ENERGY STAR® Computers in Australia

Results of testing 22 Computers
Marked with **ENERGY STAR®** V4.0 and V5.0

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EQUIPMENT ENERGY EFFICIENCY

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Prepared by Thinkwell Australia Pty Ltd
A.C.N. 113 454 112
PO Box 3453 Broadway
Nedlands, Perth, WA 6009
Email: Michael.McCann@thinkwell.com.au

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For further information please contact:
Equipment Energy Efficiency (E3) Team
Department of the Environment,
Water Heritage and the Arts
GPO Box 787
CANBERRA ACT 2601
Or via email to: energyrating@environment.gov.au
Website: www.energyrating.gov.au

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EXECUTIVE SUMMARY

The Department of the Environment, Water, Heritage and the Arts (DEWHA) commissioned expert test facilities to confirm the energy efficiency claims by major-brand computer suppliers. Desktop (DT) and notebook (NB) computers were bought on the open market, guided by information available to consumers, noting particularly any claims of ENERGY STAR® compliance.

The computers purchased all claimed compliance with the global ENERGY STAR® (E*) scheme developed by the US Environmental Protection Agency (EPA) some 15 years ago. Retailers were requested to supply either E* version 4 (E*V4.0) which commenced in 2007 or E* version 5 (E*V5.0) the most recent high efficiency standard that commenced in July 2009.

After a significant research effort 23 computers that made E* claims were identified, and purchased, by a highly computer literate researcher. The researcher reported very poor, inconsistent and hard-to-find market information about energy efficiency. An almost complete lack of detailed information about E* computers on the Australian market forced the researcher to rely on lists of E* compliant computers from the EPA website in the US to identify compliant models available for purchase in Australia. Ultimately, only 22 computers (11 DTs and 11 NBs) were tested, as one computer purchased was subsequently found to be an older model, complying with an earlier version of E* that was no longer expected to be promoted in the market.

Overall, 12 of the 22 machines tested passed the E* test criteria if the measurements are applied strictly.

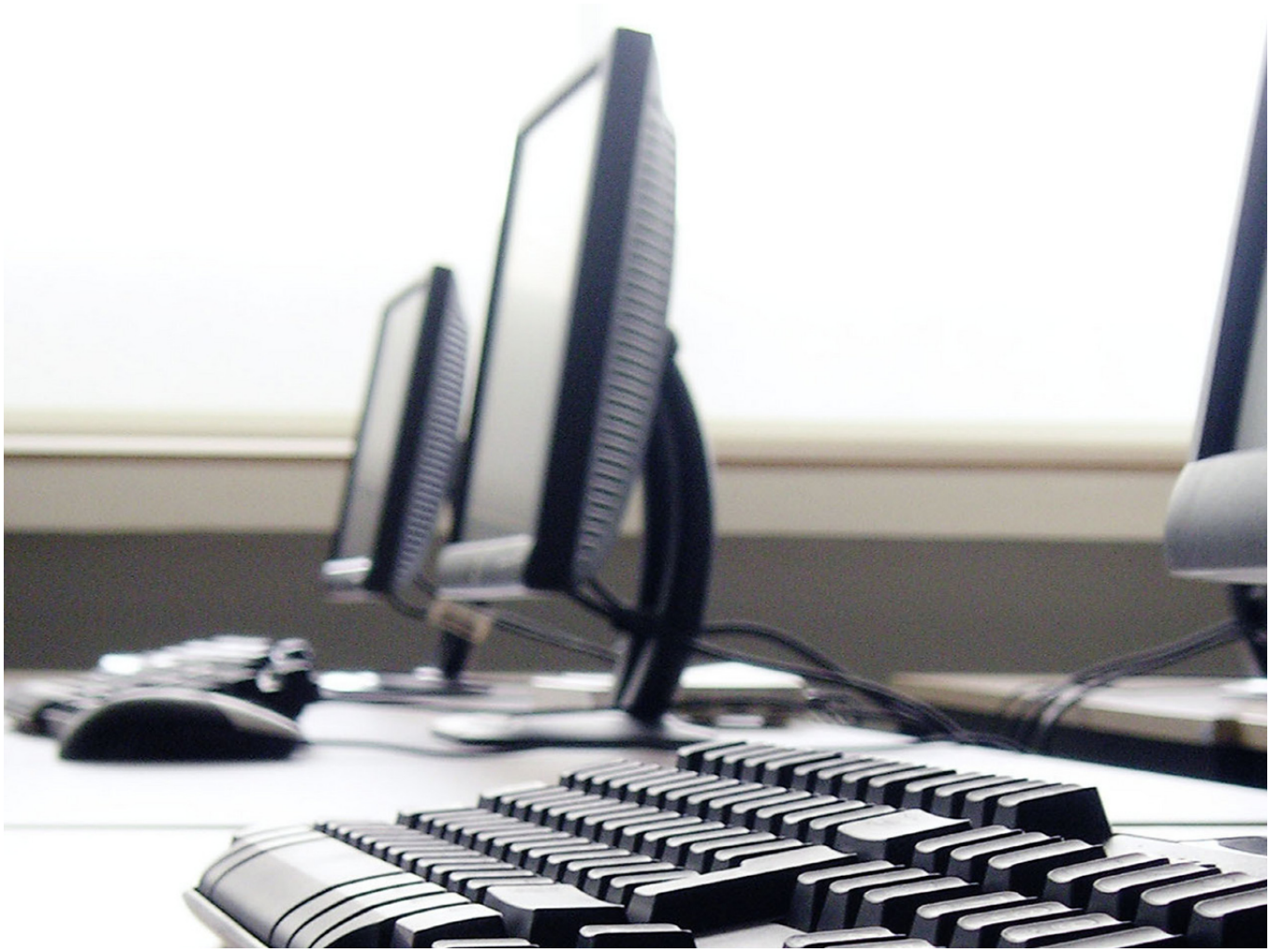
Normally, where independent testing is attempting to verify the efficiency claims of suppliers, measurement tolerances are applied to avoid the risk that a single sample result may not be representative of the efficiency of the entire model range. Even after applying such a discretionary tolerance to all of those computers that failed at least one mandatory criterion, 8 of the 22 computers still failed to meet the claimed status of E*V4.0 or V5.0, an overall failure rate of 36%.

SEVERAL CONCLUSIONS CAN BE DRAWN FROM THESE FINDINGS:

- In this small sample the level of compliance with V5.0 is higher than compliance with the older V4.0.
- In general the availability of E*V4.0 and E*V5.0 computers is quite limited, with the vast majority of computer models on the Australian market presently bearing no useful information regarding compliance with any energy efficiency standards.
- One DT computer available on the market was found to be compliant only with E*V3.0, a standard introduced in the year 2000 and superseded in 2007.
- Very poor public visibility of useful information could be a significant barrier to consumers seeking higher efficiency computer equipment.

- Irrespective of whether better information is available to the public, if some of the information is inaccurate, as the overall 36% failure rate of this sample suggests, action should be taken to ensure consumer confidence in energy efficiency claims is justified.

The computer suppliers concerned will be provided with their individual model test results and the Department will seek their cooperation to establish why such a poor result occurred. The Department is proposing to test a larger sample of E* computers in 2010 where the results may be published in a report that will be available to the public.



THE METHODOLOGY

The Appliance Energy Efficiency Branch at DEWHA set out to explore the efficiency of computers that are marketed in Australia as being compliant with E*4.0 or E*5.0 efficiency benchmarks, as published by the US Environmental Protection Agency (EPA).

DEWHA chose to test computers using the US EPA ENERGY STAR® methodology as the ENERGY STAR® benchmarks and test methodologies have become the de-facto international standard for energy efficiency for computers. For instance the EPA methodology is used as a mandatory qualifier for computers purchased by the US Government. ENERGY STAR® is also the only scheme accepted by multinational computer suppliers . More information about the ENERGY STAR® scheme can be found at www.energystar.gov

The availability of ENERGY STAR® compliant desktop and notebook computers in Australia was assessed by reference to manufacturer, distributor and retailer internet sites and published advertising literature.

National computer sales data was purchased on which an assessment of market share of make and models of computers could be made. A purchasing list of ENERGY STAR® compliant computers that were representative of the market shares of the major brands was drawn up. Computers selected were those suitable for home, commercial or government use but were not considered to be high end gaming machines.

One of the notable early observations was the difficulty even a highly informed buyer encountered when trying to identify E* compliant computers. For instance a review of computer products in printed advertising material in Canberra (The Canberra Times and numerous direct mail retail catalogues) found none that included claims of ENERGY STAR® compliance, for laptops or desktops.

An extensive online review of laptop and desktop computer sales information included popular Australian retail and computer company web sites. There were none that prominently flagged ENERGY STAR® compliance. It proved exceedingly difficult to find specific information on energy performance of individual products from retail sites or even from leading brands online.

Leading brands at vendor sites, and at the brands[1] Australian web sites, had no product specific energy performance information. A representative from one leading brand supplied a list of complying products and claimed that the company was in the process of updating their product documentation to include ENERGY STAR® information. One leading online distributor at least had a general account of energy performance with many of its products, though not specifically relating product performance to ENERGY STAR® compliance.

A search on "energy star", within the Australian site of the brand that appeared to be most committed to making energy performance information prominent, returned 41 products (19 desktop computers, 9 printers, 7 laptops and 6 printers). A search on "energy" within two other leading brands and suppliers' Australian sites returned no products. The product specifications at a major online retailer included no reference to ENERGY STAR®. A link to manufacturer's web sites was included for more information.

[1]A revised standard, Version 5 for computers, came into effect July 2009 and hence was not used for this analysis. Version 4 for computers commenced in 2007 and replaced an earlier version, Version 3, which came into effect in 2000.

A June 2009, glossy, color, 56 page printed catalogue of a leading Australian technology retailer was closely examined for reference to energy. It had only two instances of the word "energy" – both however were within promotional material for Intel processors, and not actually associated with leading models or makes of computers.

Enquiries and conversations with technicians at contracted testing laboratories, who had conducted an earlier testing program, confirmed that they had also encountered a high degree of difficulty in finding information on claims of ENERGY STAR® compliance.

The earlier test population had partially been assembled by purchases through retail outlets. The technicians involved reported that retail sales people had simply no useful knowledge about ENERGY STAR® compliance of products they were selling. Further it was suggested that in the retail environment, questions about energy efficiency tended to illicit responses that suggested retail sales staff will tell a customer what the sales person thinks they want to hear, as opposed to something that was genuinely accurate.

Ultimately, given the difficulty encountered in identifying ENERGY STAR® compliant computers from publicly available information in the retail environment in Australia, it was decided to take another approach.

The US EPA ENERGY STAR® website provides a Purchasing & Procurement resources page (www.energystar.gov/index.cfm?c=bulk_purchasing.bus_purchasing) which includes ENERGY STAR-Qualified Model Lists for Desktops, Integrated and Portable Computers. These lists include information about the market region of listed products.

A number of qualifying computers was selected from that list, and a computer hardware services provider was asked to try to confirm the availability of these machines. The same list was used to search for individual computers on the (if possible Australian) websites of the equipment manufacturer, and obtain supporting documentation on ENERGY STAR® compliance.

This process was time consuming and, even with a list of products registered by manufacturers with the EPA, it was often not possible to find supporting documentation published by the manufacturer that detailed the performance or compliance of the individual devices.

Finally, after many days of research and communication with a large number of suppliers and manufacturers, a list of 23 computers that made explicit ENERGY STAR® claims were identified as being available in Australia, and suppliers had confirmed they had them in stock. In the end one of these was discovered to be an E*V3.0 computer, so only 22 computers that met the original criteria for testing were procured.

One of the immediate conclusions that can be drawn from this exercise is that, given the tremendous array of computer equipment that is available and actively marketed to the Australian public, computer manufacturers do not make any significant effort to promote energy efficiency, or make information about the efficiency of computers available in a form that allows consumers to compare performance of computers.

DEWHA DECIDED TO TEST THE EFFICACY OF E* CLAIMS AS A MEANS OF PROVIDING MEASURES OF COMPARATIVE COMPUTER EFFICIENCY FOR TWO CENTRAL CONSIDERATIONS:

- The absence of any other benchmark that is as widely accepted by industry makes E* the simplest and most appropriate comparison between models sourced from different suppliers; and,
- The global ICT industry is forthright in making claims about their "green credentials" and examining the products actually available in the market, and that are promoted as being E* compliant, was a simple method to verify those claims.

THE SAMPLE

During mid-2009, while the computers for this study were being purchased and tested, there were computers in the market compliant with two E* benchmarks, E*V4.0 and E*V5.0.

E*V4.0 was introduced in 2007 and E*V5.0 was introduced to the market in July 2009. While the E* program requires that earlier versions of E* equipment have the marketing material identifying them removed, following the commencement of a new standard, there is a period of grace during which stock labelled under the prior standard is expected to be still moving through the supply lines and into the market.

As a result, and given the relatively limited sample that could be procured making any E* claims, equipment making both E*V4.0 and E*V5.0 claims were tested in this study.

Of the 22 computers that made up the sample, 11 were desktop computers and 11 were notebook computers. Of the DT computers, eight made claims to being E*V4.0 compliant and three made claim to being E*V5.0 compliant. Of the NB computers, six made claim to being E*V4.0 compliant and five made claim to being E*V5.0 compliant.

THE TESTING

Under the ENERGY STAR® protocol, desktop (DTs) computers and notebook (NBs) computers are divided into categories of equipment depending on their base line configuration such as RAM, hard disk drive(s), processor cores etc. The categories applied to computers tested against E*V4.0 criteria are DTA, DTB, DTC and NBA and NBB.

Additional categories have been added under the more recently introduced E*V5.0 criteria. Under E*V5.0 the categories used are DTA, DTB, DTC and DTD, and NBA, NBB and NBC.

The change from E*V4.0 to E*V5.0 has also involved a change in how energy performance is measured. Under E*V4.0 performance is measured against specific power use in various modes of operation, plus the state of the power management settings. The criteria used and the power consumption levels applied under E*V4.0 are displayed below in Tables 1, 2, and 3.

Class	DTA	DTB	DTC	NBA	NBB
Max Idle Power Watts	≤50	≤65	≤95	≤14	≤22

TABLE 1: IDLE POWER LIMITS FOR EQUIPMENT CLASSES UNDER E*V4.0

Class	DTA	DTB	DTC	NBA	NBB
Max Sleep Power Watts	≤4	≤4	≤4	≤1.7	≤1.7

TABLE 2: SLEEP POWER LIMITS FOR EQUIPMENT CLASSES UNDER E*V4.0

Class	DTA	DTB	DTC	NBA	NBB
Max 'Off' Power Watts	≤2	≤2	≤2	≤1	≤1

TABLE 3: OFF POWER LIMITS FOR EQUIPMENT CLASSES UNDER E*V4.0

In addition, 0.7 W is allowed in both sleep and off mode power for computers with 'Wake-on-LAN' (WOL) enabled.

Under the E*V5.0 standard the performance criteria were changed to allow a calculation of 'Typical Energy Consumption' (TEC) per annum. This is calculated using a set of assumptions for hours of operation and hours in any particular mode. The power use of the computer in each mode – idle, sleep, and off or standby – still need to be measured, but then the TEC is calculated using a set formula for annual hours of operation. Allowances are made under E*V5.0 for various configurations such as extra gigabytes of RAM and additional hard drives.

The TEC Values applied to E*V5.0 computers are listed below in *Tables 4 and 5*.

DT Category	Base TEC kWh pa
A	148
B	175
C	209
D	234

TABLE 4: ANNUAL TEC REQUIREMENTS FOR E*V5.0 DESKTOP COMPUTERS

NB Category	Base TEC kWh pa
A	40
B	53
C	88.5

TABLE 5: ANNUAL TEC REQUIREMENTS FOR E*V5.0 NOTEBOOK COMPUTERS

Power management settings are mandatory under both E*V4.0 and E*V5.0 and computers must have the specified power management settings enabled when they are first taken out of the box.

To qualify under E*V4.0 in its category a computer must meet all three mode power limits, and have power management enabled, set to put the computer to 'sleep' after 30 minutes of inactivity, and the monitor to 'sleep' after 15 minutes of inactivity.

To qualify under E*V5.0 in its category a computer must meet the specified TEC and have power management enabled as per the E*V4.0 settings.

It is important for the reader to note that presentation of test results from computers claiming compliance with E*V4.0 and E*V5.0 is not intended to imply that a computer from one category does not comply with requirements under the other category. E*V4.0 and E*V5.0 use different approaches to benchmarking the efficiency of computers. The aggregation of test results from computers claiming compliance to these different standards is purely for information only, and is not a comparison of the relative merits of E*V4.0 versus E*V5.0.

DESKTOP RESULTS

The computers were tested for power used in idle mode, sleep mode and when off. In the case of the E*V5.0 machines these results were then used to calculate the TEC of the device, however in the charts below the performance of the E*V5.0 machines on individual measures is included with the results of the E*V4.0 machines to assist readers understand the components of the E*V5.0 TEC calculation.

Further the compliance of all of the computers' power management settings were checked against the ENERGY STAR power management requirements.

All eight E*V4.0 DT computers were Category B machines as defined by the E*V4.0 protocols. The E*V5.0 DT computers were one Category B, one Category C and one Category D machine.

All of the eight E*V4.0 DT computers met idle power limits as shown in *Figure 1.*

Performance in 'sleep' mode and when 'off' or in standby mode is tested against two operational states, with Wake-On-Lan (WOL) disabled and with WOL enabled. In the following two figures only the results of tests with WOL disabled are displayed. The results were essentially identical when WOL was enabled across all machines.

All of the eight DT computers claiming E*V4.0 met the sleep mode limit of 4W, although one of the E*V4.0 DT computers was found to not have a sleep mode at all, as was one of the E*V5.0 machines. This distinction does not change the result as the E*V4.0 computer moved straight from idle mode to standby mode which was even lower energy.

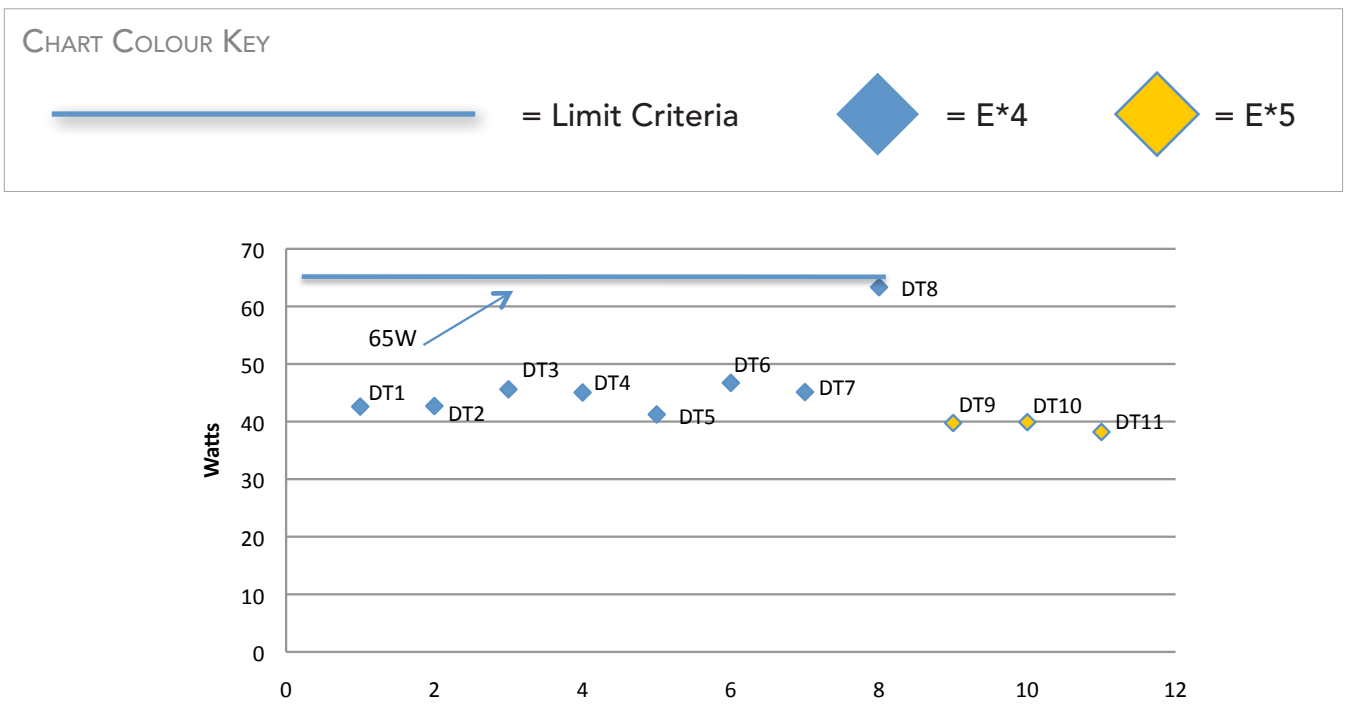


FIGURE 1 – IDLE POWER IN 11 DESKTOP COMPUTERS AGAINST E*V4.0 POWER LIMITS

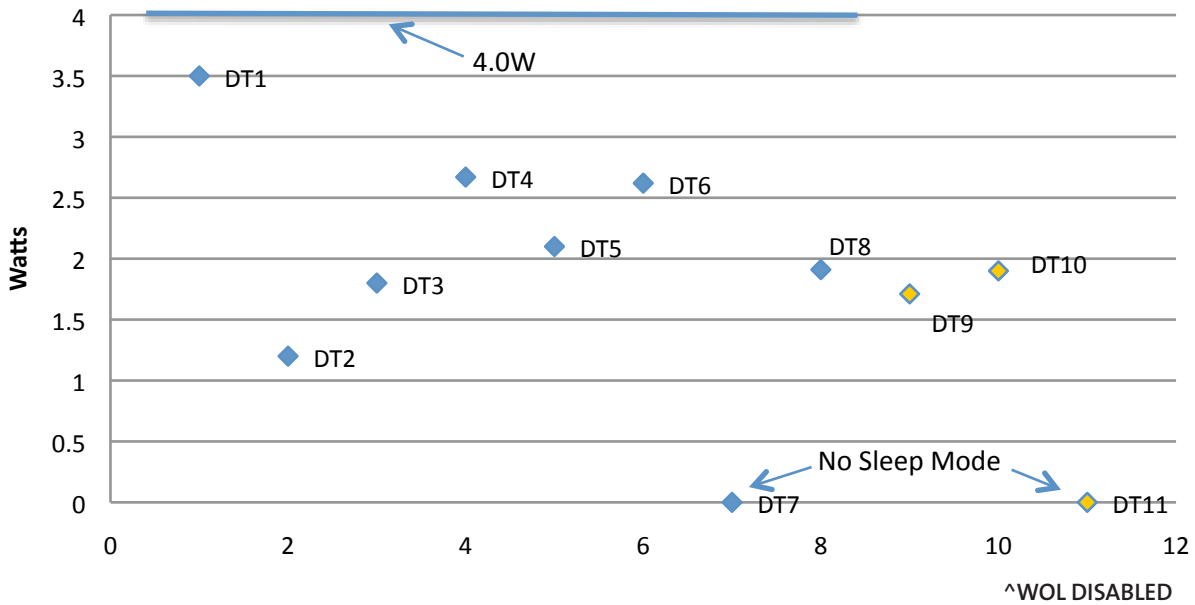


FIGURE 2 – SLEEP POWER^ IN 11 DESKTOP COMPUTERS AGAINST E*V4.0 POWER LIMITS

All but one of the E*V4.0 DT computers passed the standby power limit of 2W.

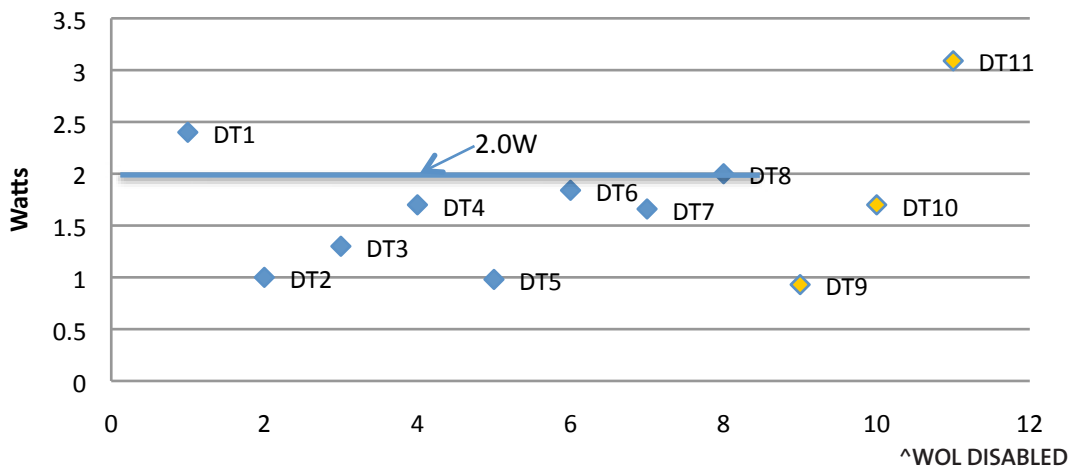
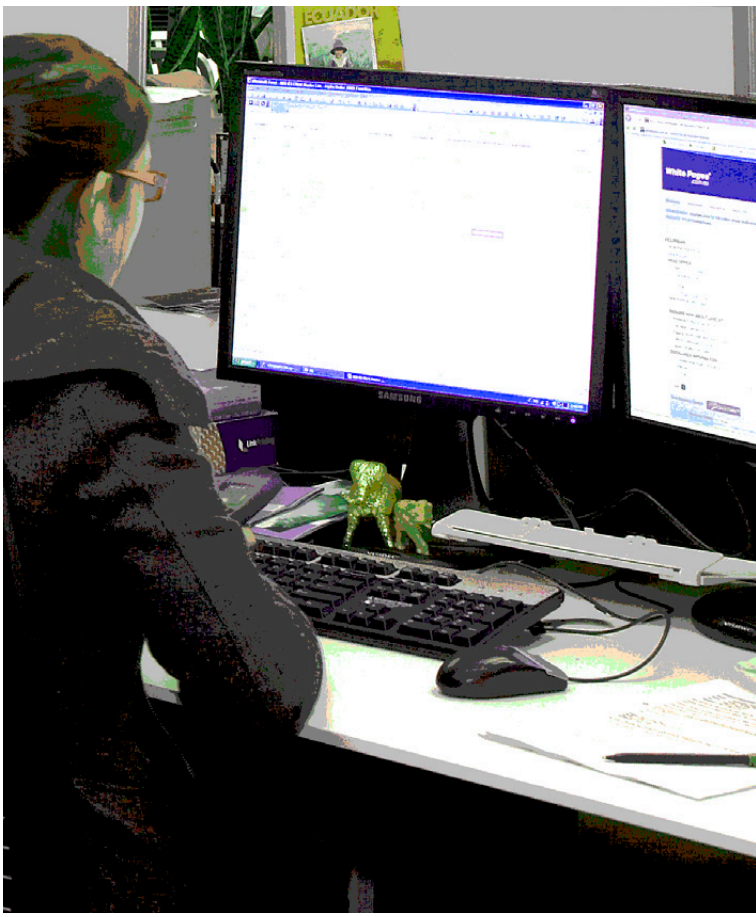


FIGURE 3 – STANDBY POWER^ IN 11 DESKTOP COMPUTERS AGAINST E*V4.0 POWER LIMITS

Thus when compared across all power limit criteria, strictly speaking, only one of the DT computers failed against the E*V4.0 power requirements. However the one E*V4.0 DT that failed on the Standby Power test criteria did pass when tested for Standby Power with WOL enabled. Because of the risk of potential testing error, and the chance that a single sample might not be representative of the average performance of this model, for the purposes of this report this computer will be deemed to pass the E*V4.0 power use criteria.

Power management settings were assessed by the test labs when the computer is first commissioned 'out of the box'. These test results for the DT computers were not as positive as on the power consumption limit tests.

Of the eight DT computers claiming E*V4.0 compliance, four did not have power management settings in place on either the computer system or for the monitor as required. Thus Table 6 shows the results of testing of the E*V4.0 machines.



Number E*V4.0 DT Computers Tested	Passed Power Limit Criteria	Passed Power Management Criteria	Passed E*V4.0 Completely	Percentage that failed to pass E*V4.0 completely
8	8*	4	4	50%

*Allowing deemed to pass result for the DTB computer that failed Standby power test WOL disabled.

TABLE 6: RESULTS FOR DT COMPUTERS TESTED AGAINST CLAIMED E*V4.0 COMPLIANCE

The E*V5.0 DT computer results on these individual measures were used to calculate their annual TEC. The three E*V5.0 DT computers were all from different categories, one being DTB, one DTC and one DTD, for which different TEC limits are applied.

For the sake of easy comparisons of performance between the E*V4.0 DTs and the E*V5.0 DTs the TEC of the E*V4.0 computers has also been calculated and included in *Figure 4*.

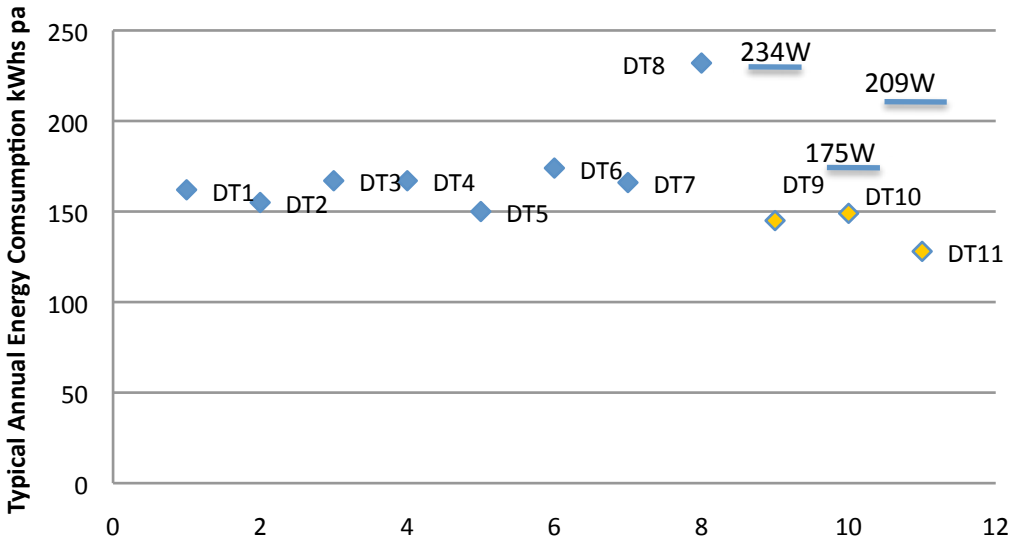


FIGURE 4 – TEC IN 11 DESKTOP COMPUTERS AGAINST E*V5.0 TEC ALLOWANCES

DT9 = E*V5.0 DTD
DT10 = E*V5.0 DTB
DT11 = E*V5.0 DTC

It is notable that even though DT11 would have failed the standby power test under E*V4.0, because of the way that the aggregate Typical Energy Use per annum is used to assess compliance with E*V5.0, this computer passes in its category.

Further all three E*V5.0 DT computers were found to be compliant with power management settings thus giving the results set out in *Table 7*.

Number E*V5.0 DT Computers Tested	Passed Power Limit Criteria	Passed Power Management Criteria	Passed E*V4.0 Completely	Percentage that failed to pass E*V5.0 completely
3	3	3	3	0%

TABLE 7: RESULTS FOR DT COMPUTERS TESTED AGAINST CLAIMED E*V5.0 E*V5.0 COMPLIANCE

NOTEBOOK RESULTS

Of the eleven NBs that were tested, six claim to be E*V4.0 compliant and five claim to be E*V5.0 compliant.

One of the E*V4.0 NBs was a Category A computer and 5 were Category B computers. As shown in *Figure 5* below, the NBA computer failed to meet idle power limits for its class.

Of the six E*V4.0 NBs tested for energy used in 'sleep' mode, one failed to meet the E*V4.0 power limitation of 1.7W as illustrated in *Figure 6*, and failed by a very large margin. The computer that failed was once again the NBA computer that failed the idle power test.

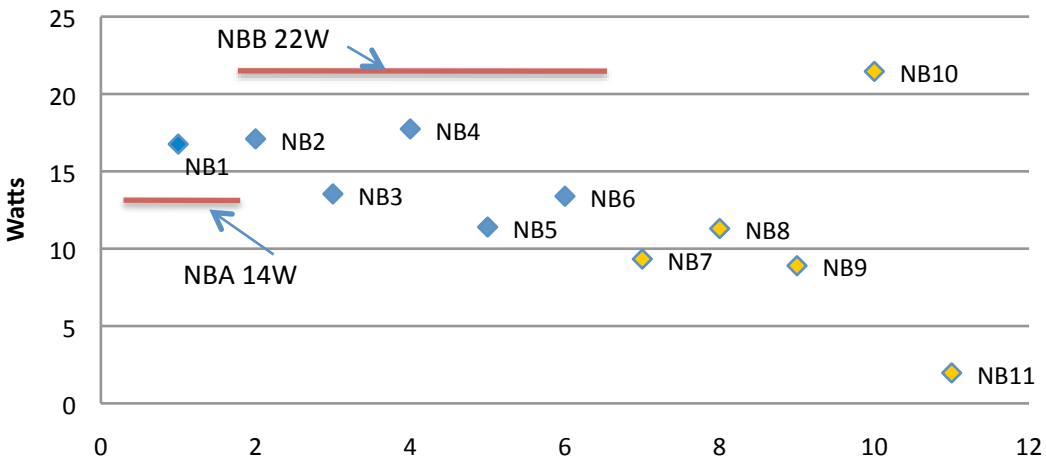


FIGURE 5 – IDLE POWER IN 11 NB COMPUTERS AGAINST E*V4.0 POWER LIMITS

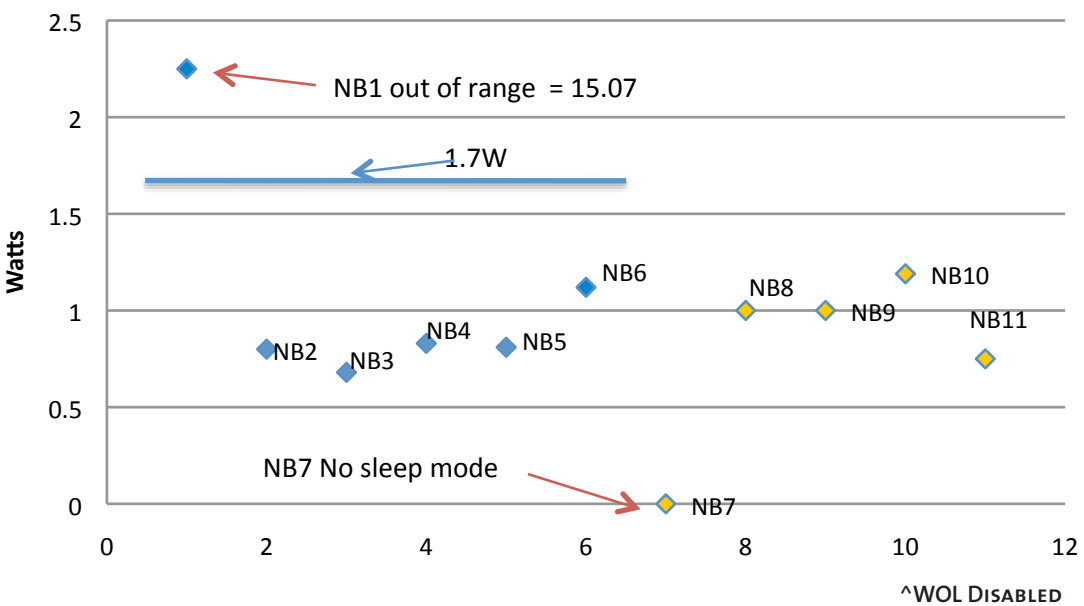


FIGURE 6 – SLEEP POWER^ IN 11 NB COMPUTERS AGAINST E*V4.0 POWER LIMITS

Of the six E*V4.0 NBs tested for power consumption when in 'off' mode, two failed to meet E*V4.0 power limits as illustrated in *Figure 7* below. Once again the NBA computer that had failed on the other two power limit measures, failed this test, but also one of the NBB category computers failed to meet the standby power limits of 1W.

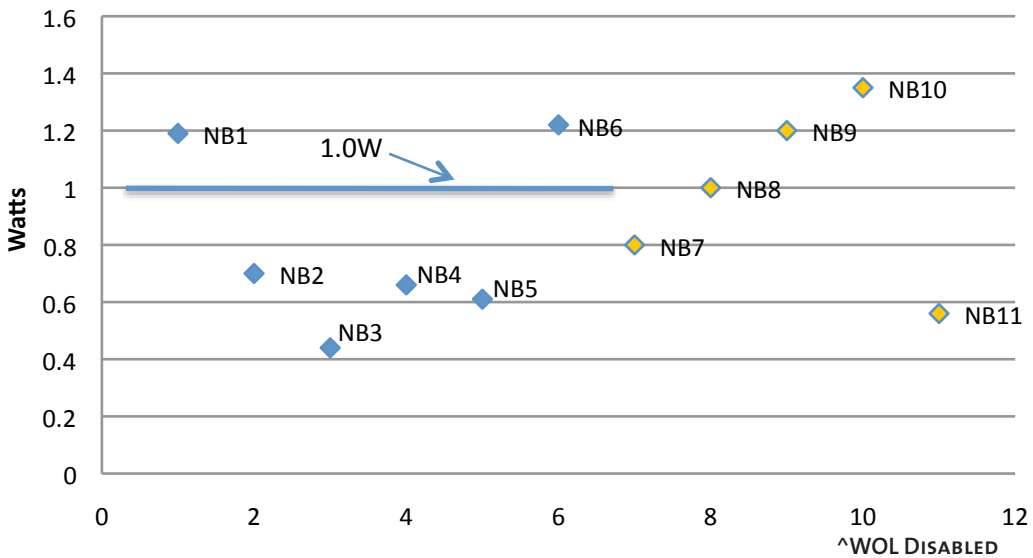


FIGURE 7 – STANDBY POWER^ IN 11 NB COMPUTERS AGAINST E*V4.0 POWER LIMITS

Thus when the NB computers claiming E*V4.0 compliance are tested across all power limit criteria two failed. However because one of these computers failed only one of the three power limit criteria, and in this case the standby power limit where the failure test showed that it failed by just 0.2W, this machine could be deemed to be passed given the single test result, the potential for testing error, and the fact that it did pass the second standby power test with WOL enabled.

When the six NB computers claiming E*V4.0 compliance had their power management settings examined, it was found that one failed. Thus across all criteria of the six NB computers tested claiming E*V4.0 compliance, two failed as shown in *Table 8*.

The results for NB computers that claimed E*V5.0 compliance were used to calculate their annual TEC. The five NB computers claiming E*V5.0

Number E*V4.0 NB Computers Tested	Passed Power Limit Criteria	Passed Power Management Criteria	Passed E*V4.0 Completely	Percentage that failed to pass E*V4.0 completely
6	5*	5	4	33%

*Allowing deemed to pass result for NBB computer that failed Standby power test WOL disabled

TABLE 8: RESULTS FOR NB COMPUTERS TESTED AGAINST CLAIMED E*V4.0 COMPLIANCE

compliance covered all NB categories, three being NBA, one NBB and one NBC, for which different TEC limits are applied.

For the sake of easy comparisons of performance between the E*V4.0 NBs and the E*V5.0 NBs the TEC of the E*V4.0 computers has also been calculated and included in *Figure 8* below.

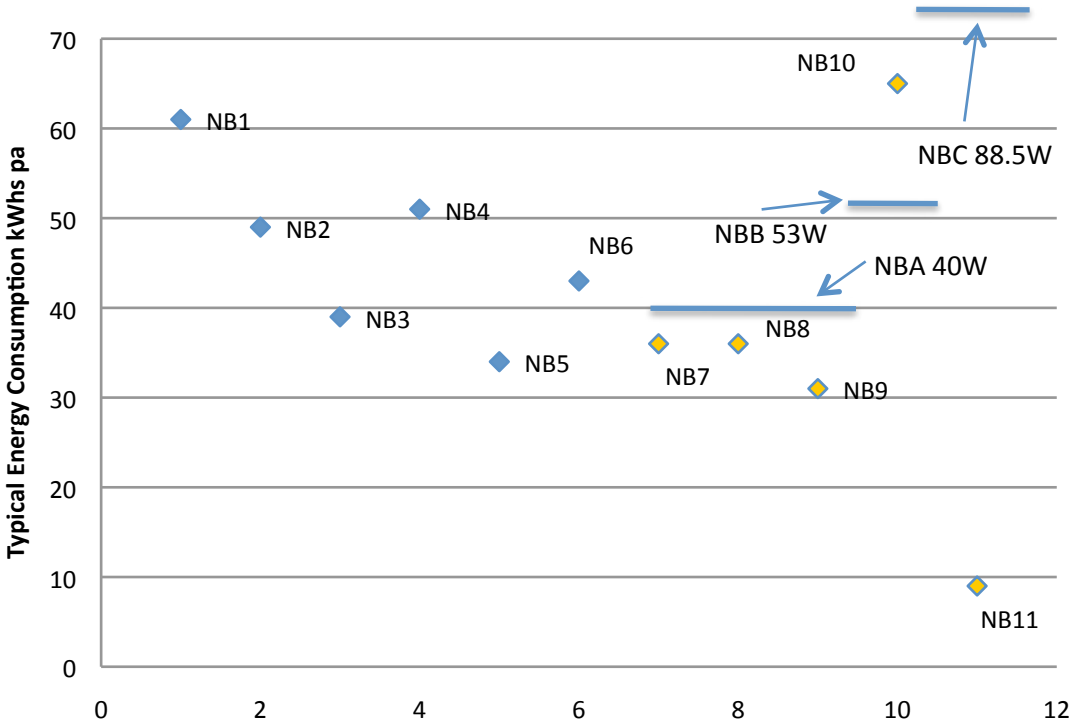


FIGURE 8 – TEC IN 11 NOTEBOOK COMPUTERS AGAINST E*V5.0 TEC ALLOWANCES

Notably the NB computer claiming E*V5.0 compliance that failed the TEC limit test for its NBB category, also had high individual results against both idle power and standby power, compared to other NB computers tested in this sample.

When the five NB computers claiming E*V5.0 compliance had their power management settings examined, it was found that one failed. Thus across all criteria, of the five NB computers tested claiming E*V5.0 compliance, two failed as shown in *Table 9*.

Number E*V5.0 NB Computers Tested	Passed Power Limit Criteria	Passed Power Management Criteria	Passed E*V5.0 Completely	Percentage that failed to pass E*V5.0 completely
5	4	4	3	40%

TABLE 9: RESULTS FOR NB COMPUTERS TESTED AGAINST CLAIMED E*V5.0 COMPLIANCE NUMBER E*V5.0 NB COMPUTERS TESTED

Consolidated results for both DTs and NBs against the E* class that they claimed compliance with are illustrated in *Tables 10 and 11* below.

E*V4.0	Number Tested	Failed Power Limit Criteria	Failed E*V4.0 Power Management Criteria	Did Not Meet Completely	Met E*V4.0 Completely	Failed %
DTs	8	0	4	4	4	50%
NBs	6	1	1	2	4	33%
Total	14	1	5	6	8	43%

TABLE 10: RESULTS OF TESTING 14 COMPUTERS AGAINST CLAIMS OF E*V4.0 COMPLIANCE

E*V.05	Number Tested	Failed Power Limit Criteria	Failed E*V.05 Power Management Criteria	Did Not Meet Completely	Met E*V.05 Completely	Failed %
DTs	3	0	0	0	3	0%
NBs	5	1	1	2	3	40%
Total	8	1	1	2	6	25%

TABLE 11: RESULTS OF TESTING 8 COMPUTERS AGAINST CLAIMS OF E*V5.0 COMPLIANCE

Finally, aggregated results of all the computers in the sample are presented in *Table 12.*

E*4 and E*5	Number Tested	Failed Power Limit Criteria	Failed Power Management Criteria	Did Not Meet Completely	Met Completely	Failed %
DTs	11	0	4	4	7	36%
NBs	11	2	2	4	7	36%
Total	22	2	6	8	14	36%

TABLE 12: RESULTS OF TESTING 22 COMPUTERS AGAINST E* COMPLIANCE CLAIMS

The overall rate of compliance with E* claims raises serious questions over the value of the ENERGY STAR program's ability to provide useful consumer information.

Further testing of E* claims among consumer computer equipment is recommended.