[[The Wikibon Project]]

A Method and Process to Measure the Energy Efficiency of Storage Arrays

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Phoenix, 10/15/2009

Agenda

Introduction
- Wikibon
- Wikibon Energy Lab
- Vendors & Technologies Measured

- Measuring the Impact of Energy Efficient Technologies on Storage
  - Measurement Method
  - Hardware Example
    - Measurements
    - Hero Report
    - Field Validation
  - Software Examples
    - Measurements
    - Hero Report
    - Field Validation
- Towards an Energy Star Program
- Conclusions, Summary & Discussion

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Introduction to Wikibon (1)

- A growing community of 7,000 IT practitioners
- Goal is to provide an open source platform for practitioners to share knowledge
- Based on a Wiki (2,000+ pieces of content)
- www.wikibon.org

Deep Storage Domain Expertise

David Vellante – former IDC Senior Vice President

David Floyer – former IBM, IDC Research VP

Nick Allen – former Gartner Research VP

Bill Mottram – former Copan/STK Vice President

Dennis Martin – former Evaluator Group / STK

Gary MacFadden – Former Meta, Giga, IDC

Wikibon Energy Lab

- Established to help the storage industry qualify for energy rebates from utility companies
- Provides validation of vendor lab measurements
- Developed Processes in close coordination with PG&E
  - Mark Bramfitt, Principal Program Manager
  - Randy Cole, Senior Project Manager
  - Bill Dunckel, Senior Project Manager

- Working with PG&E to extend programs to Seattle, Austin, and other utilities

Storage Vendors & Energy/Power – Saving Technologies Measured

3PAR	Virtualization & Thin Provisioning
compellent	Virtualization & Thin Provisioning
COPAN	MAID *
DataDirect Networks	Spin-down
EMC²	Thin Provisioning, Spin-down, Flash Drives
HITACHI	Virtualization & Thin Provisioning, Spin-down
nexsan	AutoMAID
Verari systems	Vertical Cooling
Xiotech	Virtualization & Thin Provisioning

* Before Wikibon

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  - **Measurement Method**
  - **Hardware Example - AutoMAID**
    - **Measurements**
    - **Hero Report**
    - **Field Validation**
  - Software Example – Virtualization & Thin Provisioning
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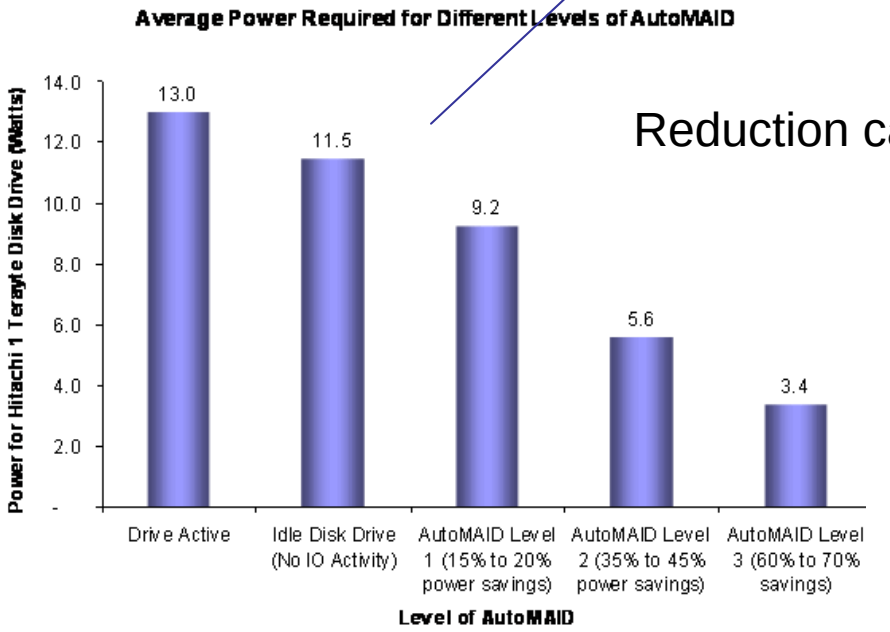
Measurement Method

- All measurements in Lab, not on site
- IO Workload defined as:
  - 1/3 Random (small block),
  - 1/3 Sequential (large Bock),
  - 1/3 Idle
- Storage Array Components Measured Included:
  - Drive-types
  - Drive Chassis
  - Ports
  - Service Processor
  - Controller(s)
- Able to Calculate any Configuration from Sum of Components (accuracy >95%)
- Base-line is Storage Product ***without*** Energy Saving Technology

Hardware Example: AutoMAID Measurements

Table 2a: Power Input (VA) Savings from AutoMAID on Disk Drives for Nexsan Storage Arrays - Dual Controller, Dual Power Supply					
	Capacity/RPM	Idle	MAID Lv1	MAID Lv2	MAID Lv3
Hitachi	500/7200	0	1.6	4.3	5.9
Hitachi	750/7200	0	2.0	5.3	7.3
Hitachi	1000/7200	0	2.2	5.9	8.1
Seagate	750/7200	0	0.0	0.0	7.2



Reduction calculated from Idle Disk as Base Measurement

Source: Wikibon 2009, http://wikibon.org/wiki/v/Wikibon_Green_Validation_Report:_Nexsan_Energy_Efficient_AutoMAID_Technology

Hardware Example: AutoMAID "Hero Report"

AutoMAID Performance

Description	Disk-Time	Percent
Disks active	441 hours 53 mins	6 %
Heads parked (Level 1)	520 hours 56 mins	7 %
Reduced speed (Level 2)	18 hours 27 mins	0 %
Disks stopped (Level 3)	5829 hours 15 mins	85 %
AutoMAID Efficiency	-	88 %

88% Saving

Source: Wikibon 2009, http://wikibon.org/wiki/v/Wikibon_Green_Validation_Report:_Nexsan_Energy_Efficient_AutoMAID_Technology

Hardware Example: Field Validation

Nexsan Storage Use	MAID Levels							
User Application	Day	Evening	Weekend	Comments	AM0	AM1	AM2	AM3
Genealogy Data	1	2	4	Most clients use the system during the evening and weekends - day use is light	48%	5%	5%	43%
Medical Image Archive	4	1	2		52%	4%	4%	39%
Scientific Images	1	2	2		31%	6%	6%	57%
email Archive	1	2	2		31%	6%	6%	57%
Medical Research Archive	2	2	3		46%	6%	6%	43%
Test System for delivering rich media	2	2	3		46%	6%	6%	43%
Test System for delivering scientific research data	2	2	3		46%	6%	6%	43%
Storage and backup of rich media	3	2	1	Part of the system is used for backup - that portion can use MAID since day use is light	40%	6%	6%	48%
Hours/week	60	60	48	Average	42%	6%	6%	47%

42% 6% 6% 47%

- Nexsan & Wikibon did a detailed study of the "Hero Reports" of eight customers who were analyzing the deployment of AutoMAID across multiple SATABeast arrays
- Savings calculated from # drives and % of time drives in energy saving mode

Source: Wikibon 2009, http://wikibon.org/wiki/v/Wikibon_Green_Validation_Report:_Nexsan_Energy_Efficient_AutoMAID_Technology

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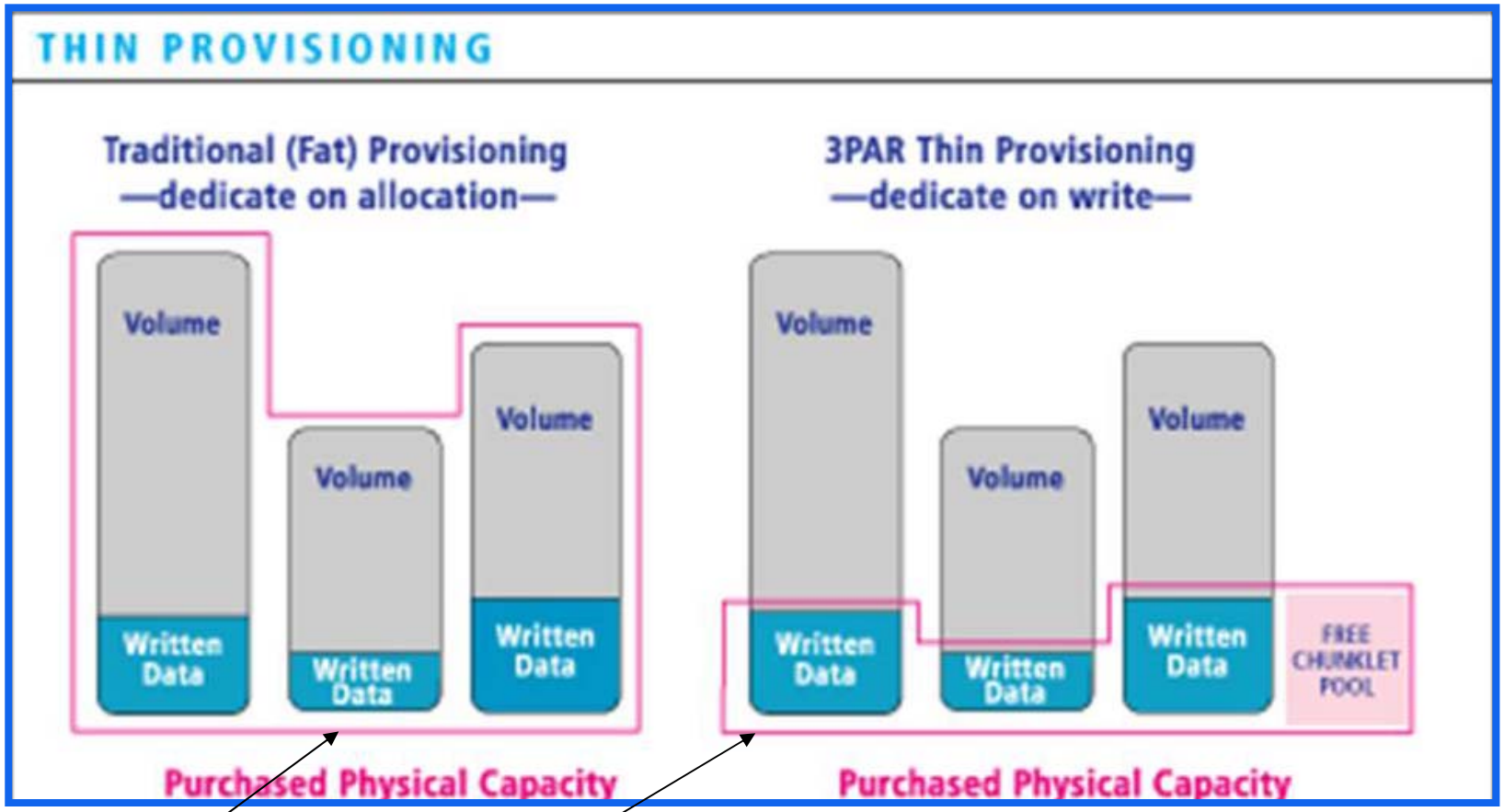
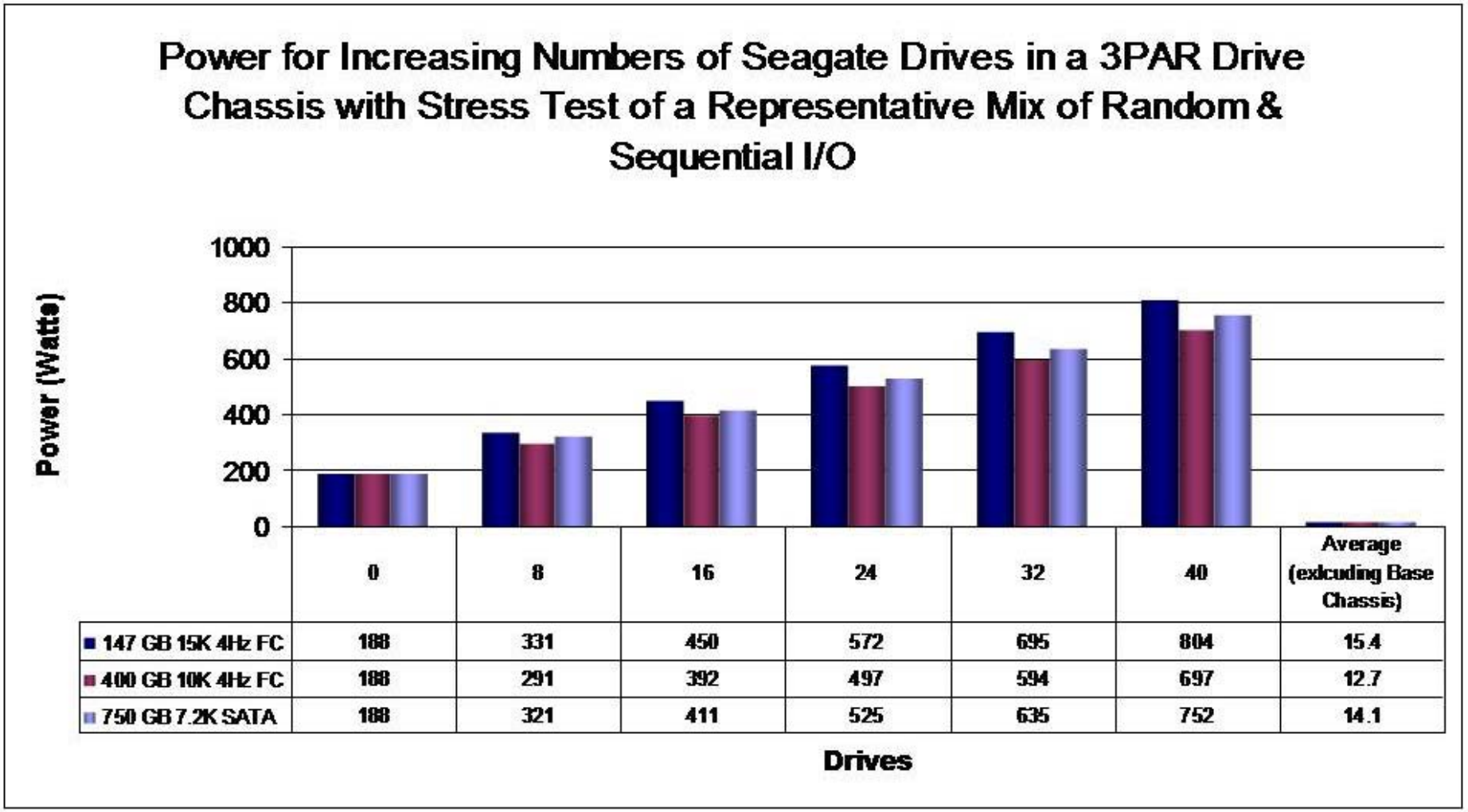
Software Example – Virtualization & Thin Provisioning Benefits



Saving of 50%+ in disk capacity

Source: Wikibon 2009, http://wikibon.org/wiki/v/Green_Validation_Report:_3PAR_InServ_Storage_Arrays

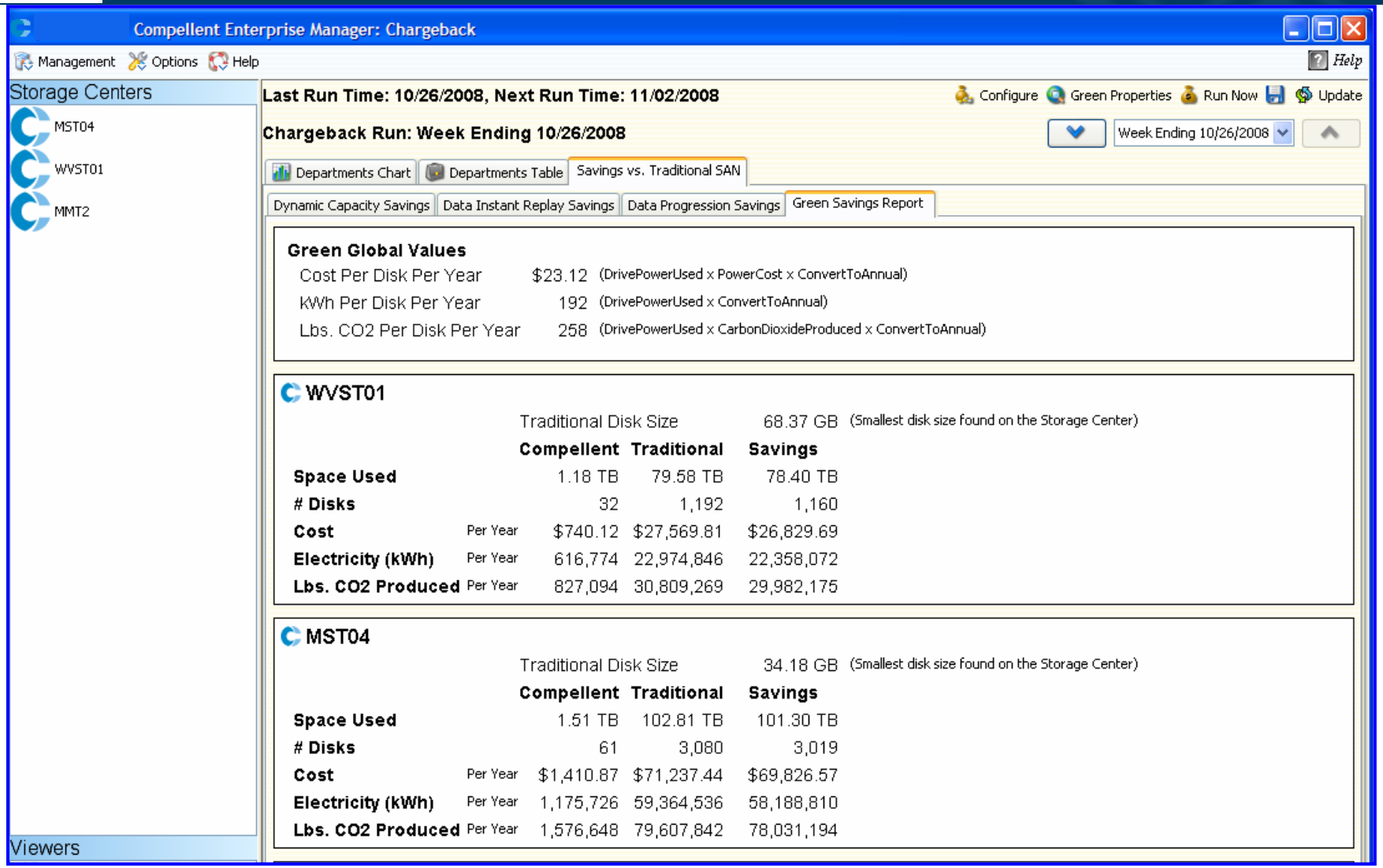
Software Example – Virtualization & Thin Provisioning Array Measurements



	0	8	16	24	32	40	Average (exlcuding Base Chassis)
147 GB 15K 4Hz FC	188	331	450	572	695	804	15.4
400 GB 10K 4Hz FC	188	291	392	497	594	697	12.7
750 GB 7.2K SATA	188	321	411	525	635	752	14.1

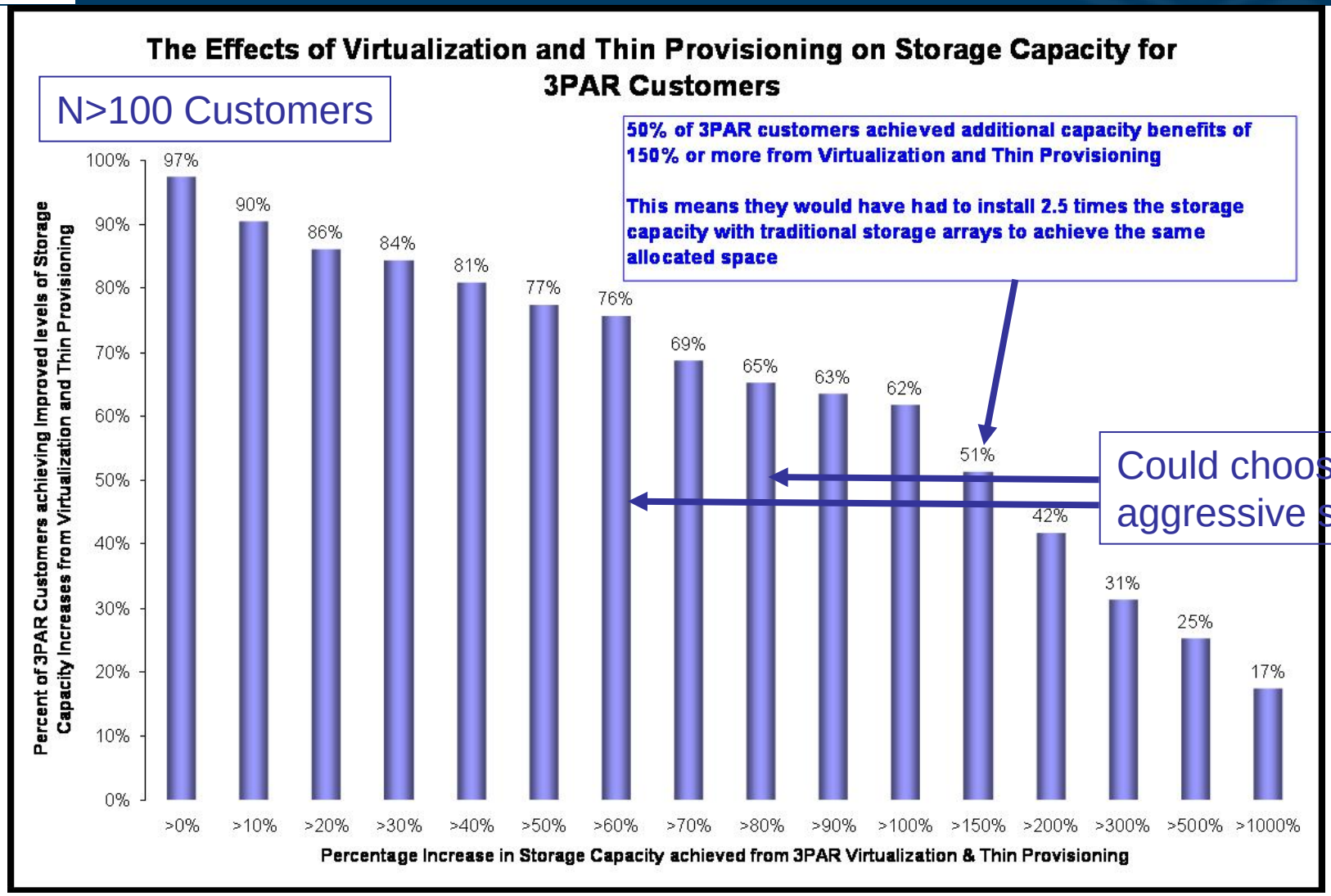
Source: Wikibon 2009, http://wikibon.org/wiki/v/Green_Validation_Report:_3PAR_InServ_Storage_Arrays

Best of Breed Software Hero Report (Compellent)



Source: Wikibon 2009, http://wikibon.org/wiki/v/Wikibon_Green_Validation_Report:_Compellent_Thin_Provisioning_and_Virtualization_Technologies

Best of Breed Software Field Validation Study



Source: Wikibon 2009, ttp://wikibon.org/wiki/v/Case_Study:_Evaluating_the_virtualization_and_thin_provisioning_benefits_achieved_by_3PAR_customers

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Towards an Energy Star Program (1)
Define Technologies & Array Component Savings

- Define List of Software & Hardware Technologies that can save Significant Energy/Power e.g.,
  - Virtualization
  - Thin Provisioning
  - MAID, AutoMAID & Spin-down
  - Flash Drives
  - Deduplication
  - High Efficiency Power Supplies
  - Etc.
- Collect Measurements of Energy/Power Savings in the field from each vendor for each technology (from “Phone-Home” function). Data maintained centrally with customer/vendor confidentially and savings in storage array components achievable
- Vendors who cannot supply (say) >10 deployments and (say) 30% of base and do not achieve (say) 60% of average savings of all vendors cannot include technology
- Technologies that do not improve Energy/Power by (say) >10% are not included

Towards an Energy Star Program (2) Define Baseline & Vendor Energy Savings

- Define Baseline for each Vendor/Technology as Storage Array without Energy Efficient Technologies
- Develop a consistent methodology to measure array components
  - Define workload
  - Components within the array
- Measure Configuration with Energy Saving Technologies as defined
- *Either* Measure either Baseline configuration directly
- *Or* Calculate Baseline by adding additional components required to Energy Saving Configuration
- Calculate Vendor Array Energy Savings from Technology

Source: Wikibon 2009, http://wikibon.org/wiki/v/Wikibon_Green_Validation_Report:_Nexsan_Energy_Efficient_AutoMAID_Technology

Towards an Energy Star Program (3)
% Savings by Vendor Array

- Calculate Energy Savings from all Technologies in Vendor Array
- Set Energy Star Rating according to % reduction achieved by top 20%
  - >70% (say)
- Change over time as new technologies added

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Conclusions & Discussion

- Pragmatic & Adjustable Approach - No Classification of Array Types Required
- Measurements completed by Vendors with External Review
- Including Hardware ***AND*** Software Features will drive up % Savings
- Data on Technology Impact supplied by Vendors (Hero reports & Field Validation) with External Review
- Very fast final process to award Energy Star
- Discussion……..