not yet established requirements on idle mode power consumption, and power management was widely known to be ineffective in the enterprise setting. The typical commercial desktop was estimated to consume over 300 kWh per year, approximately three times as high as the best desktop designs available today.

From the onset, the 80 PLUS program developed a set of assumptions that drew heavily on Lawrence Berkeley National Laboratory (LBNL) research from the early 2000s on commercial “after hours” computer usage (Webber et al. 2001; Roberson et al. 2004). LBNL’s research indicated that power management was largely disabled in the corporate environment, resulting in significant amounts of idle and active mode usage even during nighttime periods.¹ As a result, the 80 PLUS program and NEEA’s associated ACE model attributed 63% of a computer’s duty cycle to active and idle modes. No time was attributed to sleep mode.

In 2010, NEEA refined 80 PLUS savings rate calculations including the duty cycle. Assumptions were brought further in line with the ENERGY STAR Version 5.0 (V5) program duty cycle, but the active/idle share of the duty cycle actually increased to 67%. Sleep mode was set at 5%, and the remainder of the duty cycle was ascribed to standby/off mode. Existing and legacy duty cycle assumptions from NEEA’s 80 PLUS ACE model are provided in Table 1 below.

Table 1: 80 PLUS ACE Model Assumptions

Vintage	Duty Cycle Percentage by Mode of Operation			
	Active	Idle	Sleep	Standby/Off
2010, first revision	7%	60%	5%	28%
2004, 80 PLUS inception	8%	55%	0%	37%

¹ IT departments needed to leave computers active after hours to maintain network connectivity, allowing for remote maintenance and to push software updates.

1.2 Trends and Market update

Since the mid-2000s, several trends have eroded the amount of time that desktop computers spend in idle and active modes:

- Greater user awareness of power management: educational efforts on the part of programs like ENERGY STAR as well as corporate sustainability initiatives have raised awareness of plug load energy use in general. A key plug load energy savings recommendation in corporate environments is to maintain aggressive power management settings on computers.
- Enterprise energy management software: corporate IT managers now have access to an array of power management tools that enable them to remotely establish standardized power management profiles across fleets of computers.² This potentially thwarts the efforts of individual users who might disable power management settings.
- Improved wake-on-LAN (WOL) support: the concept of WOL, which allows a sleeping computer to be woken by a special network request, has existed since the late 1990s. Support for the protocol in both hardware and software has matured to the point that the technology is effectively available in all computers. WOL is a key technology for computers in enterprise settings where central IT administrators may wish to gain access to a networked computer that is in a sleep state.

These trends, coupled with significant improvements in baseline desktop computer power consumption (e.g. reduced idle power, more efficient power supplies) and increased sales of notebook computers, are reducing the estimated annual energy consumption of individual computers — ironically, during a time when computers have become deeply entrenched in our economy and personal lives.

1.3 National Policy Update

State and federal regulators and program managers have also modified their duty cycle assumptions during the past decade to keep pace with the shifting computer landscape and to better reflect data gathered from field studies of computer usage (see following section). The two largest recent developments involve the ENERGY STAR program and the California Energy Commission. In June of 2013, ENERGY STAR adopted its Version 6.0 (V6) computer specification. V6 incorporates a duty cycle derived from a usage profile study conducted as part of the Ecma-383 standard (Ecma 2010), to be discussed in detail in the following sections. ENERGY STAR now assumes only 50% of computer usage in idle mode, 5% in sleep, and 45% in standby/off.

² Examples of such programs are available at http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_comm_packages.

The California Energy Commission (CEC) initiated an “invitation to participate” in May of 2013 to begin exploring the possibility of a Title 20 standard for personal computers. Stakeholders have largely advocated for a framework based on the ENERGY STAR program. We anticipate that, should the CEC pursue a computer standard, it would likely adopt a duty cycle that closely resembles the one used in ENERGY STAR V6.

2 Review of Existing Duty Cycle studies

In Table 2 below, we provide a summary of existing desktop computer duty cycle studies. Findings pertaining to notebook computers and residential duty cycles are excluded, as they are not the focus of this report. We discuss each study listed below in the following paragraphs.

Table 2. Summary of Desktop Computer Duty Cycle Studies in Commercial Buildings

	Year	Duty Cycle			Associated Program	Desktop Sample Size (Total Computers)	Commercial Building Type	Study Locations
		Active/Idle	Sleep	Standby/Off				
LBNL After-Hours Power Status of Office Equipment	2004	60%	4%	36%	80 PLUS ACE Model	1,453 (1,453)	Large, med. & small office, education, healthcare	US: San Francisco, Pittsburgh, Atlanta, Washington DC
Microsoft Power Transition Report	2008	41%	5%	54%	ENERGY STAR V5	37,388 (75,331)	Unknown	Unknown
Ecos Office Plug Load Field Monitoring Report for CEC	2008	43%	0%	57%		61 (87)	Office	California only
Ecma-383 Measuring the Energy Consumption of Personal Computing Products	2010	50%	5%	45%	ENERGY STAR V6	>500 (>500)	Intel, Lenovo, Lexmark, Sony	China, Europe, Japan, US
QDI Strategies, Inc. Thin Client Investigation for PG&E	2010	95%	1%	4%		91,000 (110,000)	Financial, healthcare, education, transactional business	US: Various cities
Cadmus PSE Power Management for RTF	2011	45%	2%	53%	RTF	314 (362)	Commercial, education, government	US: Northwest region

Note: Some studies delineated modes such as active, long idle, short idle, standby, off and/or disconnect. For simplicity in this table, we summarized modal duty cycle into three categories: Active/Idle, Sleep and Standby/Off.

2.1 LBNL After-Hours Power Status of Office Equipment

Commercial building survey data collected by LBNL provided the first estimate of computer duty cycles (Roberson et al. 2004). In a large study conducted from 2000 to 2003, LBNL evaluated afterhours power status of commercial office equipment to estimate energy use and the application of power management. Researchers visited commercial buildings after business hours and recorded the power states of office equipment. Among other office plug loads, data were collected from 1,453 desktop computers found in 12 commercial office, healthcare, and education buildings in San Francisco, Pittsburgh, Washington, DC, and Atlanta. Only 36% of the desktop computers surveyed were off during the night, while 60% remained on afterhours (the remaining four percent were in a sleep state). Power management was largely disabled in offices

visited by LBNL. Results from this study were the basis for the computer duty cycle assumptions in the first ACE model and 80 PLUS program savings estimates.

2.2 Microsoft Power Transition Report

Microsoft published an estimate of desktop computer duty cycle for ENERGY STAR during development of the V5 computer specification (Microsoft 2008). Collecting data from 37,388 desktops, researchers calculated the percentage of time spent in four ACPI power states on (S0), sleep (S3), hibernate (S4) and off (S5). Largely contradicting LBNL's findings, Microsoft reported desktop computers were on 41% of the time, off 54%, and otherwise in sleep mode. ENERGY STAR based its duty cycle assumption for the V5 specification (40% idle, 5% sleep, 55% off) on the Microsoft 2008 findings. Unfortunately, Microsoft did not report the location or market segment for the computers surveyed, so this duty cycle may reflect a mix of residential and commercial usage.

2.3 Ecos Office Plug Load Field Monitoring Report

In 2008 as part of the Public Interest Energy Research (PIER) program, Ecos performed a plug load field metering study in California commercial offices (Moorefield et al. 2011). To our knowledge, this was the first study to actually measure computer duty cycles in offices using power meters. Researchers installed meters on 61 desktop computers for two weeks to record power at one-minute intervals. Power data were analyzed to determine the amount of time computers spent active, idle, sleeping, in standby and disconnected. Desktop computers metered in this study spent 30% of the time active, 13.4% of the time idle (43.4% if active and idle are summed), 0.4% sleeping, and 57% of the time in a low-power standby/off mode, or disconnected from the mains. Field monitoring results from California offices corroborated findings from the Microsoft 2008 study, indicating that more desktop computers were being powered down at night than previously evaluated by LBNL.

2.4 Ecma-383 Measuring the Energy Consumption of Personal Computing Products

To establish a duty cycle representative of the “average” commercial user, Ecma International® performed a usage profile study as part of Standard 383 (Ecma 2010). The results are presented in an informative annex in Ecma-383. Power draw was measured at one-minute intervals over the course of a year on over 500 computers in large technology corporations (Intel, Lenovo, Lexmark, and Sony) in facilities located in China, Europe, Japan and the USA. Results were statistically aggregated into a single majority profile. Ecma separated the modes into off, sleep, long idle, and short idle. Idle computing time was delineated into short and long idle, with 35% of the time associated with the higher-power short idle, and 15% with long idle.³ Off mode accounted for 45% of the duty cycle, and the remaining 5% of the majority profile was attributed to sleep. ENERGY STAR adopted the Ecma-383 majority profile in the V6 computer specification.

2.5 QDI Strategies Thin Client Investigation

In 2010, QDI Strategies, Inc. conducted a large study on behalf of Pacific Gas & Electric (PG&E) to evaluate computer duty cycles and demonstrate savings with enterprise power management (Barr et al. 2010). QDI performed analyses in a number of different commercial markets (financial, healthcare, education, transactional business) in the United States. A sample of 91,000 desktop computers were electronically monitored for a two-week period to obtain the amount of time each unit spent in various modes (on, sleep, off). Logging of machine power states was conducted over local networks using system logging software; power meters were not used to verify power states. Researchers reported that the baseline desktop computer active/idle time on an average business day was 95%, and standby/off time only 5%. As a result, QDI concluded that dramatic savings are possible by using enterprise power management software such as Verdiem. These findings contrast sharply with other published studies. We question the validity of these results due to the large deviation from other contemporary studies, but also because operational modes were monitored remotely and not verified with power data.

³ The study found that a negligible amount of time was spent in a truly active state.

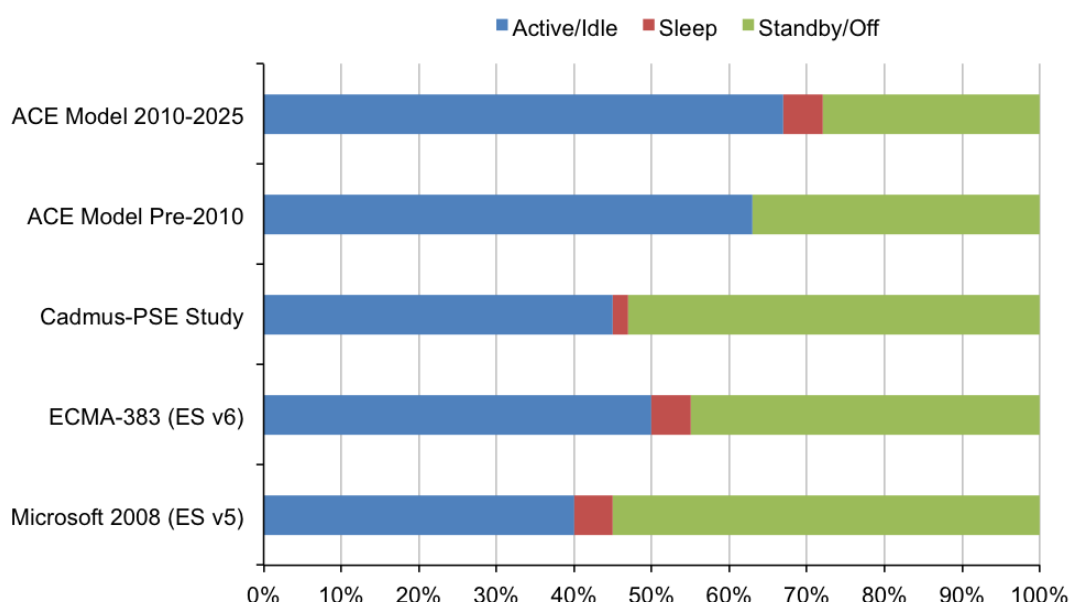
2.6 Cadmus/Puget Sound Energy Power Management

Most recently, Cadmus Group measured desktop computer usage as part of a larger study evaluating the effectiveness of the Puget Sound Energy (PSE) PC Power Management rebate program (Cadmus 2011). Cadmus monitored the power consumption of 314 desktop computers in commercial, education and government office buildings in the northwest. Data were taken at one-minute intervals over a two- to three-week period. Researchers evaluated operation in five modes: active, idle, sleep, off and unplugged. Computers were in an unplugged, off or sleep state for 55% of the time, active or idle for 45%. These computer use profiles roughly agree with Microsoft 2008, Moorefield et al. 2011, and Ecma 2010 and represent a middle ground between the assumptions used for ENERGY STAR's V5 and V6. These regionally-specific data may be appropriate for NEEA to use in its 80 PLUS ACE model.

3 Conclusions and Recommendations

The current ACE model for 80 PLUS differs significantly from most of the commercial duty cycle studies that have been conducted in the past five years, as illustrated in Figure 1. The ACE model assumes anywhere from 17 – 28% more active/idle time in its duty cycle than the most credible field studies. Since the 80 PLUS measure derives effectively all of its deemed savings from operation during active/idle modes, these assumptions result in an exaggeration of deemed savings.

Figure 1. Comparison of ACE Model to other published duty cycle estimates



Of all the field studies surveyed in our literature review, we find the Ecma-383 profile study and the Cadmus 2011 power management study to be the most credible. Both of these studies measured the usage of a significant number of computers in office settings with power meters. As such, they provide the best alternative duty cycle assumptions for NEEA to adopt in lieu of the existing ACE model values.

Below, we provide an illustration of how the Ecma-383 and Cadmus 2011 duty cycles could be translated into ACE model assumptions for 80 PLUS, an estimate of the energy savings impacts, and a summary of the pros and cons of each alternative.

The proposed alternative ACE model assumptions are presented in Table 3. We distributed hours from Ecma-383 idle modes to the various power supply loading bins that the ACE model uses (30%, 20%, 10%). We maintained 5% of the duty cycle as truly active (assigned to the 30% load bin) and assigned the remaining 45% of active/idle hours to the 10 and 20% load bins. We weighted the hours more heavily to the 20% bin to reflect ENERGY STAR's assumption⁴ that computers spend greater amounts of time in so-called "short idle," which consumes slightly more power than "long idle." Overall, the Ecma-383 duty cycle results in a 25% reduction in active/idle time, which would translate to a corresponding reduction in deemed savings. Cadmus 2011 assumes slightly less active/idle time than Ecma-383, resulting in about a 33% reduction in deemed savings.

⁴ See the final ENERGY STAR V6 computer specification for clarification on the definition between short and long idle.

Table 3: Comparison of Proposed Alternative ACE Model Assumptions

Proportion of Power Supply's Maximum DC Power Output Rating Standby Sleep			Idle mode					
			10%	20%	30%	...	100%	Total
ECMA-383 Duty Cycle								
Proportion of Year	45%	5%	15%	30%	5%	-	-	100%
Operating Time (hr/yr)	3,942	438	1,314	2,628	438	-	-	8,760
Cadmus 2011 Duty Cycle								
Proportion of Year	53%	2%	14%	28%	3%	-	-	100%
Operating Time (hr/yr)	4,643	175	1,226	2,453	263	-	-	8,760

The Ecma-383 field study and associated ENERGY STAR V6 duty cycle should be chosen if NEEA wishes to maintain harmonization with other jurisdictions, including ENERGY STAR and potentially the CEC. This would result in roughly a 25% reduction in savings. However, if NEEA aims to craft its duty cycles around more regional assumptions, it may be beneficial to opt for the Cadmus 2011 duty cycle instead. The Cadmus duty cycle would result in even steeper declines in deemed savings (approximately 33%).

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