UA POWER MANAGEMENT PROJECT

Introduction

The Administrative Review and Restructuring (ARR) initiative was started in November 2009 to address the financial challenges facing the University of Illinois. As part of the initiative, a working group was established to conduct a broad scale review of administrative structures and services at the University with the aim of improving performance and reducing costs. One of the cost saving methods identified in the working group's final report is to implement a method for reducing power consumption for personal computers (recommendation 23e).

In response to the ARR recommendation and to conserve energy, central administrative units, known collectively as University Administration (UA), undertook a UA Power Management project. The goal of this project is to reduce energy use and costs with no negative impact to the user. While the results of UA-focused efforts are described here, it should be noted that the University of Illinois in general is committed to reducing energy usage and has several ongoing initiatives, with examples at each of its campuses (Urbana-Champaign, Chicago, and Springfield).

History

Administrative Information Technology Services (AITS) is a UA department that manages almost all UA PCs and some non-UA PCs as well. AITS initiated a small pilot project in 2009 using a third-party tool to manage the power settings of PCs. While the results of the pilot were promising and suggested significant energy and money could be saved by managing power settings, the added cost of the management tool needed to be considered. As the merits of the third-party tool were being considered, Microsoft announced that the next service pack for System Center Configuration Manager 2007 (SCCM) would add the ability to manage power settings of PCs and also provide reporting tools. Since AITS was already managing PCs using SCCM, the decision was made to wait for the update from Microsoft and do another pilot to determine if SCCM 2007 R3 would meet our needs. At the same time, AITS implemented an aggressive plan to upgrade all PCs to Windows 7, which had the additional benefit of providing better built-in power management tools and reporting in the PC operating system.

Methods

Microsoft published a technical white paper that details their efforts to put a global power management solution in place for their company using SCCM 2007 R3. The Microsoft paper, which explains step by step how they implemented their program, was used by AITS as a guide to put a power management solution in place for UA PCs.

The initial steps involved upgrading the SCCM infrastructure to R3. This included upgrading the server infrastructure, including configuring SQL Reporting Services, as well as deploying the new client agent to all PCs.

AITS developed a communications plan to encourage maximum participation in the program by UA employees. Employees were made aware of the potential benefits to the University of Illinois that would result from having power settings of their PCs managed. Employees were also given the opportunity to opt out of the program if they felt it would negatively impact their productivity.

When reporting energy usage for PCs, it is important to have a valid estimate of the amount of power each type of PC consumes. The majority of PCs AITS supports are manufactured by Dell, who provides power consumption information on their web site for most models. The power consumption information was also verified for several models by taking measurements using P3's Kill A Watt® device. The average power consumption for laptops (46.8 W) and desktops (123.5 W) was calculated by considering the distribution of PC models in our environment as of July 2011. These values are used in reports created in SCCM in an attempt to accurately estimate the potential energy and cost savings in our specific environment. Chip manufacturers focused on energy conservation continue to produce newer chips with increased performance to power consumption ratios. As older PCs are continually replaced with more efficient PCs, the power consumption values will need to be recalculated in our environment, and would be expected to decline for average laptops and desktops.

Implementation

The upgrade of the production SCCM environment and clients to R3 was completed in February 2011. A small number of IT staff PCs were tested to determine the management and reporting capabilities of SCCM 2007 R3 in our environment. This also provided the opportunity to develop a more comprehensive strategy to allow completion of the project in an efficient manner. Considerable effort was spent designing the SCCM collections to minimize complexity and to allow the best use of data generated by the built-in reporting tools.

The actual project was started March 14, 2011 as a two-week pilot with about 13 PCs of volunteer participants within AITS. An additional 40 PCs within a division of AITS were added to the pilot group on April 6, 2011. A separate SCCM collection was created for these PCs, and their energy usage was monitored for a period of 30 days to establish a baseline. A full communications strategy was not yet in place, so pilot participants were sent a targeted email on April 1, 2011 providing them with information about the project. Users were given the opportunity to opt out of the pilot by simply responding to the email. Feedback was solicited by having them use a spreadsheet to track any issues during the week-long trial period. On April 6, 2011 power settings of a 60-minute time-to-sleep period during both peak (between 9 a.m. and 5 p.m.) and non-peak (between 5 p.m. and 9 a.m.) hours were applied by modifying the collection settings. This means that if a computer has no activity for 60 minutes it will go to sleep. PCs were also set to wake-up nightly at 3 a.m. in an effort to provide a nightly maintenance window.

A targeted email was sent on July 5, 2011 to the rest of AITS staff informing them of the project. Users could also visit a web site that briefly described the project for UA users, and also provided a link to a web form so they could opt out of the program. Users could submit the opt out form for two weeks from when the email was sent. An opt out form submitted online by the

end user required supervisor approval before they could formally opt out of the project. Supervisors were encouraged to approve the end user's desire to opt out only for valid business reasons, and most supervisors considered this in their decision.

Beginning July 18, 2011 all of AITS' PCs were added to the pilot group. During the pilot phase, the 60-minute time-to-sleep setting during peak hours was found to be overly aggressive. Users complained that if they were gone for a meeting of an hour or more, it was likely their machine would go to sleep and they felt it negatively impacted their productivity. The weekly on-demand scan for viruses which was scheduled late in the evening would cause PCs to slow down the next morning if the entire scan had not completed because the PC had gone to sleep. After several months of testing, on December 19, 2011 all of AITS-supported PCs (about 1580) were set to a 120-minute time-to-sleep setting between 9 a.m. and 5 p.m. (peak) and to a 60-minute time-to-sleep setting between 5 p.m. and 9 a.m. (non-peak). The nightly wake-up of PCs at 3 a.m. was retained as well.

Results

Power settings of all AITS-supported PCs that use the Windows operating system are now being actively managed. As a result, there have been significant energy and cost savings. A 48% reduction in power consumption was observed when comparing monthly results for unmanaged (November 2011) and managed power settings (January 2012). At a marginal power rate of $0.05/kWh, this translates to a savings of about $2,000/month for about 1580 machines being managed. Figure 1 shows observed savings for a representative subset of the entire PC population. It should be mentioned that the total number of opt outs as of May 1, 2012 is 68 machines out of an entire population of 1583 machines. If the cost for capitalized power ($0.09/kwh) is used in the calculation, savings would increase to $3,575/month.

A comparison of daily power consumption is shown in Figure 2 for a representative subset of the entire PC population. The greatest savings is consistently for weekends as would be expected, since all users likely did not shut their machines down before leaving for the weekend in the unmanaged environment. It appears that there are still a number of PCs that are not readily sleeping, or else significantly more users consistently work on weekends than would be normally expected.

Figure 1. Monthly Average Power Cost for Reporting Computers

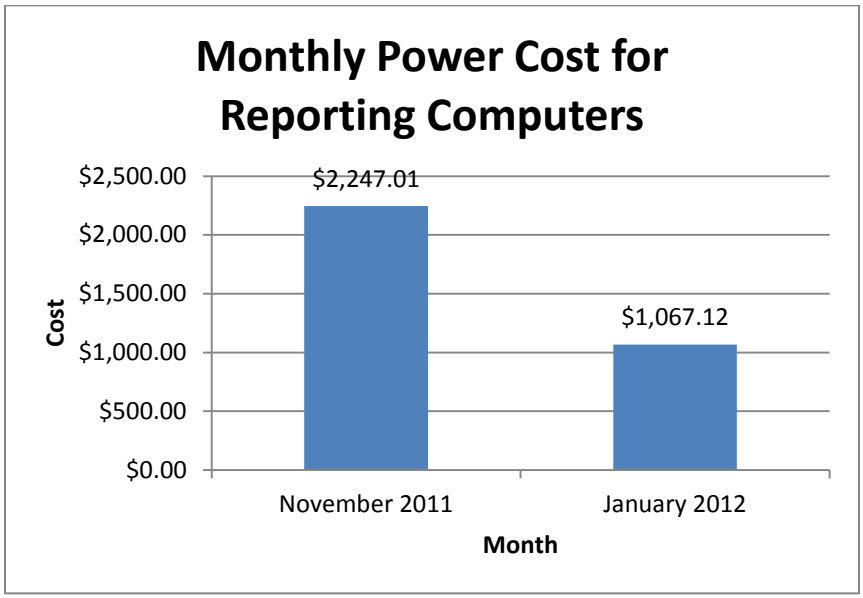
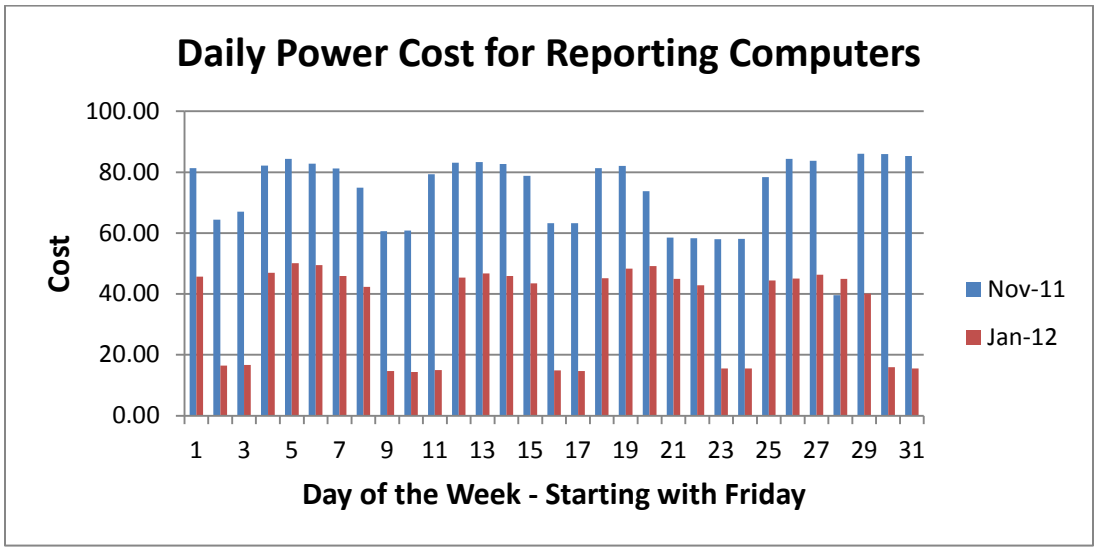


Figure 2. Daily Average Power Costs for Reporting Computers



Figures 3-7 represent examples of reports created from the built-in reports included in SCCM 2007 R3. Note that the scales in Figures 3 and 4 are different, and that in each figure the results are for a representative subset of the entire PC population.

Figure 3. Daily Power Cost for Reporting Computers (November 2011)

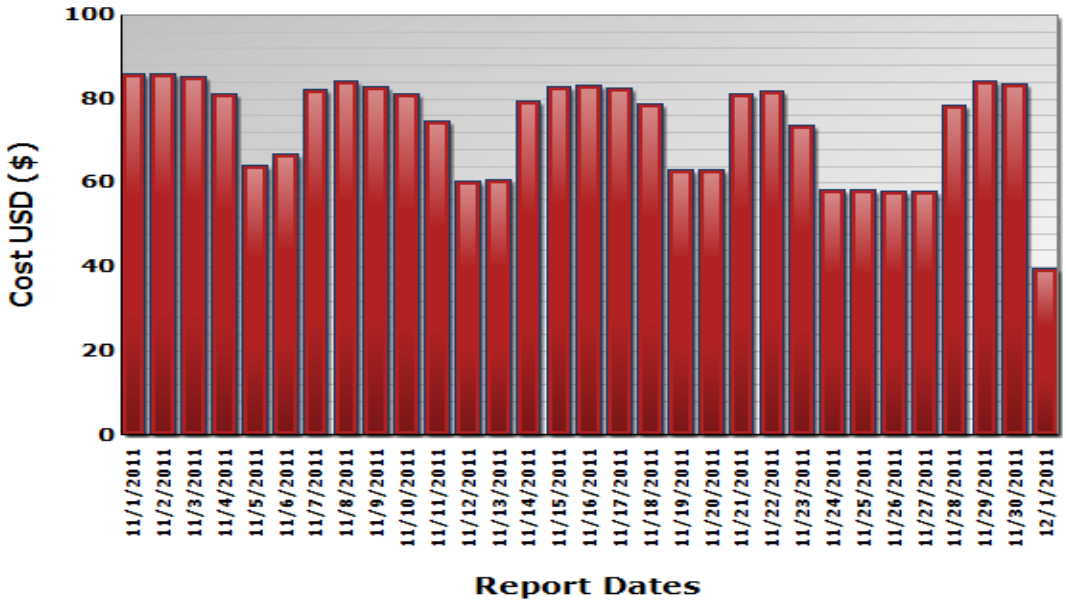


Figure 4. Daily Power Cost for Reporting Computers (January 2012)

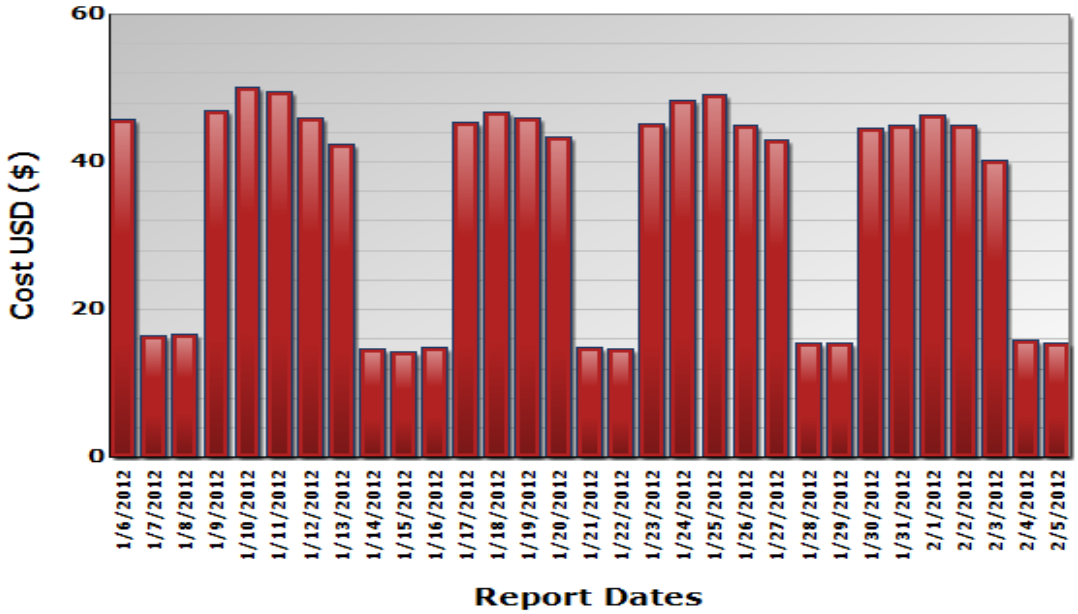
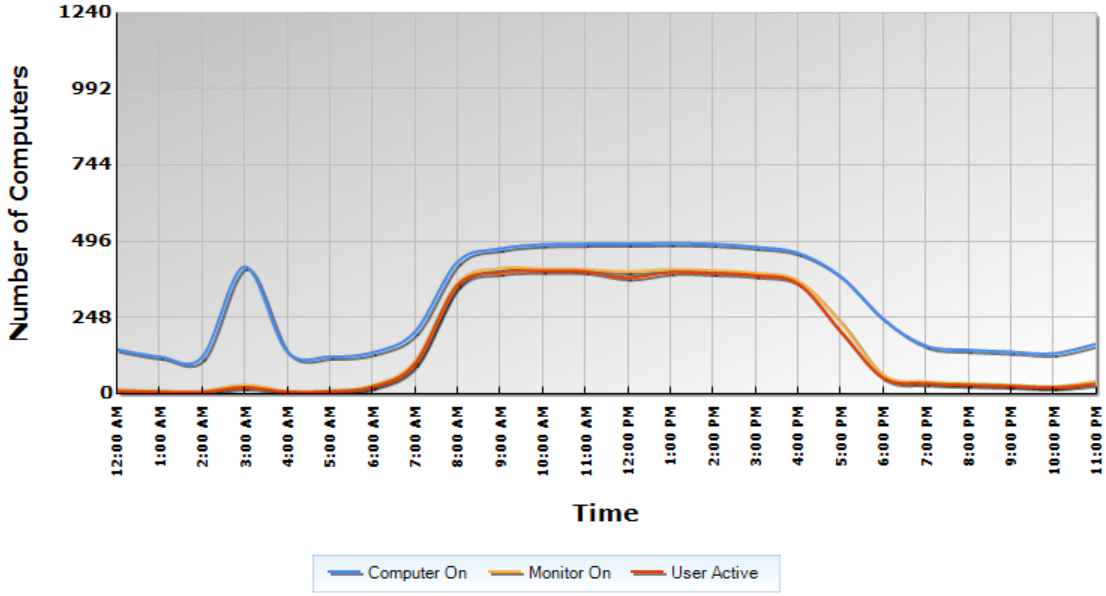


Figure 5. Number of Computers with Power Staying On (January 2012)



The following are environmental reports that were created from built-in SCCM reports. When comparing November 2011 with January 2012, approximately 29 tons of CO_2 was saved. (Figures 6 and 7)

Figure 6. Daily Average Environmental Impact by Computer (November 2011)

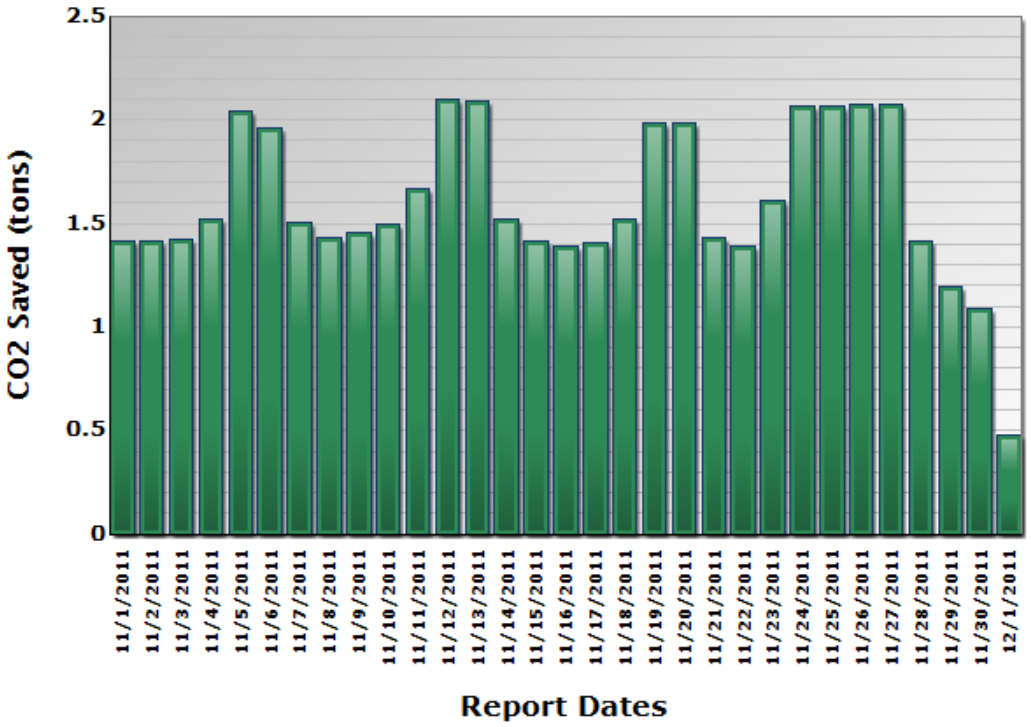
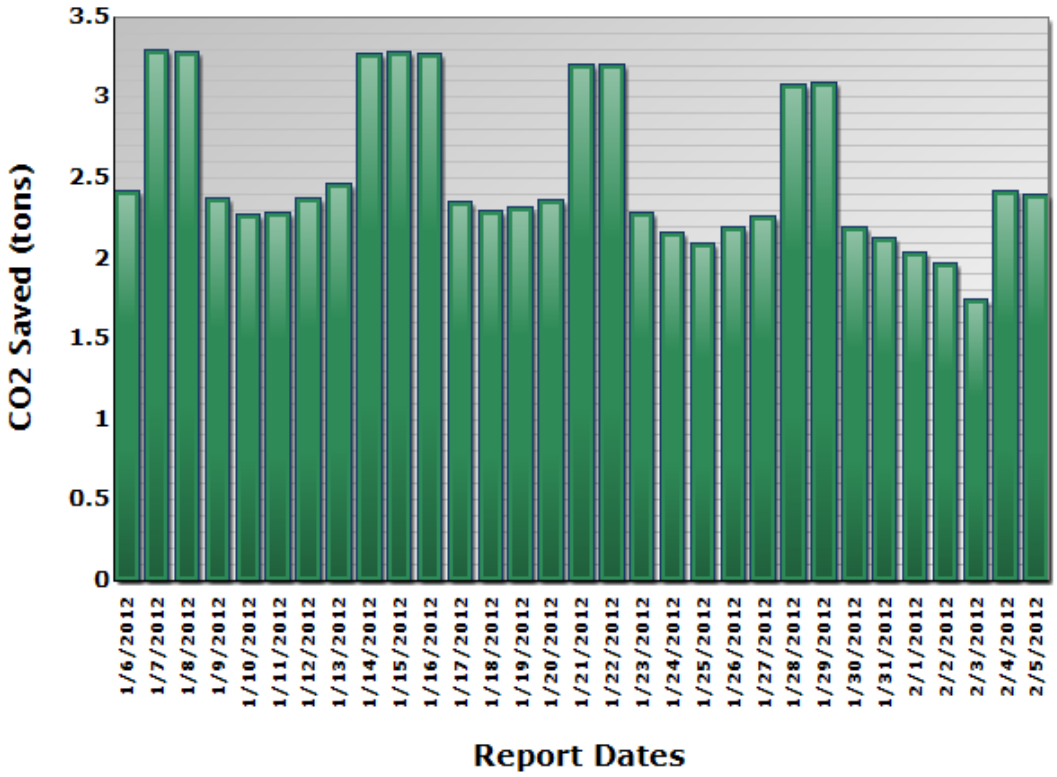


Figure 7. Daily Average Environmental Impact by Computer (January 2012)



Discussion

While the energy and cost savings resulting from managing power settings for PCs within UA are beneficial, truly significant savings for the University of Illinois would be realized by managing the entire population of PCs. If the results from the UA study are extrapolated to an estimated 40,000 PCs across the entire university, the potential exists to save about $600,000 per year. Interestingly enough, there is a highly visible project underway at the university to utilize Microsoft's SCCM and IBM's Tivoli Endpoint Management (TEM) tools to manage a majority of PCs (including Mac clients). Both of these products include the ability to manage power settings for clients.

In the white paper published by Microsoft, they offer best practices that were captured during their program implementation. These best practices were followed closely for this project and held true in our environment as well. No new recommendations were identified as a result of this project. In brief, the best practices Microsoft identified are:

- Pre-deployment baseline determination is critical to measuring project success.
- Reduce collection complexity.
- Plan for an exception process to accommodate exclusions of business critical computers.
- Carefully consider results of the pilot programs.

- Consider other initiatives.
- Create a structured communication and feedback mechanism.
- Communicate clearly and concisely.

While SCCM 2007 R3 proved adequate to manage power settings for PCs and to report on results of those efforts, there were a few things that possibly could be improved. Daily information collected from client PCs is recorded for only one month, and then the month's daily data is aggregated into a monthly value. In effect, access to individual data is available for only the most recent 31 days. This means it is necessary to consistently prepare and save reports at regular intervals so that daily data can be compared for several months.

It was felt that more customizable built-in reports would be better, like being able to choose a scale for the data. Certainly custom reports that would be specific to our environment can be created using Microsoft's Reporting Services tools, or data could be exported and massaged external to SCCM, but it would be nice to have additional flexibility using the built-in reports.

The tools to define power settings for SCCM collections could benefit from added granularity. The option to set a daily, or even hourly, pattern of sleep would allow easy extension of a maintenance window. For instance, PCs could wake up at 3 a.m. on just Saturday with a longer time-to sleep period of several hours while maintenance was performed. Of course, there are other methods to manage maintenance windows with SCCM, but this would be a simple method for those wishing to implement power management in their environment.

It should be mentioned that as computer replacement cycles continue to replace older inefficient PCs with more power efficient models, the impact of a power management program becomes less and less. It still can lead to significant energy and cost savings in an organization though, regardless of how efficient those computers become.

Next Steps

Microsoft has included additional reports in SCCM 2007 R3 that help identify those computers that are not sleeping regularly and details about possible causes such as running processes that are causing them to not sleep. Monitoring those results and remediating problems on a regular basis could result in additional energy and cost savings by increasing the number of PCs that sleep regularly. This strategy has not been implemented yet in our environment, but the plan is to do so in the future.

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