

80 PLUS[®]: Market Impacts and Lessons Learned

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ABSTRACT

In March 2004, Ecos Consulting (Ecos) announced an ambitious program called 80 PLUS during ACEEE's Market Transformation Symposium. Research has shown that energy consumption of nearly all desktop computers and desktop-derived servers could be reduced 15 to 25 percent by simply utilizing AC to DC power supplies that were power factor corrected and at least 80 percent efficient. Simultaneously, ENERGY STAR[®] announced plans to revise its Version 3.0 desktop computer specification that was released in July 2000 and had remained unchanged ever since. Despite the significant energy savings opportunity (85 kWh per desktop, 301 kWh per desktop-derived server), the market infrastructure was not established to take advantage of these specifications. It was a perfect opportunity for a market intervention effort, but time was short. Could the program attract enough sponsors to entice key market actors to respond? Could the infrastructure be developed to the point where ENERGY STAR could justify including the 80 PLUS power supply specification in Version 4.0, which was scheduled to take effect July 2007?

Within 2.5 years, approximately 300 power supplies from over 50 manufacturers were certified 80 PLUS, 14 sponsors across North America were offering more than \$5 million in incentives, major OEM Hewlett-Packard had joined the program, and ENERGY STAR had included the 80 PLUS specification in Version 4.0. The purpose of this paper is to summarize the 80 PLUS initiative by: 1) quantifying the energy savings impact (for the program and the market as a whole); 2) evaluating the program's effectiveness through other metrics; 3) identifying key lessons learned; 4) assessing its duplicability for similar product categories; and 5) discussing the transition to an ENERGY STAR program effort.

What is 80 PLUS?

The 80 PLUS program enlists utilities and computer manufacturers in an innovative upstream buy-down program to integrate more energy-efficient power supplies into desktop computers and desktop-derived servers. This program design provides utility rebate incentives upstream to the computer manufacturer, to buy down or decrease the cost of more expensive 80 PLUS certified power supplies. This design was deemed to be most effective for efficient product market penetration compared with more traditional downstream programs focused on providing incentives to end consumers.

The program is built around this simple concept: recognize and reward any desktop computer or desktop-derived server containing a power supply that meets the following specification:

- 80 percent or greater efficiency at 20 percent, 50 percent and 100 percent of rated load
- True power factor of 0.9 or greater at 100 percent load

A computer's power supply converts AC (alternating current) from the wall outlet to DC (direct current) in the following voltages: +/-12 VDC, +/-5 VDC and +/-3.5 VDC, balanced appropriately to supply the power needs of the CPU and other internal chip sets required to support the operation of the computer. To promote the sales of highly efficient 80 PLUS power supplies, the program offers a \$5 manufacturer buy-down for each desktop and a \$10 manufacturer buy-down for each desktop-derived server containing a certified power supply. These rebates apply to units that are sold within service territories of North America (U.S. and Canada) where utility sponsors have decided to financially support the program. The savings benefits to sponsoring utilities equate to 85 kWh savings per year and demand reduction of 16 watts per desktop computer and 301 kWh per year and demand reduction of 34 watts per desktop-derived server.

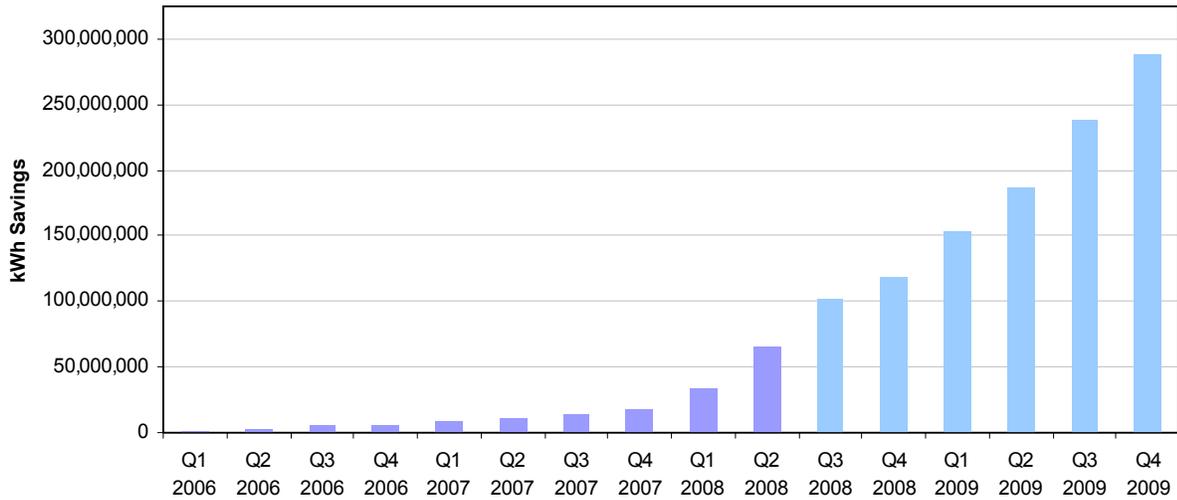
Quantifying the 80 plus Energy Savings Impact (For the Program and the Market as a Whole)

As mentioned in the previous section, on average, utilities can claim savings of 85 kWh for desktops and 301 kWh for desktop-derived servers. These values were originally developed by Ecos personnel as part of a 2004 research project in partnership with EPRI (Electric Power Research Institute) and supported by the Natural Resources Defense Council. Each utility sponsor also conducted its own internal vetting of these savings values to verify proper savings claims for the program. EPRI and Intel worked together to develop a set of specifications to encourage computer manufacturers to integrate more efficient power supply designs, as defined in Intel's ATX12V Power Supply Design Guide v2.01.

Based on these established savings values, the potential for this program is tremendous, as it is entrenched in a previously untapped market that experiences sales of over 40 million desktops annually. Even a small percentage of market penetration would equate to millions of kWh savings for participating utilities. Based on rebate claims received in 2007, 80 PLUS and ENERGY STAR 4.0 sales accounted for approximately 0.5 percent market penetration. A majority of the reported sales (over 75 percent) were represented by 80 PLUS units, and it is anticipated that this ratio will rapidly convert to ENERGY STAR product sales as manufacturers continue to broaden ENERGY STAR product lines and marketing channels. It is clear that this market transformation effort is still very much in the beginning stages in terms of energy savings potential. Based on unit sales trends from 2007 and early 2008, program staff estimates that 80 PLUS and ENERGY STAR unit sales should achieve no less than 8 percent market penetration by the end of 2009, equating to an impact of over 2.7 million tons of CO₂ offsets across North America.

The following chart illustrates the energy savings directly attributed to the 80 PLUS program, indicating an encouraging and ever-increasing energy savings trend for participating utility partners and the North American electrical infrastructure as a whole. Subsequent forecasting through Q1 2009 has also been included based on current sales data and trending.

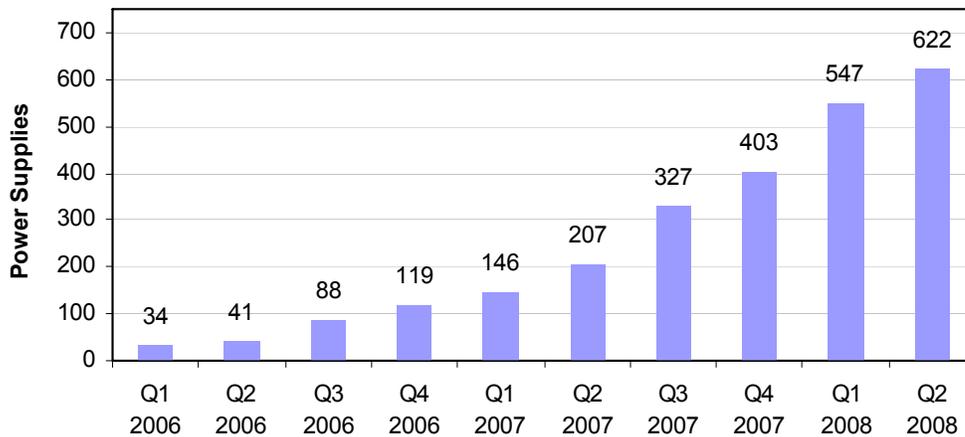
Chart 1. 80 PLUS North America kWh Savings to date (Cumulative)



Evaluation of the Program’s Effectiveness through Additional Metrics

Ecoss has tracked and analyzed several indicators over the life of the program to estimate future energy savings. The primary and initial focus was creating value within the program to empower 80 PLUS staff to engage and recruit power supply and computer manufacturers. Program staff spent a great deal of time and effort engaging the power supply industry to push these partners toward more efficient product offerings that met the 80 PLUS criteria. Initial success occurred with “boutique” manufacturers submitting reference designs and prototypes meant for lower production runs. As these reference designs and prototypes began to percolate into mainstream and larger manufacturer houses, it was clear that this segment of the industry recognized a unique marketing opportunity and ability to distinguish their products from a previously untapped marketing avenue. Chart 2 illustrates the progression of 80 PLUS certifications, demonstrating the power supply industry’s perception of the value that the 80 PLUS program has brought to their industry.

Chart 2. 80 PLUS Power Supply Certifications (Cumulative)



As with the power supply manufacturers, program staff spent considerable resources engaging with and recruiting computer manufacturers large and small. The greatest initial barriers to manufacturer recruitment were the incremental costs associated with the more efficient 80 PLUS certified models and the limited supply of models available to the market. As the above chart indicates, it was not until mid-2006 before a meaningful number of models had been recognized as 80 PLUS certified. As the certified model count grew, it served as proof to major manufacturers that achieving the 80 PLUS mark was possible. It was then dependent upon these companies to request certified 80 PLUS models from their major power supply vendors.

The 80 PLUS buy-down incentives have served as a shorter-term solution to help offset a portion of the incremental cost premium, but the most effective long-term method for driving down these costs is for computer manufacturers to procure and sell products integrated with 80 PLUS power supplies in volume. Conversations with manufacturers indicate that they continue to identify a cost premium for 80 PLUS power supplies of as much as 30 percent above less-efficient power supply models, correlating to a range of \$10-20 additional cost to end consumers. Although the upstream buy-down has helped to offset a portion of these costs, it is apparent that the market has not been transformed to the point where more energy efficient 80 PLUS and ENERGY STAR products are ubiquitous and cost-neutral to end consumers.

Chart 3 illustrates the cumulative recruitment of computer manufacturers, correlating with the progression of certified power supplies in chart 2, which indicates a relationship between the two efforts. As with the power supply certifications, the upward trend of computer manufacturers over the past 12-18 months has been a strong positive indicator that energy savings generated by the program should follow a similar upward trending pattern.

Chart 3. 80 PLUS Computer Manufacturer Partners (Cumulative)

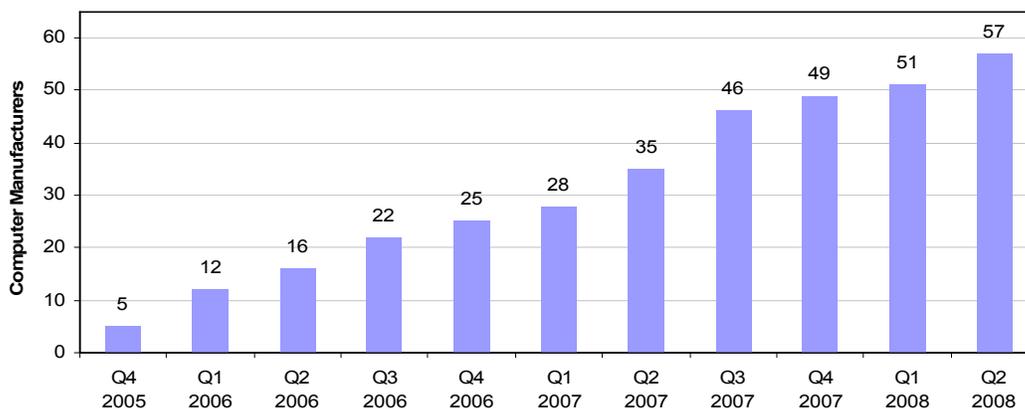
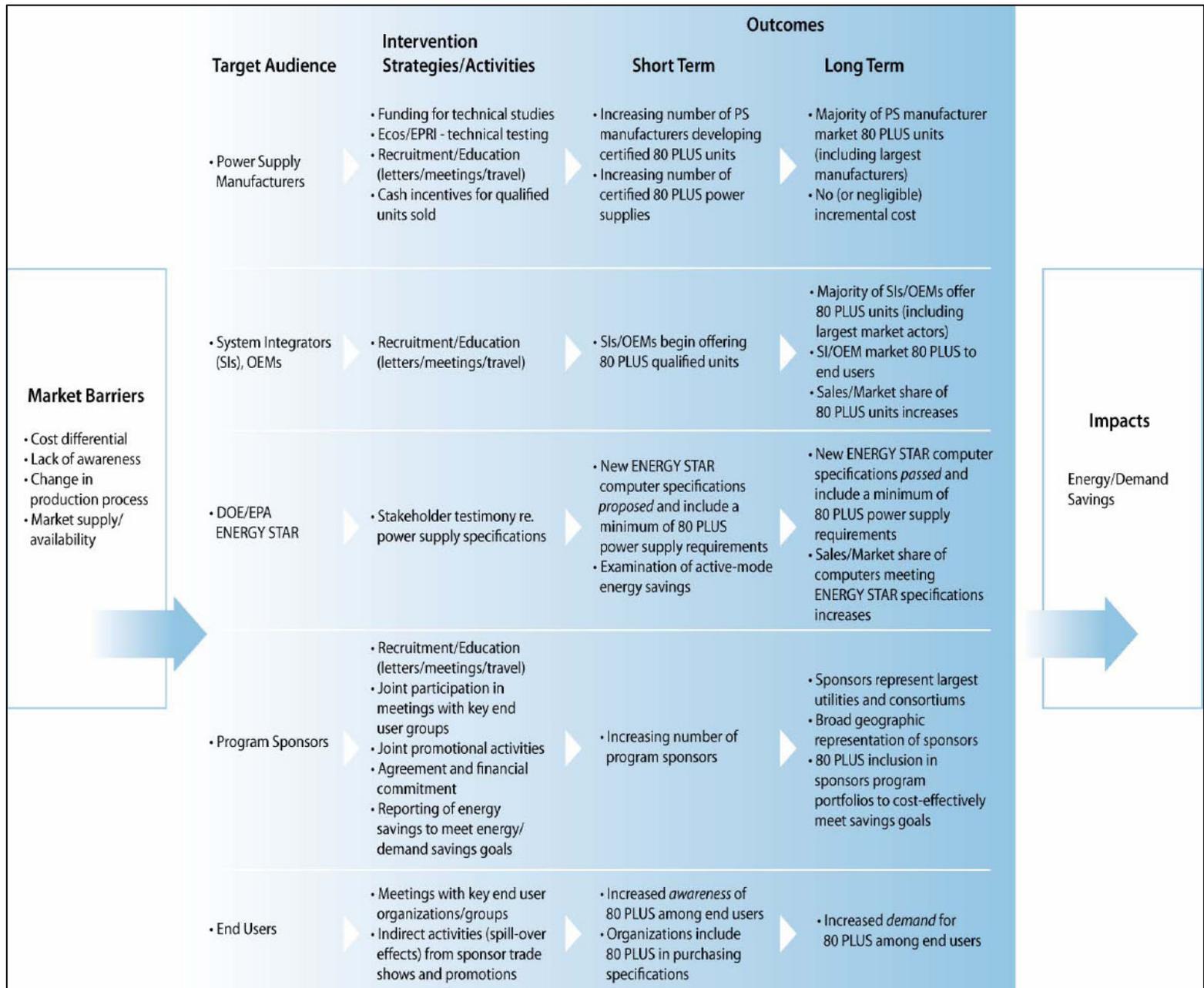


Figure 1 further summarizes the many barriers, strategies, market players and progress indicators that have been associated with the program since its inception, with the end goal of transforming the market and capturing significant energy savings for the program's funders.

Figure 1 – Program Logic and Progress Indicators¹



Key Lessons Learned

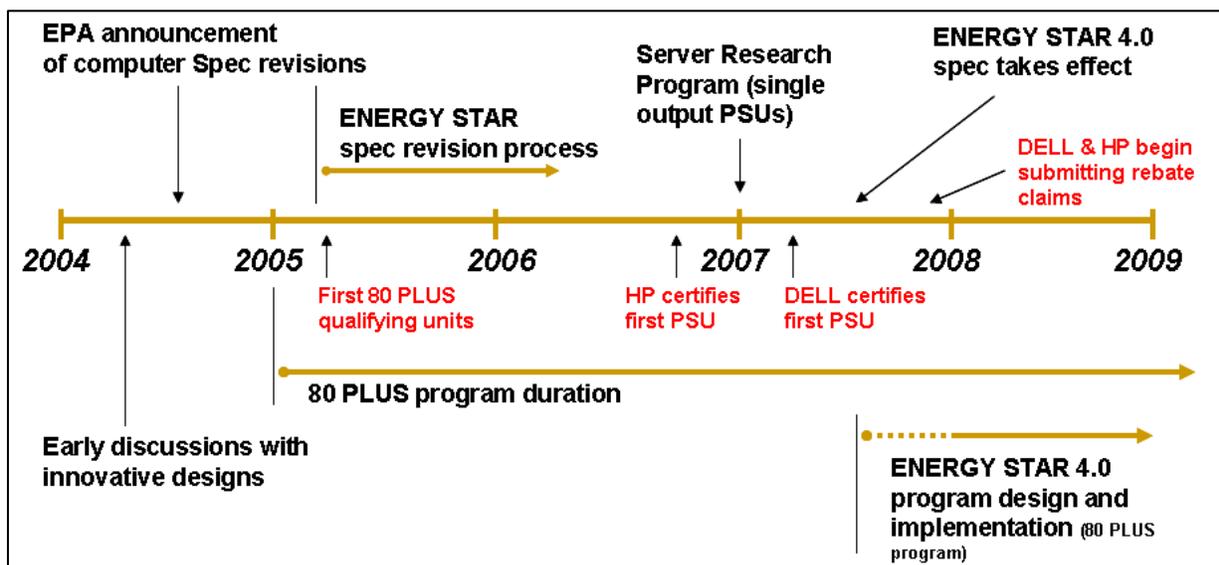
One of the key lessons learned is that market transformation takes a long time to reach any meaningful level of success. As Ecos staff first developed 80 PLUS in 2004, it was anticipated that the program would recruit and have full participation from at least one major computer manufacturer by no later than the end of 2006. In fact, the first major manufacturer had

¹ www.nwalliance.org/research/reports/MPER06-06180Plus.pdf

not signed on to the program and begun regularly submitting rebate claims until December 2007. This lag in recruitment success created an additional challenge of keeping the first utility sponsors engaged and supportive of the program despite the lack of energy savings.

As these efforts were under way, aggressive engagement with power supply manufacturers continued to ramp up testing of their most efficient models. Broadening the base of 80 PLUS certified models was essential in proving to computer manufacturers that the technology not only existed, but also that a reasonable number of models were available to meet increasing market demand. As recruitment outreach continued with computer manufacturers, power supply manufacturers and utility funders, the new ENERGY STAR 4.0 specification was also under development, which was to include the 80 PLUS test protocol and specification. This proved to be highly beneficial for 80 PLUS staff in demonstrating to the computer manufacturers that strong customer demand for efficient products would be sure to follow as the ENERGY STAR specification was slated to go into effect during the summer of 2007. Similar to the program's recruitment efforts however, the ENERGY STAR specification was implemented on a slower timeline than expected, thus affecting and decreasing the sense of urgency with computer manufacturers to integrate 80 PLUS product lines and delaying the energy savings opportunity for program sponsors. Figure 2 provides a visual representation of the program's timeline including major milestones.

Figure 2. 80 PLUS Program Timeline



Another major lesson learned from this initiative was not all utilities are created equal. It was critical to the program's success to ensure that program funding was in place to effectively engage in recruitment efforts with computer manufacturers. Fortunately, there were early adopters that not only provided essential startup funds, but also demonstrated a strong case to manufacturers that upstream buy-down funds were available and significant. The downside was that at the onset of the program (2004), only a handful of utilities had efficiency programs developed to a level where sponsorship of a program such as 80 PLUS would be possible. The early adopters, including Southern California Edison, Northwest Energy Efficiency Alliance and Pacific Gas & Electric, were willing to take a risk on an innovative and untested program as a

unique portfolio offering to address plug load. To ease concerns with funding a new and untested program, 80 PLUS was structured as a performance-based model. Aside from a modest startup fee, utility sponsors only paid on rebates as claims were submitted from computer manufacturers and verified by 80 PLUS staff. This initial movement led to a groundswell of additional sponsorship. The program reached a total of 14 major sponsors across North America by mid-2007, representing approximately 20 percent of the population, including both commercial and residential customers. As of the writing of this paper, a couple of sponsors have departed the program, citing that due to the success of its inclusion in the ENERGY STAR specification, the program is a success and has essentially transformed the market, while others had to invest in other energy projects that represented larger savings opportunities. Concurrently, several new sponsors are close to participating in the program for the first time and should be fully engaged by late summer 2008.

Even with the utility support successes that have occurred over the past couple of years, many large utilities did not take part in the program for various reasons. These would include a lack of efficiency program funds, inability to support upstream buy-down programs (focus only on downstream programs), difficulties in approving the program's savings estimates, concerns regarding overlapping service territories with surrounding utilities, market focus on residential rather than commercial programs, concerns regarding free-ridership and direct competition with similarly funded initiatives. Since the volume of utility support remained limited, especially at the onset of the program, initial startup funds were all the more critical in setting the foundation for a successful program. As helpful as the initial funds were, it was quickly realized that these fees should have been set higher to carry more of the upfront financial support for the program. Ecos had to make the decision to bear much of the financial burden of the program through 2006 and 2007, while the program awaited the first batches of higher volume rebate submittals from the major OEMs. Despite these challenges, there remains a core group of utilities supporting the program as well as new utilities joining the initiative due to the "greening" surge taking place across North America.

Another lesson that became quite apparent early on in the program was that marketing awareness and opportunities are critical for a program that lacks a specific product to promote. One of the major challenges that 80 PLUS has faced is how to effectively market a program rather than an actual product. Early development of collateral that spoke to the benefits specific to utilities, computer and power supply manufacturers, and end consumers was critical to effectively promoting the program. To further demonstrate the value of the program to utilities and manufacturers, cooperative marketing opportunities were identified and developed to bridge the gap between these two market players. Due to the complexity of 80 PLUS messaging, time was spent educating account representatives on both sides about the program mechanics and benefits to strengthen the 80 PLUS sales pitch and increase the volume of personnel actively promoting the program.

In addition, the program's website has been the most visual and consistent advertising mechanism and has been of great value to the power supply manufacturers. This industry group has had few opportunities to publicly promote and tout their efficient products. 80 PLUS has provided these manufacturers an independent, third-party verification mechanism with which to test and promote their most efficient product lines. In general, the 80 PLUS website has been a vital marketing tool to effectively promote the benefits of the program to the various market players involved. To continually bolster the website's effectiveness, new program partners with similar or complementary initiatives are also highlighted. These groups include the Climate

Savers Computing Initiative, the EPA's ENERGY STAR program, EPEAT and The Green Grid, to name a few. Working collaboratively with these initiatives has greatly broadened the program's reach on a global scale, as they are connected by the common mission to introduce more efficient computing products into the marketplace at a time when "green" products are gaining momentum and popularity.

Assessing the Program's Duplicability for Similar Product Categories

The 80 PLUS program is continually evolving. It originally focused on desktop customer power supplies (multiple output, nonredundant), and then in 2007 started to include datacenter server power supplies (single output, redundant). One potential evolution the 80 PLUS team has under consideration is replication of the program as it applies to other electronic programs. More specifically, how does something like the 80 PLUS program model look in a retail channel? We know that the relationships in the retail channel work much the same as they do in the computer power supply industry. The key to success with a program replication would be to garner manufacturer and utility support to approach mass merchants, drug stores, do-it-yourself chains, warehouse merchants and other retailers.

These relationships would most likely take the form of an upstream buy-down through manufacturer relationships, as opposed to direct coordination with retail stores. This is not to imply that the retail channels do not need relationship management as well, but the direct route into the market would be through manufacturers.

Manufacturers are generally open to coordination of upstream buy-downs and similar programs because they get to move more product. Retail stores can be persuaded to participate in upstream buy-downs through incentives. In order to join such a program, retailers need assurances that the program will be easy to administer, profitable and not cause customer confusion.

Ecos is researching the potential of the 80 PLUS program diving deeper into the retail world with its current program. We propose that promoting 80 PLUS or ENERGY STAR computers into the retail channel would work much the same way as the aforementioned idea for consumer electronics distribution, but the bonus is that Ecos already has established relationships with the computer manufacturers. Our initial ideas for developing the retail channel in regard to the 80 PLUS program would be to engage our major manufacturers in a joint effort to foster relationships within the retail channel. We anticipate the manufacturers will be highly enthusiastic about this venture because it garners more incentives, higher market share and stronger relationships with the retail channel. Next steps would include setting up coordination and communication streams between manufacturers, retailers and Ecos to manage marketing 80 PLUS computers in the retail market; while continuing to grow the utility sponsorship market.

There are many ways the 80 PLUS program is evolving and looking into the future. Part of this evolution is to see how the program itself can expand and grow and how the program model can be applied to other products in different marketplaces.

The 80 PLUS Transition to an ENERGY STAR Program

80 PLUS and ENERGY STAR desktop computers have entered the market as a direct result of this program's efforts and successes over the past four years. Due to the development of upstream incentives to manufacturers, this initiative has served a critical need in reducing the

cost barrier for producing more efficient product, thus convincing computer manufacturers to demand 80 PLUS certified power supplies from their suppliers. In addition, inclusion of 80 PLUS in the ENERGY STAR 4.0 specification was a critical development, as savings from 80 PLUS power supplies represented the lion's share of savings in the first revision to the ENERGY STAR computer specification since 2000. The version 3.0 specification was narrowly focused with loose requirements on sleep mode settings, allowing 98 percent of the computers in the market to meet those requirements. Version 4.0 required an 80 percent power supply as well as implementing aggressive idle mode requirements.

In early 2007, 80 PLUS units were sold primarily by smaller system integrator (SI) partners, but the program also focused on partnering with Hewlett-Packard (HP) and Dell, which together represent over 50 percent of the North American market. Both companies began shipping initial volumes of units to be qualified as 80 PLUS. These units were a high demand product across North America in late 2007, and it is anticipated that volumes of 80 PLUS and ENERGY STAR compliant products will continue to increase throughout 2008 and beyond. The program has spent a considerable amount of resources with these two key manufacturers and other SIs to ensure that this upstream initiative runs efficiently and effectively in order to accurately track shipments delivered into sponsored territories.

The program realized the vital need to develop and present an additional ENERGY STAR program offering to its utility sponsors and to ensure that long-term savings opportunities would be available, due to the length of time required to bring all of the appropriate market players into the program. Utilities expressed strong interest for this program expansion not only to capture additional energy savings, but to more effectively market the program due to the brand recognition and strength behind the ENERGY STAR labeling campaign.

The new ENERGY STAR computer specification increases savings above the 80 PLUS level (85 kWh) by an additional 65 kWh per year for a total of 150 kWh per year per desktop computer. These savings are derived from the idle state power requirements in the ENERGY STAR 4.0 specification for Desktop Categories A and B.² The ENERGY STAR Version 4.0 specification defines the idle state of qualifying computers as the state in which the operating system and other software have completed loading, the machine is not asleep, and activity is limited to those basic applications that the system starts by default. ENERGY STAR qualified computers will also save additional energy through lower sleep and standby power levels achieved by reducing idle state power, but these modes have been ignored for the purposes of deemed savings. Category A and B desktops will represent the majority of sales, and most directly reflect current 80 PLUS product end users. The program anticipates that as ENERGY STAR 4.0 products become more readily available and the price premium continues to shrink, the market will shift from 80 PLUS-only purchases and more toward ENERGY STAR product purchases, further benefiting the utilities that support this additional energy savings opportunity until the market reaches a significant level of saturation.

Conclusion

The 80 PLUS program has proved to be an innovative endeavor that has experienced numerous successes despite the unanticipated length of time to reach the most critical successes in securing substantial energy savings for its utility funders. Furthermore, despite these

² http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/computer/Computer_Spec_Final.pdf

challenges and delays, the program continues running strong well into its fifth year with solid utility support, collaborative partnerships with the largest computer and power supply manufacturers in the world, and expansion of additional energy savings from ENERGY STAR product sales.

It is anticipated that the program will continue to run at least through 2009, depending on market penetration rates of 80 PLUS and ENERGY STAR products. If these rates exceed 15 percent by the end of 2009, this would be a signal to utilities that the market has migrated into a fully transformed state. It is currently forecasted that ENERGY STAR computer specifications will play an important role for the next two to five years as it pertains to desktop computers and will most likely expand to include datacenter servers and other network electronics. As a result of 80 PLUS, Ecos hopes to be known as an innovator of solutions for utilities seeking help with the ever-growing electrical load in commercial environments. As the program continues to forge ahead and program partner relationships deepen, the successes of the program will not only translate into significant energy savings for 80 PLUS and ENERGY STAR products, but will also generate new savings opportunities within additional electronics product lines for years to come.