EnergyStar: Jump on the Bandwagon!

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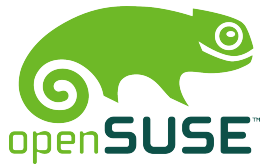
SUSE Linux Products GmbH - R&D Mobile Devices

24th February 2008



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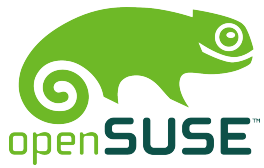

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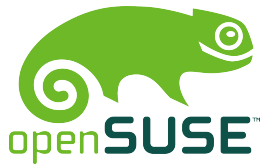
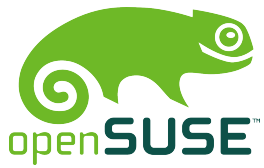


EnergyStar

Wikipedia

"Energy Star is a United States government program to promote energy efficient consumer products"



EnergyStar Label

Granting use

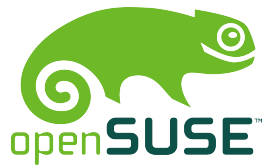
US Government decree to allow the use and procurement by public authorities

European Commission

- Subset of specs
- Own specs
- Only office equipment
- 28-12-2006: Adoption of Computer Spec

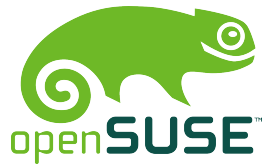
Target Products

EnergyStar: Jump on the Bandwagon!



ENERGY STAR® Program Requirements for Computers

Table of Contents



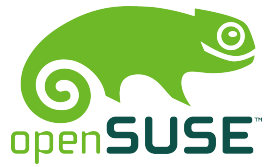
Laptop Categories

Category A

All laptops which do not fit into Category B

Category B

Video card with more than 128 MB *non-shared* memory



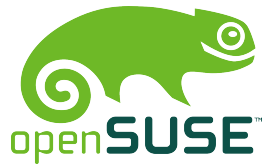
Requirements

Laptop needs support for...

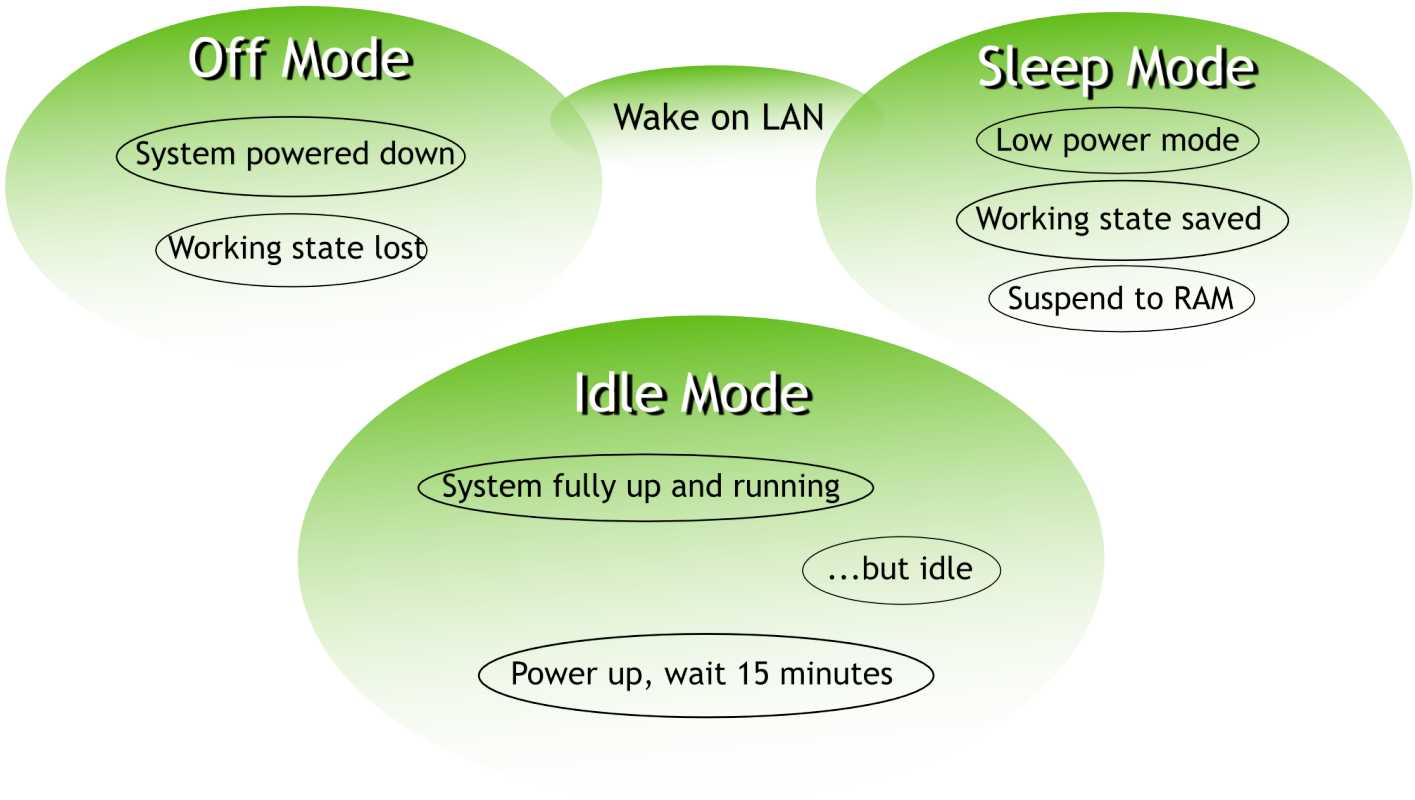
- Working Sleep Mode (Suspend to RAM)
- Wake On LAN

Software Settings

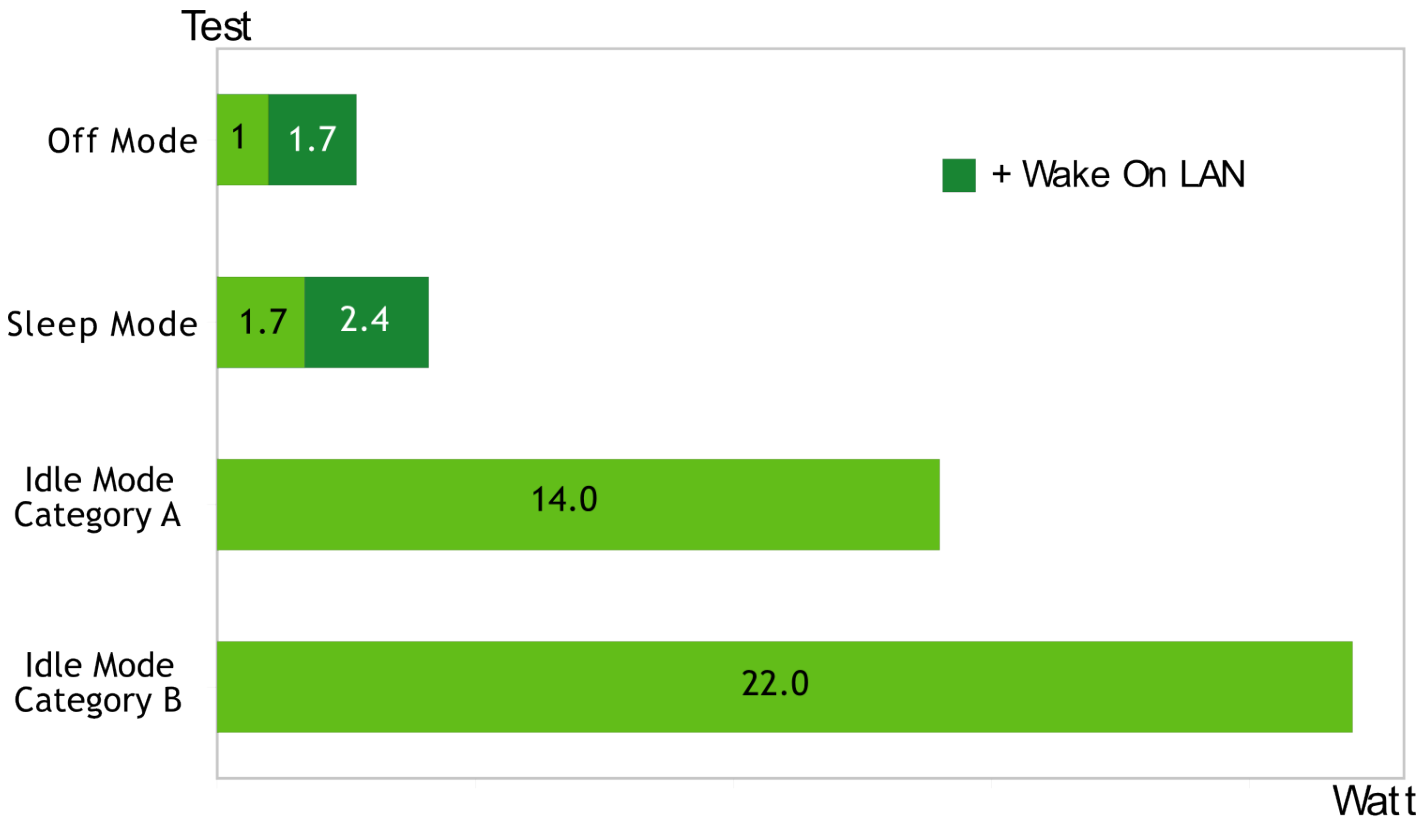
- Display to go into sleep after 15 minutes
- System to go into sleep after 30 Minutes



Operational Modes

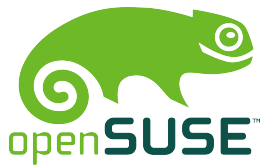


Consumption Limits



Test Setup Requirements

- Configured as shipped
- Network connectivity
  - Live network connected
  - Wireless network off (antenna off)
- No external devices such as hard disks, mice, UPS, etc.
- No battery. If not possible, make sure battery is fully loaded
- Power meter connected between main outlet and the AC power supply



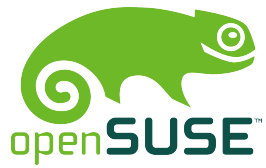
Test Procedure

All Tests

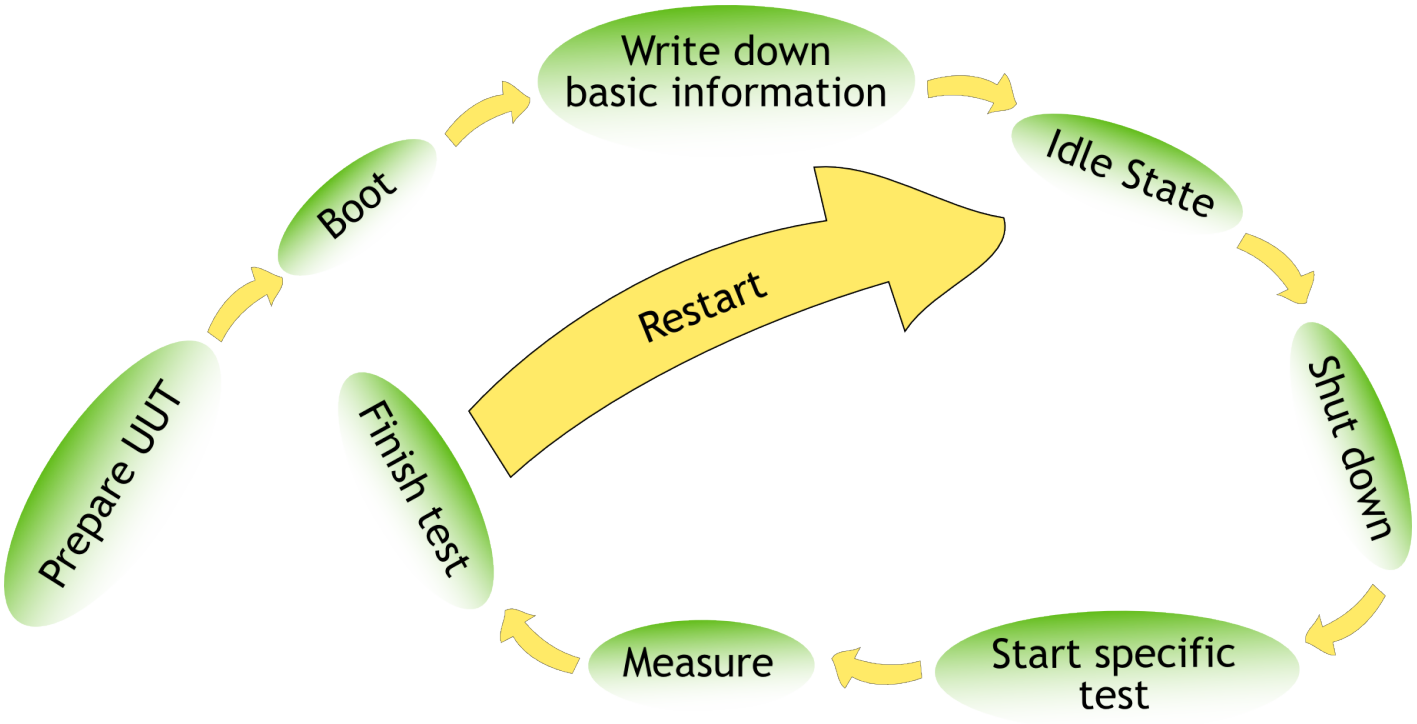
1. Record the laptop's system information
2. Make sure it is configured as shipped by default
3. Configure display to power down after 1 minute
4. Shut the laptop down

Specific Idle Test

5. Switch the laptop on, log in
6. Default desktop
7. Wait 15 minutes until the system is idle, display now off
8. Start measurement for 5 minutes (one reading per second)
9. Calculate arithmetic mean
10. Send results to EnergyStar



Big Picture


Write down basic information
Idle State
Shut down
Start specific test
Measure
Finish test
Prepare UUT
Boot
Restart

Example Test Sheet

(http://opensuse.org/PowerMeasurements)

General

Model:	Example system
Manufacturer:	PowerManufacturer
CPU:	Mobile 64 bit, 800 Mhz
RAM:	480MB
Operating System:	openSUSE 10.3
AC Voltage:	230 V
Category:	A ★ B

GFX Card

Model:	Onboard graphics with shared memory
Memory:	32 MB shared
Resolution:	1024x768
Bits per pixel:	24

Miscellaneous

Not able to determine if WOL was on or off when the system is shut down

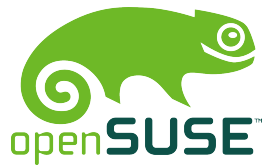
System Capabilities and Configuration

Configured as shipped:	x
Wireless network off:	x
Sleep mode:	x
Wake On LAN:	
Auto display sleep (15'):	x
Auto system sleep (30'):	x

Results

What	Result (W)	Required (W)	Passed
Off (WOL disabled)	0.5	<= 1.0	x
Off (WOL enabled)	1.9	<= 1.7	
Sleep (WOL disabled)	1.0	<= 1.7	x
Sleep (WOL enabled)	2.7	<= 2.4	
Idle	17	A: <= 14, B: <= 22	

EnergyStar compliant: x



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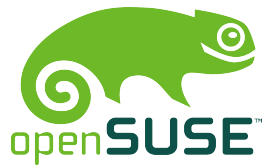


What You Get

Users

- Huh? Battery still not empty?
- Mobility
- Saving money
- Good concience

Manufacturers

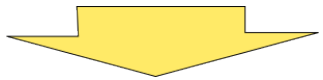
Marketing

Distributions

Marketing

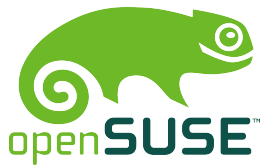
Companies

Reducing power costs



Everybody Wins!

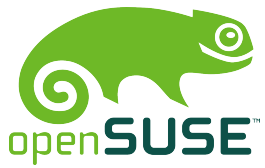
EnergyStar: Jump on the Bandwagon!



What Manufacturers need to do...

Manufacturers have to provide...

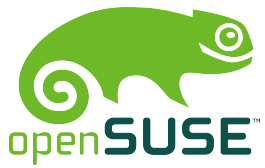
- Energy friendly hardware base
- EnergyStar compliant default BIOS configuration
- Good interface documentation for accessing power management capabilities



What Developers need to do... 1/2

Kernel

- USB power management
- Sound power management
- WLAN power management
- Dynticks/Tickless
- CPU Frequency Scaling



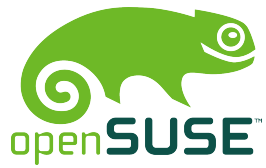
What Developers need to do... 2/2

Desktop

- Provide configuration possibilities
- Good default configuration
- Don't do stupid things like polling

Base System

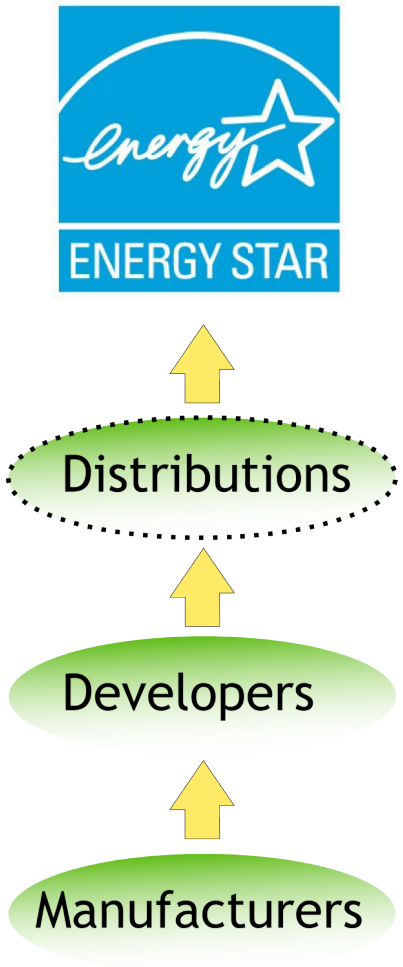
- Good policy: Don not run cron jobs on battery
- Intelligent daemons making use of inotify, udev, HAL, etc



What Distributions need to do...

Distributions have to...

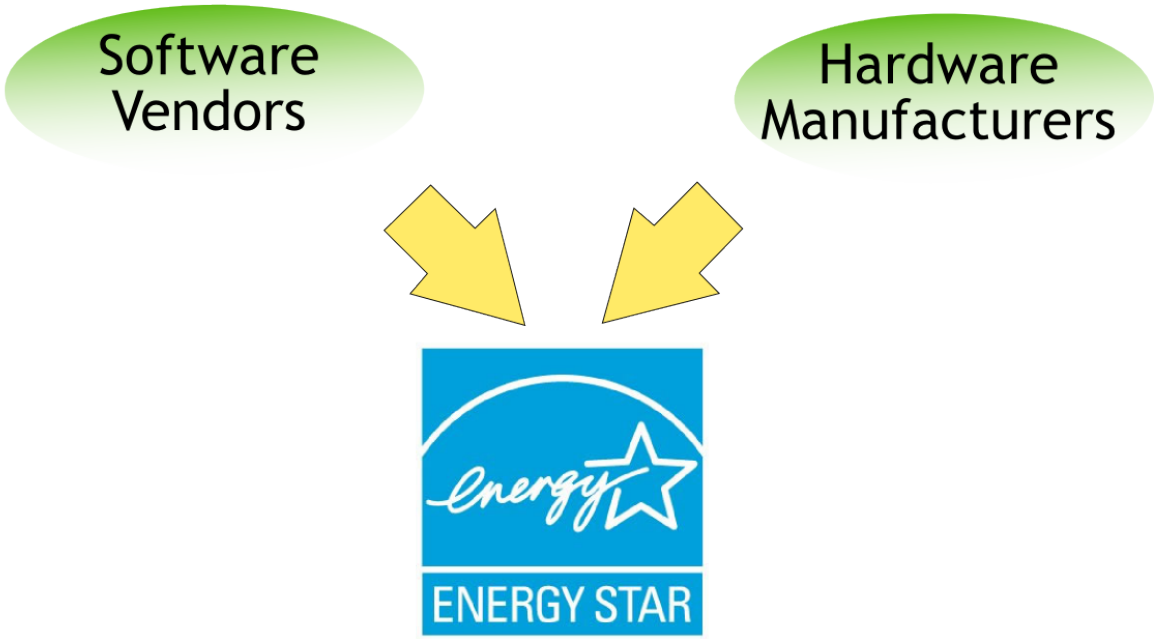
Ship EnergyStar compliant default configuration!



Taking Stock of...

Aggregation between...

Software **AND** Hardware



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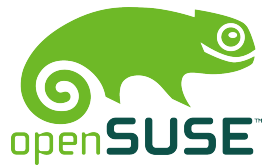
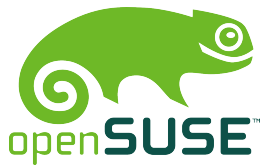


Annoying requirements

Auto sleep when on AC after *30 minutes*?

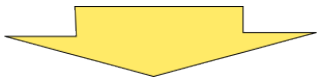
Missing test scenarios for common use cases

- No wireless connectivity
- No application tests (office, mail, editors, etc.)
- No external devices



Combination of Software *AND* Hardware

Cooperation of all involved parties is not always easy



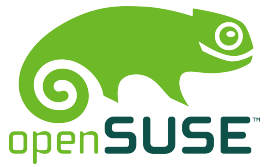
Few laptops with
EnergyStar certification!

Acceptance

Not widely established, but...

...vendors start to work on that, and...

...EnergyStar wins more and more recognition



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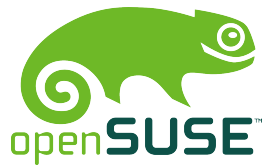
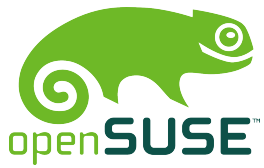
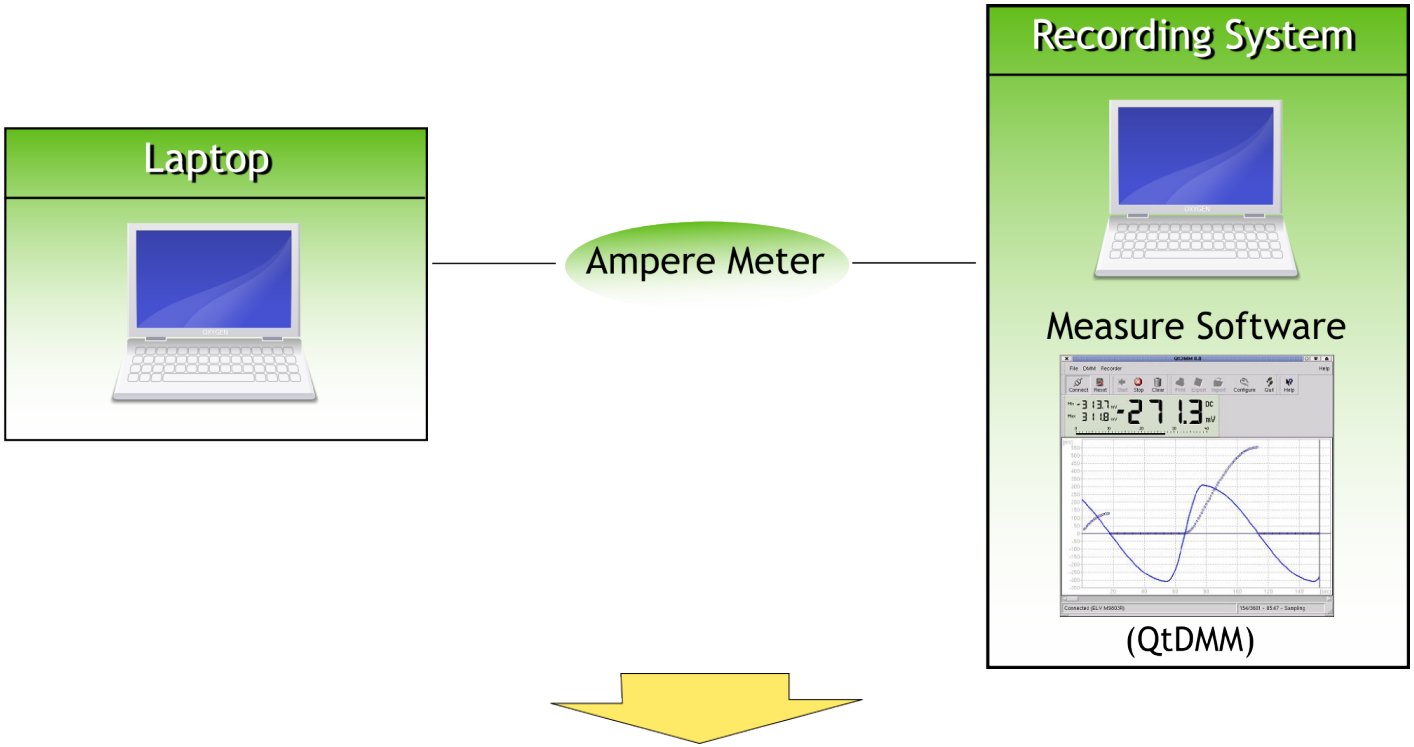


Requirements

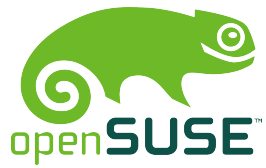
- Two computers
  - The Unit Under Test (UUT)
  - Recording system
- Ampere meter
- Measurement software QtDMM
- Script to evaluate QtDMM's exported data






```
$ ./arithmetic_mean.sh qtdmm_data
calculating arithmetic mean...done
Result: 25.30 W
```

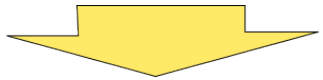
EnergyStar: Jump on the Bandwagon!



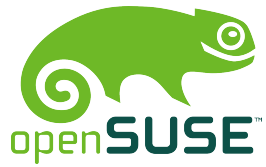
Requirements

Read from /proc or /sys

- Keep battery inside the laptop...
- ...but disconnected from power source
- Script to monitor battery drain
- Only Idle Mode testing!



```
$ ./monitor_battery_drain.sh -t 5
Using /proc/acpi/battery/BAT0/state to read from...
Reading for 5 seconds...
Average power consumption: 20.04 W
```



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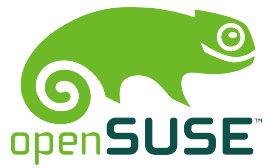
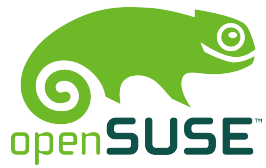


http://opensuse.org/PowerMeasurements

- EnergyStar Power Measurement Guide
- Result Sheet Template (pdf and plain text)
- Script to calculate arithmetic means produced by QtDMM
- Script to monitor /proc/acpi/battery/* over a period of time
- etc.

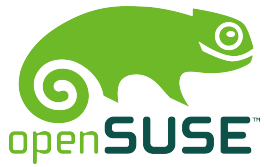


QtDMM

`http://www.mtoussaint.de/qtdmm.html`

EnergyStar

- US: `http://www.energystar.gov`
- EU: `http://www.eu-energystar.org`



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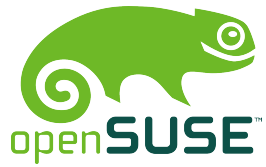
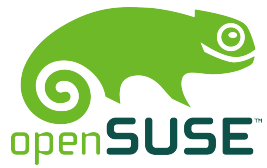


openSUSE is not completely ready

No auto sleep after 30 minutes when on AC

openSUSE Build Service

- http://software.opensuse.org (hmacht's Home Project)
  - EnergyStar compliant KPowersave
  - EnergyStar compliant GNOME-power-manager



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