

Canada's First Data Server Virtualization Energy Conservation Utility Program

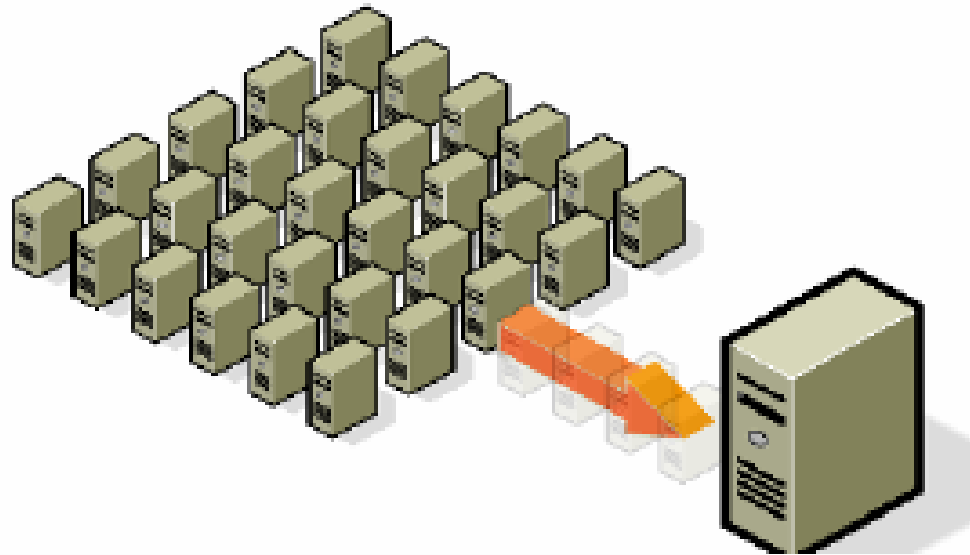
CEE – Boston

...finally.

June 12, 2008

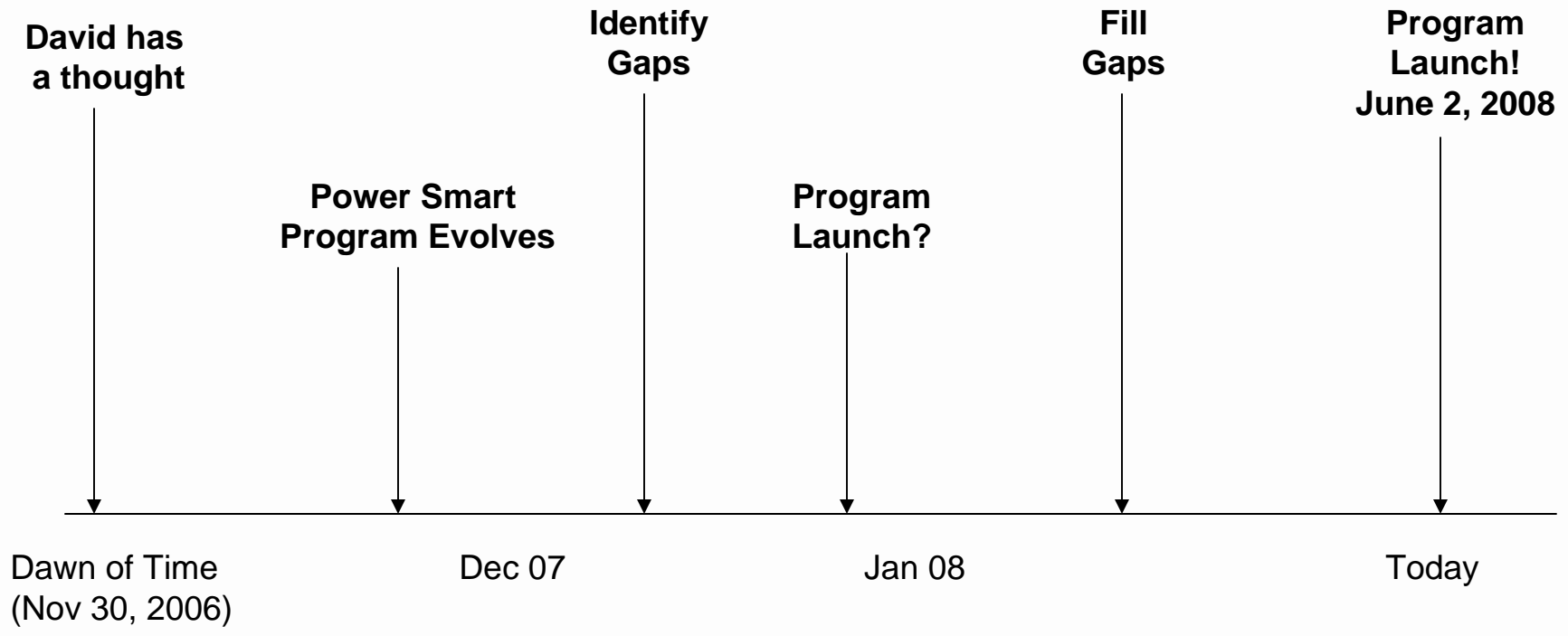
BC hydro 

BC hydro
POWER SMART



10:1 to 30:1 Ratio

Quick History



- Engineer Calculation - ISO Report verifying savings
- Incentives - Virtualization, Cooling & Power Conversion Offsets
- Effective Measure Life - 8 Year EML approved
- Measurement and Verification Plan
- Incremental Costs versus Initial Installed Costs
- \$ Risk Value – 20% of NPV of TCO of Status Quo

Incremental Cost = Incentive

Status Quo

Year 1



50 Servers

Year 2



50 Servers

Year 3



50 Servers

Year 4



50 Servers

= 200 Servers

Virtualization

Year 5
Year 5



s

Year 6
Year 6



50 Servers

Year 7
Year 7



50 Servers

Year 8
Year 8



50 Servers

= 8 Virtual
= 200 Servers
Servers

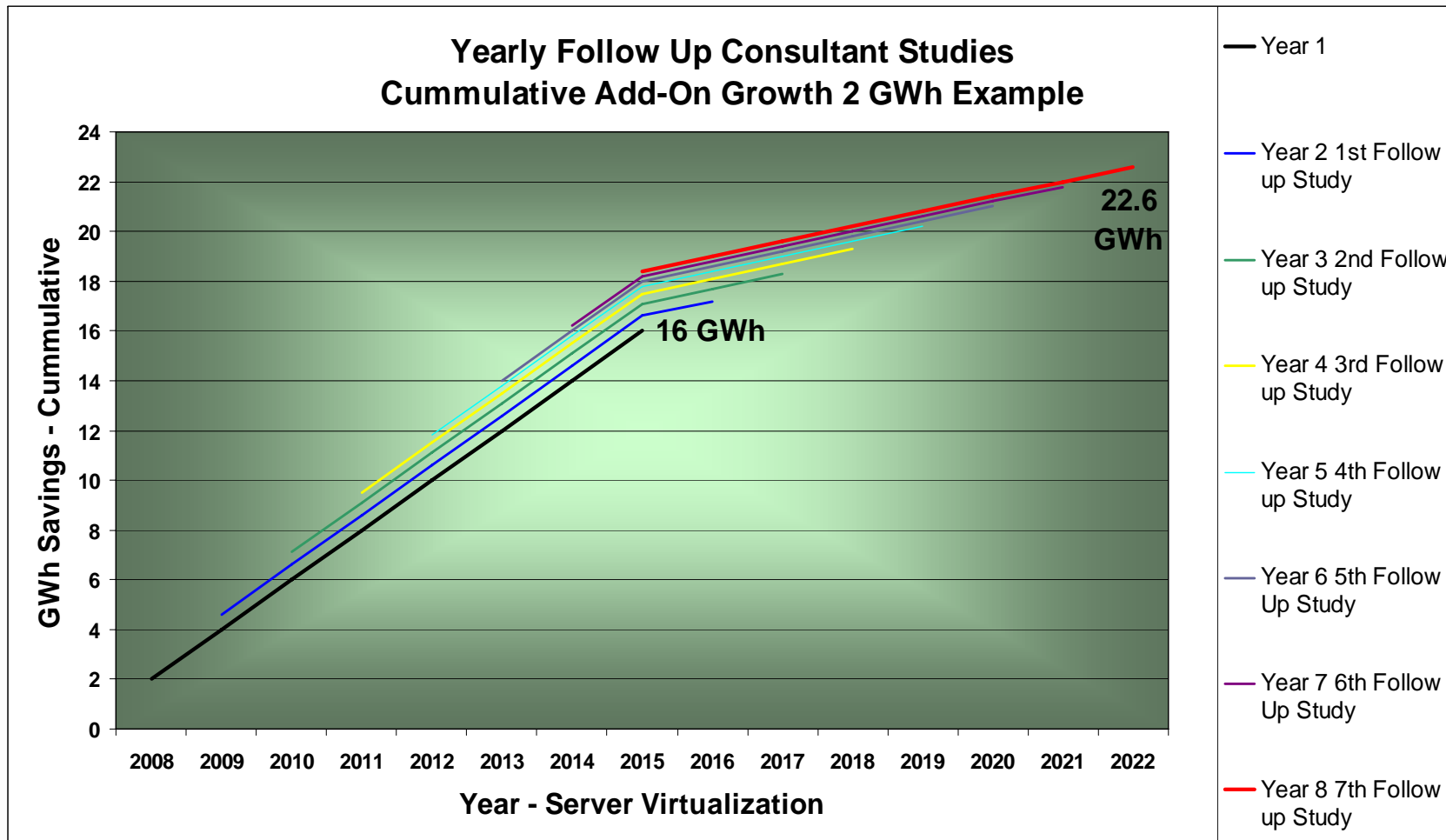
Which BC Hydro Customers Qualify?

- Spend \geq \$50,000/yr on electricity
- Each project must save \geq 100,000 kWh/yr
- Minimum of 50 Servers \geq 228W each

What is Incremental Cost?

Total Cost of Ownership over 8 yrs of Status Quo –
Total Cost of Ownership over 8 yrs to Virtualize

Every Incentive Project must have a Consultant Study
BC Hydro's pay's 50% of the study and 100% if
customer proceeds with project.



What Now?

**N
E
W**

Pre-Screen
Energy Study
Application

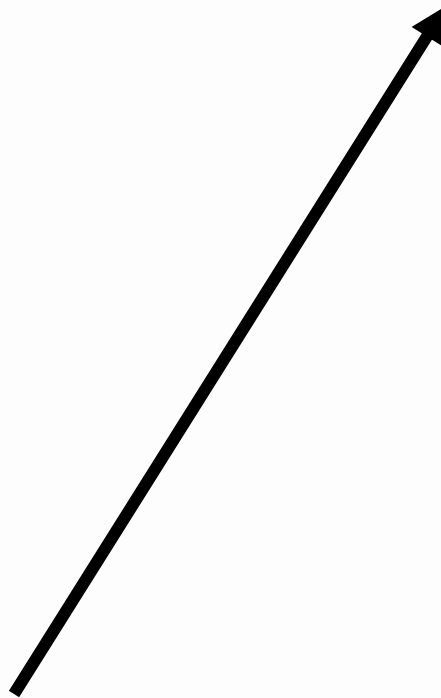


**N
E
W**

Energy Study
Contract



Energy Study



Capital Incentive
Application



Capital Incentive
Contract



Project
Completion

The Pre-Screen

Item	Date Centre Server Virtualization	Must Include Actual Number	Cost of one physical server	Estimated Total Electrical Demand kW
1	Existing Servers to Become Virtual Servers		R1	
2	New Physical Virtual Servers		R2	
3	Avoided Additional Physical Servers		R3	

R1: This is the total cost of ownership to replace one existing server, including (but not limited to) physical hardware, rack/ISO, cables, etc.
 R2: This is the total cost of ownership to purchase one new virtual server host, including physical hardware, licensing, cables, etc.
 R3: This is the number of forecasted avoided servers and requires clear documentation.

If known please include the following information:

Additional Data Storage in TB	
Additional Data Storage in Electrical Demand kW	
Is your data centre cooling system dedicated to the data centre or shared	YES / NO
UPS KVA Input	
UPS KVA Output	

Baseline Costs

Data Center Implementation	Physical Infrastructure		Virtual Infrastructure	
	Server Cost	Cost per Server	Server Cost	Cost per server (Virtual Machine)
Physical Hardware	\$8,000.00	\$8,000.00	\$35,000.00	\$1,029.41
Rack / ISO per server	\$4,500.00	\$281.25	\$4,500.00	\$16.54
4th year maintenance	\$1,500.00	\$1,500.00	\$2,000.00	\$58.82
Cost for Giga Port	\$900.00	\$900.00	\$2,400.00	\$70.59
Network Cables	\$75.00	\$75.00	\$200.00	\$5.88
KVM Switch Port	\$156.25	\$156.25	\$156.25	\$4.60
KVM Adapter	\$100.00	\$100.00	\$100.00	\$2.94
HP iLO	\$352.00	\$352.00	\$352.00	\$10.35
HBA Required	\$3,000.00	\$3,000.00	included	\$0.00
SAN Space	?	?	?	?
VMWare Licensing	\$0.00	\$0.00	\$20,635.00	\$606.91
Setup Labour (R29S)	\$208.73	\$208.73	\$208.73	\$68.76
Total	\$18,791.98	\$14,573.23	\$65,551.98	\$1,874.81

The Modeler

D41												
	A	B	C	D	E	F	G	H	I	J	K	L
1	Data Virtualization Modeling											
2				Status Quo Option								
3	Key Assumptions	# of Servers		Year	1	2	3	4	5	6	7	8
4	Status Quo	200		Server Cost	\$ 16,000	\$ 15,200	\$ 14,440	\$ 13,718	\$ 13,032	\$ 13,293	\$ 13,559	\$ 13,830
5	Virtualization	7		Cost per Year	\$ 800,000	\$ 760,000	\$ 722,000	\$ 685,900	\$ 651,605	\$ 664,637	\$ 677,930	\$ 691,488
6				NPV at 8%	\$4,101,083							
7	Risk per server	\$ 820,217										
8		(20% of total NPV cost of status quo)		Virtual Server Option								
9				Virtual Server Cost	\$65,000	\$ 61,750	\$ 58,663	\$ 55,729	\$ 52,943	\$ 54,002	\$ 55,082	\$ 56,183
10				Cost per Year	\$ 455,000				\$ 370,600			
11				Risk	\$ 820,217	\$ 738,195	\$ 664,375	\$ 597,938				
12				Cost of 3 Year Old Server	\$ 231,525							
13				Cost of 2 Year Old Server	\$ 441,000							
14				Cost of 1 Year Old Server	\$ 630,000							
15				Total Cost	\$ 2,577,742	\$ 738,195	\$ 664,375	\$ 597,938	\$ 370,600	\$ -	\$ -	\$ -
16	Please Fill in Yellow Boxes			NPV at 8%	\$4,238,810							
17	Calculated Fields											
18				Incremental Cost	\$137,727							
19												
20												
21				Potential Energy Savings								
22				Items	Status Quo	Virtualization						
23				# of Servers	200	7						
24				Demand (kW)	0.7	0.9						
25				Annual Energy Usage (kWh)	1,226,400	55,188						
26												
27				Estimated Energy Savings (kWh)	1,171,212							
28				(required minimum of 100,000 kWh for incentive)								
29												

Incentive Estimator

Power Smart Partners Commercial Incentive Estimator



Energy Cost per kWh **\$0.0450** (blended rate from AHR)

INPUT

#	Savings in kWh/yr	Energy Conservation Measure	Description	EML
1	1,171,212	Data Centre	Server Virtualization	8
2				0
3	-			0
4	-			0
5	-			0
6	-			0
7	-			0
8	-			0
9	-			0
10	-			0

SUM 1,171,212

Total Project Cost: **\$137,727.00**

Estimated incentive: \$82,000 number has been rounded as this is just an estimate



**Savings
1,350,000 kWh/yr**

Virtualized 297 Servers



**Savings
2 Million kWh/yr**

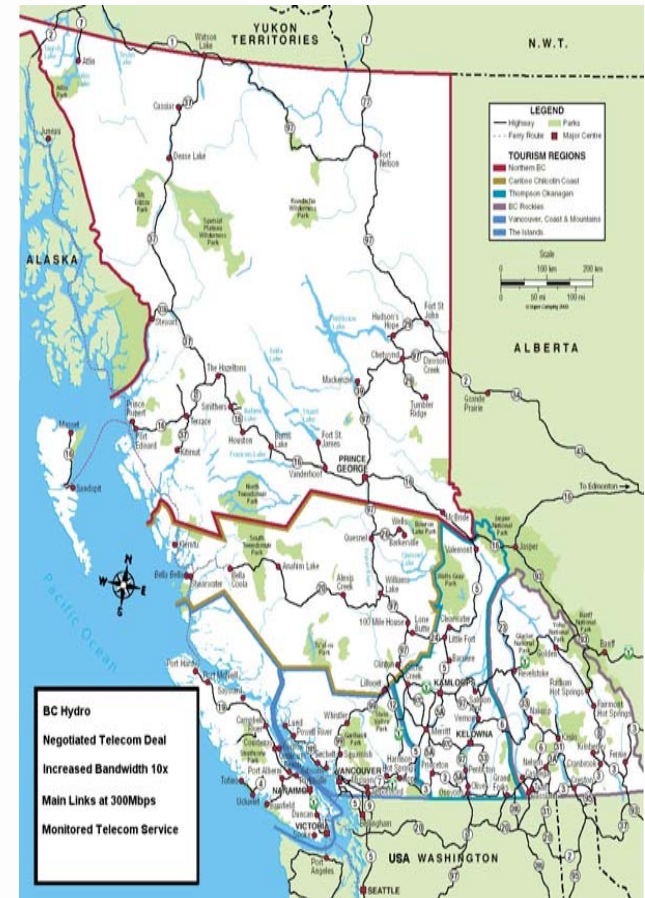
Virtualized 500 Servers

Commercial Customer	108 Servers
Savings	189,640 kWh/yr
Calculated Incentive	\$32,531
Average Server Demand	190W
TRC Benefit Ratio	0.94
EML	8 years

Health Authority	267 Servers
Savings	2,112,114 kWh/yr
Calculated Incentives	\$274,858
Average Server Demand	908W
TRC Benefit Ratio	2.88
EML	8 years

BC Hydro – Data Centre 1.325 GWh/yr in savings

1. 292 Virtual Servers
2. Consolidated 35 Servers from District Offices to Main Data Centre
3. Energy Efficient Data Storage
4. Raised its 3rd Party Benchmarking Rating from a 6 to a 9 out of 10.





**Energy Efficient Data Storage
at BC Hydro**

BChydro 

**From Symmetrix 8800, DMX1 & DMX2
5 x 4.2 kVA
58 TB Data Storage (raw)**

Saved 111,000 kWh/yr

**To Symmetrix DMX3
4 x 6 kVA
88 TB Data Storage (raw)**

BChydro 
powersmart****

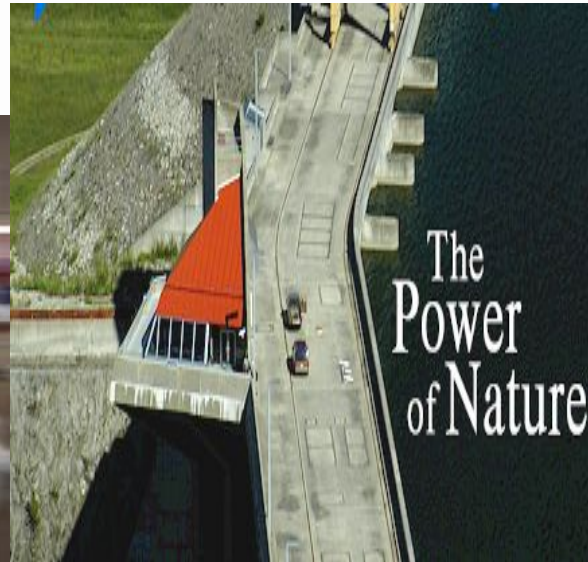
BC Data Centers Estimated 800 GWh/yr Use **BChydro**

Data Centre Energy Conservation Measure	Achievable Savings %	Energy Savings kWh millions/yr	Savings \$/yr** million's
Server Virtualization Software	50%	400	\$24
Energy Efficient Servers	35%	280	\$17
Component Level Cooling	18%	144	\$8
Optimised Liquid Cooling	18%	144	\$8
380V DC Mains + DC Power Supplies	15%	120	\$7
Server Power Management Software	10%	80	\$4
Massive Array of Idle Disks M.A.I.D.S.	9%	72	\$4
Energy Efficient Data Storage Hardware	3%	24	\$1
Energy Efficient Fans	4%	32	\$2
Energy Efficient UPS	4%	32	\$2
Energy Efficient Lighting	1%	8	\$0.5
*Total Potential Savings * Not additive	70%	570	\$30

**PRE
2007**

Questions & Comments

BC Hydro 



BC Hydro 
powersmart