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LEED Gold Certification Cost Analysis

Alberta Infrastructure

April, 2009
FINAL REPORT

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April 28, 2009

Mr. Tom O'Neill
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Dear Mr. O'Neill:

Subject: LEED Gold Certification Cost Analysis

We are pleased to present this summary report ("Report") of the activities and findings of our analysis with respect to LEED Gold certification in relation to Holy Trinity Academy ("HTA"). The procedures and scope of work we undertook were similar to the approach we employed for our initial study, summarized in a report to Alberta Infrastructure ("INFRA") dated July 30, 2008.

We are pleased to be assisting INFRA on this phase of LEED Gold analysis, and look forward to being of continued assistance to the Province of Alberta as it works toward a policy decision on whether to adopt LEED Gold for all future Alberta government-funded vertical infrastructure projects.

Yours truly,

Deloitte & Touche LLP

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1. Introduction

This report (the "Report") summarizes the activities and findings undertaken by the Deloitte Team for Alberta Infrastructure ("INFRA") in relation to LEED Gold certification analysis for Holy Trinity Academy ("HTA"). The Deloitte Team encompassed a range of experts in capital projects analysis, including quantity surveyors from BTY Group and an engineer specializing in LEED certification requirements from Eco-Integration.

The focus of our analysis was to identify the specific costs and benefits associating with moving a project from its current baseline level of funding (i.e. a building without a LEED target) to LEED Silver and LEED Gold certification levels, by assessing the various cost elements for HTA, a senior high school located near the town of Okotoks in the Municipal District of Foothills, Alberta. The procedures and scope of work we undertook were similar to the approach we employed for our initial study, summarized in a final report to INFRA dated July 30, 2008.

A literature review was also undertaken to assess the broader findings of the capital and lifecycle cost implications of LEED Silver and LEED Gold, with a focus on jurisdictions similar to Alberta in terms of climate and market sophistication, where possible.

This Report relies on certain information provided by third parties including INFRA, and Deloitte has not performed an independent review of this information. It does not constitute an audit conducted in accordance with generally accepted auditing standards, an examination or compilation of, or the performance of agreed upon procedures with respect to prospective financial information, an examination of or any other form of assurance with respect to internal controls, or other attestation or review services in accordance with standards or rules established by the CICA or other regulatory body.

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Background – Previous Analysis

Deloitte was first engaged by INFRA on May 9, 2008 to undertake a LEED Gold certification cost analysis. The purpose was to identify the specific costs and benefits associated with moving a project from a current baseline level of funding to LEED Silver and LEED Gold certification levels, and focused on the following three infrastructure projects:

- Chestermere Lake Elementary ("Elementary School Project");
- Dinosaur Provincial Park Visitor Centre and Tyrrell Field Station ("Visitor Centre Project"); and
- Mount Royal College Centre for Continuous Learning ("College Project").

A three-phase analysis approach was undertaken. Phase 1 involved an independent review of each case study project (drawings, final construction costs and LEED scorecard) to develop an initial view of the capital costs of the project had it been constructed without LEED certification (baseline design). Phase 2 involved half-day workshops with the design team members from each case study project, to determine the strategies undertaken for each project, including what points were targeted to achieve either LEED Silver or LEED Gold, and what points would have been targeted to achieve either a higher (LEED Gold)

or lower (LEED Silver) certification, depending on each project's actual rating. The workshops also provided for confirmation/refinement of Phase 1 findings.

Finally, in Phase 3, further analysis on the information compiled during Phases 1 and 2 was undertaken to determine the implications of the different LEED ratings on lifecycle costs (including capital, operating, maintenance and periodic replacement costs), water consumption, energy consumption and greenhouse gas emissions. Phase 3 also considered the positive externalities of LEED-certified buildings on building occupants, primarily through discussions with user groups for the two case study projects in operation, supplemented by independent, third-party research.

The following tables summarize the Phase 2 and 3 findings, and are replicated in this Report in Section 5 – Conclusions, where they are contrasted to the findings for HTA. Additional information on the three case study projects from last summer, including back-up analysis, can be found in the July 30, 2008 report.

Summary of Phase 2 Findings of Previous Analysis

Summary of Hard Costs

Project Name	LEED Rating	Baseline Cost	Baseline to Silver (Hard Costs) *($/% increase)*	Baseline to Gold (Hard Costs) *($/% increase)*
Elementary School Project	39 points LEED Gold	$10,594,600	$265,000/ 2.5% of baseline	$731,000/ 6.9% of baseline
Visitor Centre Project	39 points LEED Gold	$1,227,200	$65,000/ 5.3% of baseline	$119,000/ 9.7% of baseline
College Project	43 points LEED Gold	$14,014,964	$400,000/ 2.9% of baseline	$750,000/ 5.4% of baseline

Summary of Soft Costs

Project Name	LEED Rating	Baseline Cost	Baseline to Silver (Soft Costs) *($/% increase)*	Baseline to Gold (Soft Costs) *($/% increase)*
Elementary School Project	39 points LEED Gold	$10,594,600	$190,000/ 1.8% of baseline	$190,000/ 1.8% of baseline
Visitor Centre Project	39 points LEED Gold	$1,227,200	$151,000/ 12.3% of baseline	$151,000/ 12.3% of baseline
College Project	43 points LEED Gold	$14,014,964	$232,000/ 1.7% of baseline	$232,000/ 1.7% of baseline

Summary of Phase 3 Findings of Previous Analysis

Summary of Lifecycle Cost Savings

Project Name	LEED Silver		LEED Gold	
	$	Payback (years)	$	Payback (years)
Elementary School	1,504,300	7	1,126,900	13
Visitor Centre Project	57,300	27	8,800	28
College Project	1,723,100	8	1,331,100	12

Summary of Consumption Reduction

Project Name	LEED Silver		LEED Gold	
	% water (litres)	% energy (MJ)	% water (litres)	% energy (MJ)
Elementary School	10.5	31.7	32.5	46.9
Visitor Centre Project	0.0	27.2	35.5	43.2
College Project	22.9	32.0	81.7	49.0

2. Our Approach

Background

HTA, located near the town of Okotoks in the Municipal District of Foothills, Alberta, was completed in 2006 at a total cost of $9,705,313 ($132.80 / square foot; $1,428.72 / square meter). The high school was designed for energy efficiency, reduced water use and improved indoor air quality. Designed with the intention of applying for LEED Silver certification (36 points), HTA surpassed its original goals and achieved LEED Gold certification with a total of 40 points.

The high school houses a chapel, library, gathering space, gymnasium and multi-purpose space (theatre/cafeteria) as well as a number of specialized classrooms for a total gross floor area of 6,793 square meters. LEED-specific highlights of HTA include the following[1]:

- Sustainable Sites –detention ponds and grassy swales prevent rapid water runoff and soil erosion on the site; reduced number of parking areas encourage groundwater replenishment and reduce stormwater runoff; bicycle storage, showers for students and staff, and designated carpooling stalls encourage alternative transportation; reflective roofing material reduces heat absorption and decreases the building's heat island effect.
- Water Efficiency – native and drought resistant plant materials reduce need for irrigation and pesticide use; water efficient fixtures reduce water usage by 40%.
- Energy & Atmosphere – efficient mechanical / electrical systems reduce natural gas and electricity costs by 47%; building controls regulate lighting in specific areas; a 5-year green power contract provides 50% of HTA's electricity from wind energy.
- Materials & Resources – waste materials salvaged, reused or recycled during construction resulted in 75% reduction of material sent to landfill; recycling containers are located throughout the school; nearly 50% of building materials were manufactured locally; 18% of building materials are recycled; all casework was constructed with wheatboard.
- Indoor Environmental Quality – low velocity displacement system delivers 100% fresh air; operable windows and carbon dioxide monitors improve ventilation and provide a comfortable indoor setting; paints, carpets and wood products comply with required VOC and chemical limits and contain no urea formaldehyde; green housekeeping program is enforced; natural light throughout school increases productivity and comfort.

Facility Tour and Half-Day Workshop

On March 2, 2009, the Deloitte Team met with representatives of HTA's architectural design team / LEED consultant, as well as HTA's vice principal, to tour the facility (interior and exterior). Following the facility tour, a workshop was held at the design team's offices.

The purpose of the workshop was to discuss with the design team the following:

[1] Source: Quinn Young Architects' write-up of Holy Trinity Academy.

1. Baseline Design - what sustainable strategies would have been included at INFRA's "baseline" level (i.e. no LEED requirement);
2. LEED Silver - what sustainable strategies would have been included if only LEED Silver were targeted; and
3. LEED Gold - what sustainable strategies were used to achieve LEED Gold certification.

Workshop attendees included the following:

Organization / Role	Attendee
Quinn Young Architects / Architect and LEED Consultant	Sheldon Quinn Erik Heck Susan Taff
Wiebe Forest Engineering, division of SNC Lavalin / Mechanical Engineer	Jeff Swart *(via telephone)*
Alberta Infrastructure	Brian Oakley
BTY Group	Joe Rekab Fred Schiebe
Eco-Integration	Diana Klein
Deloitte	Ruth Summers

Capital Cost Considerations

During the analysis of baseline design costs (i.e. assuming INFRA's baseline design for school projects), it was discovered through discussion with the design team that by eliminating certain strategies to arrive at INFRA's baseline design, some project costs would have actually been higher than LEED Gold. These primarily related to sustainable site strategies and were a function of the lower costs associated with the LEED Gold approach. We note this result is not considered typical; more commonly, incorporation of LEED strategies tends to increase project capital costs, but provides benefits in terms of life cycle cost, reduced maintenance, reduced energy consumption, etc. This anomaly is discussed further in Section 3 – Our Findings.

In the analysis of LEED Silver, two different strategies were considered for cost estimating purposes, in order to address the anomaly highlighted above. By considering the cost implications of two different strategies for targeting LEED Silver, the Deloitte Team attempted to provide a lower and upper bound cost for LEED Silver, to provide a range of costs that may be expected on future projects. We have defined the upper bound as "Proposed" LEED Silver because it represents the LEED strategy proposed by the design team. The lower bound is defined as the "Alternative" LEED Silver.

The approach used to arrive at a LEED Silver score included removing certain points from the actual LEED Gold project checklist (including the two credits that were denied by the Canada Green Building Council ("CaGBC") for HTA – see below) as follows:

- For the Proposed LEED Silver approach, as established in conjunction with the design team during the HTA workshop, the following four points were removed: SSc4.4 – Alternative Transportation – Parking Capacity (1 point), SSc7.2 - Heat Island Effect – Roof (1 point), and EAc6 – Green Power (2 points). Total LEED score = 36.
- For the Alternative LEED Silver approach, as established by the Deloitte Team following the HTA workshop, the following four points were removed: EAc1 Optimize Energy Performance (1 point), IEQc8.2 Daylight & Views (1 point), and EAc6 – Green Power (2 points). Total LEED score = 36.

Lastly, in the analysis of LEED Gold, we noted that although a total of 42 points were targeted for LEED Gold certification, only 40 points were achieved as two points (MRc8 – Materials & Resources – Durable Building and EQc2 – Ventilation Effectiveness) were denied by CaGBC. For the purpose of this Report, however, the two denied points were included in our cost estimating analysis for LEED Gold as those points were included in HTA's design and documentation and the associated costs of these were incurred and are included in the total cost figures.

Lifecycle Cost Considerations

For the purpose of analyzing lifecycle costs, we considered capital costs, periodic replacement costs, maintenance costs and energy costs over a 30-year period, as follows:

- Capital costs (hard and soft) were based on our analysis of the four different design scenarios (baseline, Proposed LEED Silver, Alternative LEED Silver, and LEED Gold) as discussed above;
- Replacement costs were estimated based on the building system descriptions for the four different design scenarios;
- Annual maintenance costs were estimated based on historical cost data for buildings of similar size and nature; and
- Annual operating costs (gas and electricity) were estimated based on energy models prepared by the mechanical engineers in the early stage of the building design.

Over the 30-year period, an annual escalation factor of 5% was assumed, and those costs were then discounted at a rate of 6% to determine the present value of all future costs (consistent with the previous analysis on the first three buildings). A payback period was calculated to provide an indication as to how long it takes for the annual lifecycle cost savings to equate to the additional capital expenditure (hard and soft costs) to achieve the Proposed LEED Silver, Alternative LEED Silver and LEED Gold levels.

Water and Energy Consumption Considerations

For the purposes of analyzing the impact of the different LEED ratings on water consumption, energy consumption and greenhouse gas ("GHG") emissions, the following approach was undertaken:

- For water consumption, an estimate was arrived at using the LEED Calculation Template for the LEED Water Efficiency Credit 3, provided by the design team; and
- For energy consumption and related GHG emissions, an estimate was arrived at using the LEED Calculation Template for the LEED Optimize Energy Performance Credit 1, provided by the design team.

There was no differentiation made between Proposed LEED Silver and Alternative LEED Silver in this section of our Report, as there would have been no change in water consumption levels and only minor differences related to GHG emissions between the two LEED Silver approaches.

3. Our Findings

Capital Cost Implications

As discussed earlier, it was established during discussion with the design team for HTA that eliminating certain LEED Gold strategies to arrive at a baseline design resulted in some increased baseline project costs over LEED Gold. Specifically, the sustainable strategies that cost less under the LEED Gold strategy than under the baseline design are as follows:

- SSc4.4 – Alternative Transportation – Parking Capacity and Carpooling: a fairly common sustainable strategy is to reduce the number of parking stalls, making it more difficult to park and encouraging alternate methods of transportation. This strategy would not have been used for baseline, and was assumed to not be used for Proposed LEED Silver. ***As a result, removing parking capacity to meet this LEED credit resulted in cost savings to the project for LEED Gold.***
- SSc6.1 – Stormwater Management – Rate and Quantity: due to the location of the site and its sustainable goals (large, rural open space), the site needed to manage its own stormwater (and not connect to a municipal system). As a result, pervious paving (gravel) was used on the parking area to reduce runoff and decrease heat-island effect. Surface runoff is directed to detention ponds and grass swales. At the workshop, it was established that asphalt (non-pervious) paving would have been baseline for the project. If an asphalt surface was used, it is likely that the detention ponds and grass swales would have been upsized to deal with the greater stormwater loads. ***Therefore, designing a gravel parking lot to meet this LEED credit resulted in cost savings to the project for LEED Gold.***
- SSc7.2 – Heat Island Effect – Roof: in order to achieve this credit, high albedo (co-polymer alloy) roofing was incorporated in over 80% of the roof surface. At the workshop, however, the design team noted they were dissatisfied with the quality of the roofing, and would not use it again. For both baseline and Proposed LEED Silver, it was established that the likely roofing material would have been 2-ply SBS – which is more expensive than the co-polymer alloy roofing. ***In summary, using the co-polymer alloy roofing to meet this LEED credit resulted in cost savings to the project for LEED Gold.***

Based on the results of our workshop discussion, and subsequent analysis, the following table outlines the cost premium associated with moving from a non-LEED rated baseline design to LEED Silver (Proposed and Alternative) and LEED Gold.

LEED Requirement	Proposed LEED Silver	Alternate LEED Silver	LEED Gold Actual
Hard Costs	**36 points**	**36 points**	**40 points**
Sustainable Site	($69,600)	($119,900)	($119,900)
Water Management	$10,700	$10,700	$10,700
Optimize Energy Performance	$125,000	$104,600	$125,000
Indoor Environment – Staged flush out, low emitting materials, etc	$35,700	$35,700	$35,700
Indoor Environment – Additional windows	$96,900	$0	$96,900
Contractor Administration	$181,700	$181,700	$181,700
Hard Costs sub-total	***$380,400***	***$212,800***	***$330,100***
Soft Costs			
LEED Registration, Additional Consultants	$58,100	$58,100	$105,700

Commissioning Fundamental	$75,000	$75,000	$75,000
Green Power Contract and Durable Building Design Change	$5,000	$5,000	$18,000
Soft Costs sub-total	***$138,100***	***$138,100***	***$198,700***
Total Cost Premium	**$518,500**	**$350,900**	**$528,800**

In summary, the premium in capital costs (hard and soft) of moving from baseline design to **Proposed LEED Silver** is $518,800, a 5.5% increase over baseline, and $528,800 for LEED Gold, a 5.6% increase over baseline. Although these findings are unusual in that the premium costs for LEED Silver and LEED Gold are almost identical, it is not unexpected in this case because the building was designed to achieve LEED Silver, and only achieved LEED Gold through targeting (and achieving) a higher-than-required number of points. If the design team had an objective of LEED Gold at the outset, it is likely that additional strategies would have been employed above and beyond what was actually done, at a higher cost. As a result, the only real difference in cost between LEED Gold and Proposed LEED Silver is an increased parking count and impervious parking area for Proposed LEED Silver, amounting to only $50,300 in hard cost increases, and a $47,600 difference in soft costs between LEED Gold and the two LEED Silver approaches relating to design consultant's fees for each of the LEED certification levels (as suggested by the design team at the HTA workshop).

Under the **Alternative LEED Silver** scenario developed by the Deloitte Team post-workshop, which targeted certain other LEED credits (including the same parking strategy as LEED Gold), the premium in capital costs (hard and soft) of moving from baseline design to Alternative LEED Silver is $350,900, a 3.7% increase over baseline. This scenario achieves LEED Silver at lower cost by targeting LEED credits that are less costly than those under the Proposed LEED Silver design. However, in discussion with INFRA following release of a draft version of this Report, it was noted that the one credit (IEQc8.2 Daylight & Views) removed in the Alternative LEED Silver scenario most likely would not be sacrificed in a school.

These findings illustrate that different strategies can be deployed to achieve a LEED certification level, and that the strategies implemented can have significantly different capital cost implications.

Lifecycle Costs

The estimated lifecycle costs, including payback period (in years) for the four different design scenarios are outlined in the table below.

	Baseline		Proposed LEED Silver		Alternative LEED Silver		LEED Gold	
	Estimated Cost	**Present Value**	**Estimated Cost**	**Present Value**	**Estimated Cost**	**Present Value**	**Estimated Cost**	**Present Value**
Initial Costs								
Construction	$9,375,200	$9,375,200	$9,375,200	$9,375,200	$9,375,200	$9,375,200	$9,375,200	$9,375,200
Premium for LEED (Hard costs)			$380,400	$380,400	$212,800	$212,800	$330,100	$330,100
Premium for LEED (Soft costs)			$138,100	$138,100	$138,100	$138,100	$198,700	$198,700
Total Initial Costs (A)		**$9,375,200**		**$9,893,700**		**$9,726,100**		**$9,904,000**
Replacement Costs								
Replacement costs over 30 years		$472,000		$487,100		$441,600		$487,100
Total Replacement Cost (B)		**$472,000**		**$487,100**		**$441,600**		**$487,100**
Annual Costs								
Maintenance costs	$152,800	$3,879,500	$160,400	$4,072,500	$152,800	$3,879,500	$160,400	$4,072,500
Operating costs	$140,650	$3,571,000	$86,350	$2,192,400	$121,350	$3,081,000	$86,350	$2,192,400
Total Annual Costs (C)		**$7,450,500**		**$6,264,900**		**$6,960,500**		**$6,264,900**
Total Lifecycle Costs (A+B+C)		**$17,297,700**		**$16,645,700**		**$17,128,200**		**$16,656,000**
Variance ($)		BASE		($652,000)		($169,500)		($641,700)
Variance (%)				3.8%		1.0%		3.7%
Payback (years)				12 years		18 years		12 years

The analysis shows a higher payback period for Alternative LEED Silver compared to LEED Gold. This unusual result is due to there being no heat recovery system in the Alternative LEED Silver design and therefore less annual energy savings compared to LEED Gold.

Water Consumption

Our analysis below is based on an estimated water consumption level for HTA to achieve LEED Gold certification, as well as an estimate for the defined baseline design. At our workshop meeting, the Deloitte Team was informed that for LEED Silver, there would have been no design changes from the LEED Gold certification.

	Baseline	LEED Silver	LEED Gold
Water Consumption (Irrigation)			
Total water use (litres)	School board policy is no water for irrigation	0	0
Water Consumption (Building); Occupants = 542			
Description	• Conventional toilets (6 litres) for students and staff • Full flow (3.8 l.) urinals • Lavatory (9.5 lpm) standard system with no sensor • Janitor sink (9.5 lpm) • Shower (9.5 lpm) no flow restrictor • Kitchen sink (9.5 lpm)	• Same as LEED Gold	• Conventional toilets (6 litres) for students and staff • Waterless urinals for students • Dual flush toilet for staff (4.7 l. average) • Lavatory (1.9 lpm) • Janitor sink (9.5 lpm) • Shower (7.5 lpm) and shorter duration • Kitchen sink (8.3 lpm)
Total Annual Volume (litres)	3,023,158	1,811,802	1,811,802
Grand Total (Irrigation + Building Use)	**3,023,158**	**1,811,802**	**1,811,802**
Variance (litres)	**0**	**1,211,356**	**1,211,356**
Variance (%)		**40.1%**	**40.1%**

Based on the analysis undertaken, total water consumption decreases by 40.1% for LEED Silver and LEED Gold in comparison to the baseline.

Energy Consumption and Greenhouse Gas Emissions

Our analysis below is only an approximation of the energy savings and GHG emissions for LEED Gold (6 points) based on energy modeling of the LEED Gold scenario, and the assumption of LEED Silver being the same as LEED Gold. For the baseline scenario, an estimate of energy consumption (assuming 3 LEED points) was used, based on discussion with the design team during the workshop meeting. For a more accurate assessment, energy modeling should be undertaken for the baseline scenario. Furthermore, in order to confirm the actual energy consumption for the building operations, the Deloitte Team recommends undertaking post-occupancy energy consumption analysis.

	Baseline	LEED Silver	LEED Gold
Energy Consumption			
Electricity (MJ)	2,288,028	2,070,121	2,070,121
Natural Gas (MJ)	3,260,283	2,949,780	2,949,780
Total	**5,548,311**	**5,019,901**	**5,019,901**
Energy Savings (Electricity MJ)	0	217,907	217,907
Electricity MJ not from coal-fired plants	0	0	1,035,061
GHG Savings (Electricity tonnes of CO_2)	0	60.4	60.4
GHG Savings (Green Power for 50% LEED Gold)	0	0	287
Energy Savings (Natural Gas MJ)	0	310,503	310,503
GHG Savings (Natural Gas tonnes of CO_2)	0	15.3	15.3
Total GHG Savings (tonnes of CO_2)	**0**	**75.7**	**362.4**
Tonnes of CO2/sqm Savings		**0.011**	**0.053**

Based on the analysis undertaken, total energy consumption decreases by 9.5% for LEED Silver and LEED Gold in comparison to the baseline.

4. Literature Review and Analysis

Deloitte was asked to undertake a review of recent literature on the capital and lifecycle cost implications of moving to LEED certification, with a focus on jurisdictions similar to Alberta in terms of climate and market sophistication where possible.

Although no literature was found that specifically addressed the Alberta market, the following literature was found that reviewed the costs for sustainable buildings:

1. *"The Costs and Benefits of High Performance Buildings: Lessons Learned"*, A Collection of Papers assembled by Earth Day New York, 2006;
2. *"A Business Case for Green Buildings in Canada"*, Mark Luciuk, P.Eng, March 2005;
3. *"Costing Green: A Comprehensive Cost Database and Budgeting Methodology"*, Davis Langdon, July 2004;
4. *"Cost of Green Revisited"*, Davis Langdon, July 2007; and
5. Report (source not listed for confidentiality) on costs for LEED Silver and LEED Gold for a university laboratory building in Western Canada, 2002.

A summary of the relevant findings from each of the research papers is discussed further below.

1. The Costs and Benefits of High Performance Buildings: Lessons Learned

This publication included research papers from various authors. Summarized below are the findings from two particular research pieces:

The Costs and Financial Benefits of High Performance Buildings, Greg Kats (page 9)[2]

Cost data was collected on 40 individual Californian LEED registered projects (32 office buildings and eight school buildings) with actual and projected dates of completion between 1995 and 2004. Assuming conservative, relatively high California commercial construction costs of US$150 - US$250 per square foot, it was found that there exists an approximate 2% green building premium (equivalent to US$3 - US$5 per square foot).

	8 LEED Certified Buildings	21 LEED Silver Buildings	9 LEED Gold Buildings	2 LEED Platinum Buildings
Premium over conventional building	0.7%	1.9%	2.2%	6.8%

The study went on to analyze the payback/lifecycle benefits of these premiums, including cost savings from reduced energy, water and waste; lower operations and maintenance costs; and enhanced occupant productivity health. Based on the analysis, as outlined in the table below, the total financial benefits of green buildings were over ten times the average initial "green premium" required to design and construct a green building.

[2] Attached as Appendix F to this Report.

Financial Benefits of Green Buildings Summary of Findings (US$ per ft²)	
Category	**20-year NPV**
Energy Value	$5.79
Emissions Value	$1.18
Water Value	$0.51
Waste Value (construction only) – 1 year	$0.03
Commissioning O&M Value	$8.47
Productivity and Health Value (Certified and Silver)	$36.89
Productivity and Health Value (Gold and Platinum)	$55.33
Less: Green Cost Premium	($4.00)
Total 20-year NPV (Certified and Silver)	**$48.87**
Total 20-year NPV (Gold and Platinum)	**$67.31**

Defining LEED Costs for the US General Services Administration (GSA), John Amatruda, RA, Steven Winter Associates (page 27)

This report provided information on two LEED cost studies undertaken for the GSA:

- A new midrise federal courthouse – five stories, 262,000 GSF, including 15,000 GSF of underground parking and a base construction cost of approximately US$220/GSF; and
- A midrise federal office building modernization – nine stories, 306,600 GSF, including 40,700 GSF of underground parking and a base construction cost of approximately US$130/GSF.

For this study, LEED credits were categorized by cost: GSA mandate (no cost); low cost (<US$50,000); moderate cost (US$50,000 - US$150,000); high cost (>US$150,000). These categories were then used to establish lower and upper bound levels of LEED – 28 points for LEED certified, 35 points for LEED Silver, and 41 points for LEED Gold, and used synergy strategies to group the credits so that with one strategy more than one credit could be obtained.

The following were the cost and percentage increases for the courthouse project[3] versus a standard GSA building budget:

	LEED Construction Cost Impacts – New Courthouse					
	Certified		Silver		Gold	
	Low cost	High cost	Low cost	High cost	Low cost	High cost
US$/GSF	($0.76)	$2.86	($0.07)	$9.57	$2.97	$17.79
% Change	-0.4%	1.0%	-0.03%	4.4%	1.4%	8.1%

2. A Business Case for Green Buildings in Canada

This Canadian report reviews the economics of green buildings, from both a capital cost and return on investment perspective. Economic considerations are broken down into the following categories: direct capital costs; direct operational costs; life cycle cost; productivity effects; property values; other indirect benefits (increased retail sales/risk reduction); and external or tertiary effects such as reduced infrastructure reliance, reduced greenhouse gas emissions, and reduced health costs.

[3] The federal office building was deemed less relevant for this Report as it was a renovation project.

The findings of the report, based on various studies of green buildings, suggest that green buildings add about 2% to overall design and construction costs. However, there are strong indications that this increase in capital cost is outweighed by the operational benefits, many of which provide a strong economic case, particularly when occupancy issues are considered.

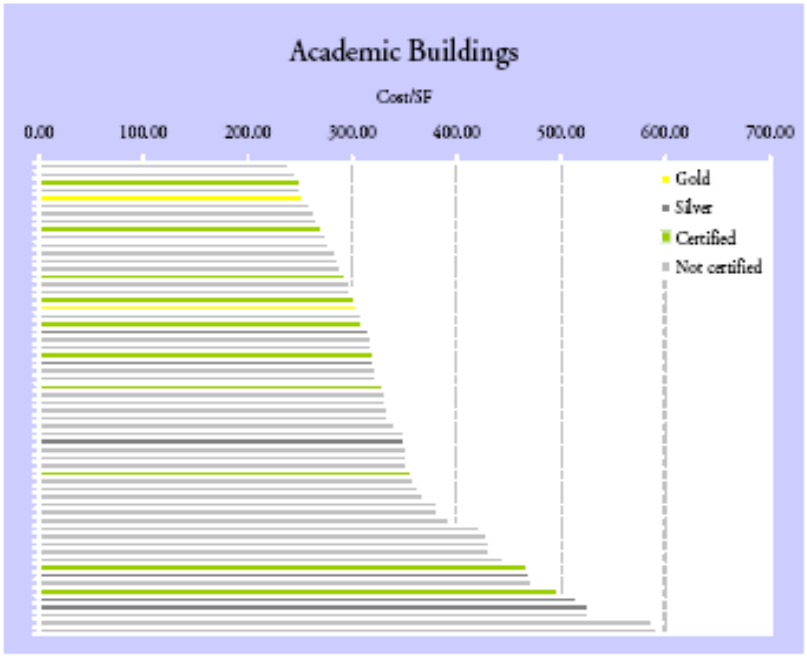
3. Costing Green: A Comprehensive Cost Database and Budgeting Methodology

In this report a detailed analysis was undertaken to look at the cost of LEED credits and understand the factors that influence both feasibility and cost. The report concludes by suggesting that it is important to understand both the feasibility of each LEED point as it relates to a particular building, and the factors affecting cost and feasibility (demographic location, bidding climate and culture, local standards, intent and values, climate, timing of implementation, size of building, and point synergies).

An analysis was undertaken to look at building costs of similar buildings – LEED and non-LEED. The results did not show any trends to indicate that LEED buildings are more or less expensive than conventional buildings.

4. Cost of Green Revisited

This report was a follow up to the 2004 "Costing Green" paper, and reviewed market developments from 2004 to 2007. In this study, 221 buildings were analyzed, 83 of which were designed to meet various LEED levels. In the following graph of 60 academic buildings (classroom, computer lab or faculty office buildings) – 17 seeking LEED and 43 non-LEED – the results indicated that there is no correlation between the costs of non-LEED and LEED buildings. These costs were normalized for time and location to ensure consistency of comparison.



Similar analysis was undertaken, with similar results, for laboratory buildings, libraries, community centres and ambulatory care. In the report, four key conclusions were drawn:

- Large variations exist in building costs (even of similar type);
- Cost differences are primarily related to program type;
- There are low cost and high cost green buildings; and
- There are low cost and high cost non-green buildings.

5. Confidential Report for University Laboratory Building

Baseline Cost (no LEED)	Cost Premium for LEED Silver	Cost Premium for LEED Gold	Lifecycle Payback for LEED Gold
$9.2 million	+ $175,000	+ $325,000	NPV over 75 years = $1.8 million
0% increase	1.9% increase	3.6% increase	8 year payback

Summary of Findings

The research papers discussed above are based on a variety of projects in different jurisdictions over different time periods, and the results vary widely. Without having access to the in-depth background and parameters for these projects, it is difficult to accurately explain why results vary significantly. However, we do know that the following variables can result in significant differences in baseline capital costs:

- Project timing – construction costs have risen significantly in recent years, so comparing a project (non-LEED or LEED) now to one five years ago does not produce useful results;
- Site conditions – challenging soils, sloping sites, etc can alter costs significantly;
- Design brief – addition of basement, number of stories, baseline standards, level of fit-out/finishes can increase or decrease costs significantly;
- Location of site – from a LEED perspective, there are often "free" credits associated with the location of a site (Greenfield, brownfield, transport, open space, urban density, etc). These factors can increase or decrease the cost for LEED significantly;
- Local standards and codes impact the establishment of a "base level" of performance;
- Market acceptance of "green" – depending on a local market's experience designing and building "green", the cost associated with the unknowns of a green building can add to the overall project cost compared to a more seasoned market where that cost disappears;
- Climate – costs can vary significantly depending on a region's climate; and
- Economic climate – costs of construction will vary depending on how active the building market is.

Another key factor to consider is that most of the studies undertaken focused on different buildings at various levels of non-LEED and LEED. A more accurate assessment of the costs of LEED certification is to approach the analysis as the Deloitte Team has done for INFRA – considering sustainable strategies for non-LEED, LEED Silver and LEED Gold, for the same building. Although some of the strategies and "free" credits will vary from project to project, these can be more easily identified and assessed accordingly.

There is strong research to support the concept that incorporating the commitment to sustainability at the outset of the building conception will provide financial benefits. An early and accurate LEED assessment can be made based on actual site conditions (e.g. the "free" LEED points and other strategies can be assessed so a budget reflecting the sustainability opportunities for the project can be set early on). There is also opportunity to budget for lower operational costs / maintenance and greater building durability. Ideally, to be really cost effective, sustainability goals and strategies should be embedded into the initial building concept development documents prior to the assembly of the design team.

Due to the numerous variables discussed above, it is difficult to extrapolate, from a cost perspective, the results and findings from green building literature to the Alberta market with any strong degree of confidence. We suggest that INFRA may wish to consider undertaking a similar review for an additional two or three LEED certified buildings in the Province, preferably not an academic building as three of the four case study projects have been in the education space, to glean additional insight into the actual cost differentials moving from baseline to LEED Silver to LEED Gold for Alberta-based vertical infrastructure projects.

5. Conclusions

The following tables consolidate the Deloitte Team's findings from our original work completed last summer with the more recent analysis undertaken for INFRA on HTA.

Capital Cost Findings

Summary of Hard Costs

Project Name	LEED Rating	Baseline Cost	Baseline to Silver (Hard Costs) *($/% increase)*	Baseline to Alternative Silver (Hard Costs) *($/% increase*	Baseline to Gold (Hard Costs) *($/% increase)*
Elementary School Project	39 points LEED Gold	$10,594,600	$265,000/ 2.5% of baseline	n/a	$731,000/ 6.9% of baseline
Visitor Centre Project	39 points LEED Gold	$1,227,200	$65,000/ 5.3% of baseline	n/a	$119,000/ 9.7% of baseline
College Project	43 points LEED Gold	$14,014,964	$400,000/ 2.9% of baseline	n/a	$750,000/ 5.4% of baseline
HTA	40 points LEED Gold	$9,375,200	$380,400[1]/ 4.1% of baseline	$212,800/ 2.3% of baseline	$330,100/ 3.5% of baseline

1. Proposed LEED Silver scenario for HTA.

Summary of Soft Costs

Project Name	LEED Rating	Baseline Cost	Baseline to Silver (Soft Costs) *($/% increase)*	Baseline to Alternative Silver (Soft Costs) *($/% increase*	Baseline to Gold (Soft Costs) *($/% increase)*
Elementary School Project	39 points LEED Gold	$10,594,600	$190,000/ 1.8% of baseline	n/a	$190,000/ 1.8% of baseline
Visitor Centre Project	39 points LEED Gold	$1,227,200	$151,000/ 12.3% of baseline	n/a	$151,000/ 12.3% of baseline
College Project	43 points LEED Gold	$14,014,964	$232,000/ 1.7% of baseline	n/a	$232,000/ 1.7% of baseline
HTA	40 points LEED Gold	$9,375,200	$138,100[1]/ 1.5% of baseline	$138,100/ 1.5% of baseline	$198,700/ 2.1% of baseline

1. Proposed LEED Silver scenario for HTA.

Based on the analysis above (and excluding the Visitor Centre Project due to the outlier results), the premium associated with moving from baseline design to LEED Silver (hard costs only) ranged from approximately 2.0% to 4.0%, and from approximately 3.5% to 7.0% for LEED Gold. For soft costs, the premium associated with moving from baseline design to LEED Silver was approximately 1.7% and to LEED Gold was approximately 1.9%.

Lifecycle Cost Findings

Summary of Lifecycle Cost Savings

Project Name	LEED Silver		Alternative LEED Silver		LEED Gold	
	$	Payback (years)	$	Payback (years)	$	Payback (years)
Elementary School Project	1,504,300	7	n/a	n/a	1,126,900	13
Visitor Centre Project	57,300	27	n/a	n/a	8,800	28
College Project	1,723,100	8	n/a	n/a	1,331,100	12
HTA	652,000[1]	12	169,500	18	641,700	12

1. Proposed LEED Silver scenario for HTA.

The result for HTA with a payback of 12 years for LEED Gold is consistent with the results for the two previously studied school projects. The payback period for HTA under the Alternative LEED Silver scenario is longer than LEED Gold which is inconsistent with the previous results. This reflects an assumption of no heat recovery system and therefore no significant source of energy savings in our Alternative LEED Silver scenario.

Water and Energy Consumption Findings

Summary of Consumption Reduction

Project Name	LEED Silver		LEED Gold	
	% water (litres)	% energy (MJ)	% water (litres)	% energy (MJ)
Elementary School Project	10.5	31.7	32.5	46.9
Visitor Centre Project	0.0	27.2	35.5	43.2
College Project	22.9	32.0	81.7	49.0
HTA	40.1	9.5	40.1	9.5

The results for HTA with only a 9.5% in energy consumption is significantly less than the savings estimated for the previously studied schools, although water consumption is significantly reduced. The rationale for the relatively small savings in energy is due to the design team's estimate of baseline for HTA, which included 3 LEED points. The other case study projects all had lower baselines (more aligned with the LEED pre-requisite level) and therefore the percentage savings in energy consumption is greater.

Appendix A –
Capital Cost Supporting Analysis

Alberta Infrastructure

Holy Trinity Academy

Report 1a – Capital Cost Analysis

April 24, 2009

BTY.COM

1.0 INTRODUCTION

In May 2008, Deloitte and BTY Group were retained by Alberta Infrastructure to undertake a "LEED Certification Cost Analysis" for three completed projects; Deloitte reported to Alberta Infrastructure in July 2008. In February 2009, Deloitte, BTY Group and Eco-Integration were retained by Alberta Infrastructure to undertake a further study of additional projects to provide more data for their analysis. This report addresses the Holy Trinity Academy located near the town of Okotoks in the Municipal District of Foothills, Alberta.

2.0 PURPOSE OF REPORT

Alberta Infrastructure wishes to identify all of the premium or extra over costs associated with the funding of projects that would be certified as LEED Silver or LEED Gold, as compared to a baseline non-LEED certified project. The costs to be considered are to include both the Hard costs (direct construction costs) and the Soft costs (the design and administration costs associated with achieving the LEED certification). The baseline project costs are to be considered to be based upon best practice design, but without incurring the particular costs for achieving LEED certification. The findings of this study are to be utilized by Alberta Infrastructure and the Alberta Treasury Board as a resource for considering funding commitments for future social infrastructure projects.

3.0 EXECUTIVE SUMMARY

We estimate that the additional costs to deliver the Holy Trinity Academy Project with LEED Silver certification or LEED Gold certification, compared to a baseline non-LEED certified project, are:

HOLY TRINITY ACADEMY PREMIUM (EXTRA OVER) COSTS (Baseline non LEED design)	LEED SILVER $	LEED GOLD $
HARD costs - Building only	$450,000 or 4.9% of the baseline cost.	$450,000 or 4.9% of the baseline cost.
HARD costs - Building & Site	$380,400 or 4.1% of the baseline cost.	$330,100 or 3.5% of the baseline cost.
SOFT costs - Administration and Commissioning	$138,100	$198,700
Total HARD & SOFT Costs (including both Building & Site)	**$518,500**	**$528,800**

The above table indicates an unusual and anomalous result that concludes that the premium costs for LEED Gold and Silver (compared to baseline non LEED design) are almost identical. Refer to **4.0 COMMENTARY**.

4.0 COMMENTARY

Our analysis of the costs for LEED sustainability strategies for the Holy Trinity Academy indicates that the premium costs for LEED Gold and LEED Silver (compared to a baseline non LEED design) are almost identical. This is a result of the study workshop design team decisions that directed us on what strategies to consider. It is more representative that there is a premium cost for LEED Gold over LEED Silver and we have addressed this counter intuitive result in the following narrative.

The particular anomaly to note is that with the exception of the parking area (Sustainable Sites credit 4.4) the costs for all other design (Hard cost) strategies are the same. We note that there is no difference for costs for the provision of vehicle parking between the baseline and LEED Silver considerations, and $50,300 between LEED Silver and LEED Gold.

Note: For Sustainable Sites Credit 4.4, (Parking) Strategies

- Non LEED design considers an impervious (asphalt) parking area for 237 vehicles
- LEED Silver design considerations were directed to be identical to non LEED design considerations
- LEED Gold considers a reduced (80) total vehicle parking count of 157 vehicles; 33 on impervious material (asphalt) and 124 stalls on pervious material (gravel)

Thus the only Hard cost differences for the LEED Gold condition is a reduced (80 vehicle) parking count and more pervious (gravel) parking.

5.0 PROJECT DESCRIPTION

The project that has been analyzed is a new High School commisioned by Christ the Redeemer Catholic Schools and located near the town of Okotoks in the Municipal District of Foothills, Alberta. The project is a two storey building plus a mezzanine floor; total Gross Floor Area is measured at 6,793 m^2. The construction commenced in December 2004 and was substantially completed in May of 2006. The project was designed to achieve LEED Gold certification; this designation was confirmed in October 2008 with a total LEED point score of 40. (Note: minimum point score for LEED Gold is 39 points).

6.0 METHODOLOGY

Since the project was designed and constructed with the goal of achieving LEED Gold the methodology that we have employed is to reverse engineer the design strategies to provide for a LEED Silver certification and a baseline non-LEED certified project. We have then reported the design strategies, and their estimated cost, as premium or extra over costs from the baseline case.

The team reviewed the tender documents, the actual tendered amount, the LEED rating/score sheet compiled for the project together with the contractor's cost breakdown for the Holy Trinity Academy project. Estimated costs were then apportioned to the various building elements to allow a detailed analysis of the appropriate design strategies.

Representatives from Deloitte, BTY and Eco-Integration (The 'Deloitte team') met for a half day workshop with the design teams. The purpose of the workshops was to establish the following:

- Baseline strategies: what would the project brief have been if LEED certification had not been a requirement;
- LEED Silver: what would the strategies have been, over and above the baseline considerations, to achieve at least 33 LEED points so as to ensure that the project would qualify for LEED Silver (for Holy Trinity Academy project, the workshop design team targeted 36 LEED points for Silver Certificate).
- LEED Gold: what would the strategies have been, over and above the baseline considerations, to achieve at least 39 LEED points so as to ensure that the project would qualify for LEED Gold (for Holy Trinity Academy project, the design team targeted 40 LEED points for Gold Certificate).

As noted above the workshops were directed towards understanding the LEED Gold strategies that were actually employed and to determine which strategies should be eliminated or reduced to bring the project back to a reduced (Silver), or non LEED rating.

Following the workshops, the elemental cost analysis prepared for the High School was then adjusted to establish the "Baseline Cost" for the building.

7.0 CASE STUDY ANALYSIS

Project Background

Holy Trinity Academy, Okotos, Alberta
Workshop Date: March 2, 2009

These notes to be read in conjunction with Table 1, attached LEED scorecard in Section 7.0 indicating the strategies for Baseline, LEED Silver and LEED Gold and the LEED checklists; Table 2 LEED Silver and Table 3 Actual LEED Gold achieved (at 40 points).

Holy Trinity Academy is a new secondary school that is owned and operated by Christ the Redeemer Catholic Schools. The project was tendered using a Stipulated Lump Sum form of contract. The final construction cost as certified by the architect in November 3, 2006 is **$9,705,313 or $1,428.72/m^2 ($132.80/sq. ft).**

Christ the Redeemer Catholic Schools have a philosophy of designing robust, durable buildings with good envelope performance and child resistant materials; past project design has employed "best practice sustainable design". Some of the design strategies employed are consistent with LEED philosophy; but some of the possible site strategies (such as stormwater management, pervious surfaces, shading, use of trees and landscaping) have not been part of the design toolbox. This has resulted in design challenges to obtain LEED recognition.

7.0 CASE STUDY ANALYSIS (continued)

The items and costs associated with achieving a LEED rating for this building have been identified as follows:

LEED Requirement	Design Solutions	Non-LEED $	LEED Silver $	LEED Gold $
Hard Cost				
Substainable Site	Cost saving for smaller parking, gravel parking surface and PVC membrane roofing	-	($69,600)	($119,900)
Water Management	Sensors and aerators to plumbing fixtures, low flow fixtures	-	$10,700	$10,700
Optimize Energy Performance	Lighting sensors, air displacement ventilation heat recovery, and high performance glazing system	-	$125,000	$125,000
Indoor environment	Staged flush out, low-emitting materials, entrance mats, partitions & ventilation to copies rooms	-	$35,700	$35,700
	Additional windows for increased daylight	-	$96,900	$96,900
Contractor Administration	LEED coordination during construction, construction waste & recycle management	-	$181,700	$181,700
Hard Costs Total			**$380,400**	**$330,100**
Soft Costs				
LEED Administration Documentation	LEED Registration; Additional Professional Design co-coordinators, LEED Consultant; Energy Modeler.	-	$58,100	$105,700
	Commissioning Fundamental	-	$75,000	$75,000
	Green power purchase contract & durable building design change	-	$5,000	$18,000
Soft Cost Total			**$138,100**	**$198,700**
TOTAL			**$518,500**	**$528,800**

8.0 Eco-Integration's Commentary

-Holy Trinity Academy

CASE STUDY ANALYSIS

Project Background

Holy Trinity Academy High School (HTA)
Workshop Date: March 2, 2009

These notes are to be read in conjunction with attached Table 1 LEED Scorecard Cost Analysis Holy Trinity Academy in Section 9.0 indicating the strategies for Alberta Infrastructure Baseline, Proposed LEED Silver, and LEED Gold Actual, and Table 1 LEED Scorecard Cost Analysis Holy Trinity Academy.

Also the LEED checklists are included for the following levels of LEED:

- Table 2 Proposed LEED Silver
- Table 3 LEED Gold Actual.

The project HTA achieved LEED Gold Certification with 40 points (>39 is LEED Gold). At the workshop we met with the design team to establish firstly what sustainable strategies would have been included at the AI baseline level (ie No LEED rating targeted). Then we discussed what strategies may not have been undertaken if only LEED Silver was targeted and finally we reviewed the strategies that achieved the LEED Gold certification. These have all been outlined in Table 1 LEED Scorecard Cost Analysis Holy Trinity Academy. At the meeting there were a few sustainable strategies discussed that the design team deemed would not have been baseline for AI. However unique to this project was the fact that undertaking these strategies to achieve LEED ***reduced the project first costs***. This is not typical, more commonly incorporation of sustainable strategies may increase first costs but provide benefits in terms of life cycle costing, reduced maintenance, reduction in ghg, better indoor environment etc. The strategies included:

- SSc5.1 Alternate Transportation. Parking Capacity – a fairly common sustainable strategy is to reduce the number of parking stalls so it becomes harder to park and alternate methods of transportation happen (car pool, bus etc. ***However removing car spaces to meet this LEED credit results in cost savings to the project*** (as reflected in the data). This strategy would not have been pursued for the AI baseline and LEED Silver (ie more parking would have been provided) resulting in a cost increase for Baseline and LEED Silver.
- SSc6.1 Stormwater Management, Rate and Quantity - Due to the location of the site and the sustainable goals (large rural open space), the site needed to manage its own Stormwater (and not connect to a municipal system). Pervious paving (gravel) was used on the parking area to reduce run-off and decrease heat island effect. By using gravel the stormwater was managed and directed to detention ponds and grass swales. However at the workshop it was established that asphalt (non-pervious) paving would have been the AI baseline for the project had LEED not been undertaken. If asphalt surface parking was used (instead of gravel) it is also likely that the detention ponds and grass swales would have increased to deal with the greater stormwater loads. ***Therefore designing a gravel parking lot to manage the stormwater for LEED resulted in cost savings to the project***. This credit is removed for the AI baseline resulting in a cost increase for the baseline. For LEED Silver the gravel parking remains.
- SSc7.2 Landscape and Exterior Design to Reduce Heat Islands, Roof – in order to achieve this credit high albedo roofing was incorporated over 80% of

the roof surface. This roofing was Co-polymer alloy roofing. At the workshop the design team identified that they were not happy with the quality of the roofing and would not use it again. For the AI baseline and the proposed LEED Silver the roofing would have been 2 ply SBS - which is more expensive than the Co-polymer alloy roofing. ***Therefore using the co-polymer alloy roofing results in a cost savings for LEED Gold***

All 3 of these strategies listed have ***decreased the baseline cost (and in some cases the LEED Silver cost).*** This will provide in the analysis a lower bound LEED Silver cost.

9.0 LEED CHECKLISTS

-Holy Trinity Academy

Holy Trinity Academy
LEED Canada Scorecard Cost Analysis
TABLE 1

Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO	Sustainable Sites 14 Points			Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7							
Y				Prereq 1	**Erosion & Sedimentation Control**	Req'd	Minor to none	standard requirement for baseline		
			1	Credit 1	**Site Selection**	1	None	not a project design choice (either receive credit or not depending on site conditions)		
			1	Credit 2	**Urban Redevelopment**	1	none	not a project design choice (either receive credit or not depending on site conditions)		
			1	Credit 3	**Redevelopment of Contaminated Sites**	1	None	not a project design choice (either receive credit or not depending on site conditions)		
			1	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1	None	not a project design choice (either receive credit or not depending on site conditions)		
1				Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1	Minor	bike storage and showers provided as baseline	bike storage and showers provided as baseline	bike storage and showers provided as baseline
			1	Credit 4.3	**Alternative Transportation**, Alternative Fuel Vehicles	1	Minor			

Holy Trinity Academy
LEED Canada Scorecard Cost Analysis
TABLE 1

Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**		14 Points				
1				Credit 4.4	**Alternative Transportation**, Parking Capacity and Carpooling	1	Minor	For Baseline likely MORE parking would have been provided (80 more stalls) and not carpooling (so no signage required) Cost: 80 additional surface parking stalls No signage for carpooling	MINUS 1 CREDIT For LEED Silver likely MORE parking would have been provided (80 more stalls) and not carpooling (so no signage required) Cost: 80 additional surface parking stalls No signage for carpooling	provided parking to meet minimum local zoning requirements and provided designated parking for carpools equal to 10% of non-visitor parking Cost: Signage for carpool parking
			1	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space	1				
1				Credit 5.2	**Reduced Site Disturbance**, Development Footprint	1	No Cost	This is baseline due to the site size and building footprint size No Cost	This is baseline due to the site size and building footprint size No Cost	This is baseline due to the site size and building footprint size No Cost
1				Credit 6.1	**Stormwater Management**, Rate and Quantity	1	none to moderate	If no LEED likely that the surface parking would have been asphalt and not gravel. The stormwater strategy would still have been dry detention ponds and grass swales but they would have been bigger to deal with the greater flow from the impervious parking surfaces Cost: Asphalt surface parking not gravel 10% bigger dry detention ponds and swales	Gravel surface parking Dry detention ponds and grass swales Cost: cost savings for gravel surface parking (versus asphalt) cost savings for smaller size of dry detention ponds and grass swales	Gravel surface parking Dry detention ponds and grass swales Cost: cost savings for gravel surface parking (versus asphalt) cost savings for smaller size of dry detention ponds and grass swales
1				Credit 6.2	**Stormwater Management**, Treatment	1	moderate	Dry detention ponds and grass swales Cost neutral to baseline	Dry detention ponds and grass swales Landscape/Building plan includes phosporous free fertilizers, cleaners etc. Cost neutral to baseline	Dry detention ponds and grass swales Landscape/Building plan includes phosporous free fertilizers, cleaners etc. Cost neutral to baseline

Holy Trinity Academy
LEED Canada Scorecard Cost Analysis
TABLE 1

Prepared: Feb 2009

Note:

1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
			1	Credit 7.1	**Landscape & Exterior Design to Reduce Heat Islands**, Non-Roof	1	moderate			
1				Credit 7.2	**Landscape & Exterior Design to Reduce Heat Islands**, Roof	1	moderate	If no LEED roof specified would have been 2 ply SBS	MINUS 1 CREDIT For LEED Silver roof specified would have been 2 ply SBS Cost: 2ply SBS (more expensive than the co-polymer alloy roofing installed)	Co-polymer alloy roofing: Energy Star-compliant , high Albedo roofing over 81% of roof Note: design team would NOT recommend specifying this roof for future buildings Cost: (savings) Co-polymer alloy roofing is cheaper than the baseline 2 ply SBS
1				Credit 8	**Light Pollution Reduction**	1	Minor	If no LEED only standard lighting fixtures would be specified	Specified more energy efficient fixtures with cut offs (not uplighting). Possibly less fixtures though Cost: same as LEED Gold	Specified more energy efficient fixtures with cut offs (not uplighting). Possibly less fixtures though Cost: Possible cost differential for "LEED compliant" fixtures - Erik Heck at Quinn Young to confirm
YES	?	?	NO							
4			1	**Water Efficiency**	5 Points					**Available Strategies**
1				Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1	Minor			
1				Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1	Minor	No Irrigation of landscape would be provided regardless of LEED No Cost	No irrigation provided, drought tolerant and moisture tolerant plants and native grass No Cost	No irrigation provided, drought tolerant and moisture tolerant plants and native grass No Cost
			1	Credit 2	**Innovative Wastewater Technologies**	1	moderate			

Holy Trinity Academy
LEED Canada Scorecard Cost Analysis
TABLE 1

Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
1				Credit 3.1	**Water Use Reduction**, 20% Reduction	1	None to Minor	conventional toilets (6 litres) for students and staff Full flow 3.8l urinals Lavatory 9.5lpm standard system with no sensor Janitor sink no change Shower 9.5lpm no flow restrictor Kitchen sink 9.5lpm Cost: Switching from standard fixtures to low flow fixtures with sensors and waterless urinals as listed	As LEED Gold	conventional toilets (6 litres) for students Waterless urinals for students Dual flush toilet for staff 4.7 litres average Lavatory 1.9lpm Janitor sink no change Shower 7.5lpm and shorter duration Kitchen sink 8.3lpm Cost: Switching from standard fixtures to low flow fixtures with sensors and waterless urinals as listed
1				Credit 3.2	**Water Use Reduction**, 30% Reduction	1	Minor	Strategies as listed above	Strategies as listed above	Strategies as listed above

YES	Y?	N?	NO							
8			9	**Energy & Atmosphere**	17 Points					**Strategies**
Y				Prereq 1	**Fundamental Building Systems Commissioning**	Req'd	None	No Commissioning Authority (CA) would be engaged Cost: no CA required	As LEED Gold	Engaging a Commissioning Authority Cost (soft cost): Approximately $75,000
Y				Prereq 2	**Minimum Energy Performance**	Req'd	minor	Energy modeling would not have taken place Cost: energy modeler not required	As LEED Gold	Energy modeling required Cost: (Soft cost) energy modeling $20,000-$25,000
Y				Prereq 3	**CFC Reduction in HVAC&R Equipment**	Req'd	None	CFC's banned in Canada	CFC's banned in Canada	CFC's banned in Canada

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3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**		14 Points				
6			4	Credit 1	**Optimize Energy Performance**	1 to 10	moderate to high (first costs)	**Lighting**: standard, no sensors, no special lighting **Heating and Ventilation**: conventional ventilation, perimeter radiant (probably wider as poorer quality envelope), standard efficiency boiler, no heat recovery **Envelope:** 4" insulation roof, 2" insulation walls, Windows standard double glazed (no low E or argon) (MINUS 3 POINTS for BASELINE)	As LEED Gold	**Lighting**: controls and sensors, energy efficient lighting (lower lighting levels) **Heating and Ventilation**: air displacement ventilation, perimeter radiant, standard efficiency boiler, heat recovery **Envelope:** 6" insulation roof, 4" insulation walls, Windows low E, argon filled, thermally broken Cost: **Lighting**: upcharge for controls and sensors and energy efficient technology **Heating and Ventilation**: cost differential for ventilation system, cost saving on perimeter radiant, heat recovery system **Envelope:** Cost of additional insulations and associated supports
			1	Credit 2.1	**Renewable Energy**, 5%	1	High (first costs)			Not targeted and achieved
			1	Credit 2.2	**Renewable Energy**, 10%	1		see above	see above	see above
			1	Credit 2.3	**Renewable Energy**, 20%	1		see above	see above	see above
			1	Credit 3	**Best Practice Commissioning**	1	none to minor			Not targeted and achieved (though Quinn Young commented they would target this if they were doing a LEED Gold building)
1				Credit 4	**Ozone Depletion**	1	none to minor	Would possibly have equipment with HCFC's	As LEED Gold	Equipment specified to be HCFC free Cost: upcharge on equipment HCFC free

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3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
			1	Credit 5	**Measurement & Verification**	1	moderate			Not targeted and achieved
1				Credit 6	**Green Power**	1	Minor	Not baseline to buy green power	MINUS 1 CREDIT do not buy green power for 2 years Cost: of not buying green power for 2 years = $5200	2 year purchase of green power required for this credit Cost: 1.5c/kwh premium (actual cost premium to be confirmed by Quinn Young) Information from Quinn Young states 1c/kwh premium = $2600 per year premium
YES	Y?	N?	NO							
6			8	**Materials & Resources**	13 Points					**Strategies**
Y				Prereq 1	**Storage & Collection of Recyclables**	Req'd	none to minor	Not baseline to provide recycling areas - normally would be just garbase dumsters outside	As LEED Gold	storage room has to be assigned for recycling - this is taken from school program space Cost: cost of area of recycling that would otherwise have made up program area
			1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors, & Roof	1		n/a	n/a	n/a
			1	Credit 1.2	**Building Reuse**, Maintain 95% of Existing Walls, Floors, & Roof	1		n/a	n/a	n/a
			1	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-structural Elements	1		n/a	n/a	n/a

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3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO					Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**			14 Points				
1				Credit 2.1	**Construction Waste Management**, Divert 50%	1		none	Not baseline to do construction waste recycling: would be a cost from construction company	As LEED Gold	Contractor would have drawn up construction waste management plan and implemented recycling on site. May be associated soft costs to sort recycling that would not be offset by dumping fees in Alberta Cost: soft costs identified in contractor LEED costs
1				Credit 2.2	**Construction Waste Management**, Divert 75%	1		none	As above	As LEED Gold	As above
			1	Credit 3.1	**Resource Reuse**, Specify 5%	1		minor	not baseline	not targeted	Not targeted
			1	Credit 3.2	**Resource Reuse**, Specify 10%	1		minor	not baseline	not targeted	Not targeted
1				Credit 4.1	**Recycled Content**, Specify 7.5% (post-consumer + ½ post-industrial)	1		none	Not baseline but many recycled content choices are cost neutral	As LEED Gold	Recycled content materials specified and sourced Cost: minimal to none (estimate a small % upcharge above baseline)
1				Credit 4.2	**Recycled Content**, Specify 15% (post-consumer + ½ post-industrial)	1		none	As above	As LEED Gold	As above
1				Credit 5.1	**Regional Materials**, 10% Extracted & Manufactured Regionally	1		none	Not baseline but many local choice materials are cost neutral	As LEED Gold	Local materials specified and sourced No additional cost
1				Credit 5.2	**Regional Materials**, 20% Extracted & Manufactured Regionally	1		none	As above	As LEED Gold	As above
			1	Credit 6	**Rapidly Renewable Materials**	1					Not targeted

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3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**		14 Points				
			1	Credit 7	**Certified Wood**	1	none to high			Not targeted
			1	Credit 8	**Durable Building**	1	minor	Not baseline Cost: delete costs for documentation from LEED Gold scenario	MINUS THIS CREDIT FOR COSTING Cost: delete costs for documentation from LEED Gold scenario	Targeted but not achieved - cost of documentation already in place Cost: Add costs for documentation
YES	Y?	N?	NO							
10			5	**Indoor Environmental Quality**		15 Points				**Strategies**
Y				Prereq 1	**Minimum IAQ Performance**	Req'd	none	Baseline: Mandatory compliance with ASHRAE 62-1999 standard.	as baseline	as baseline
Y				Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Req'd	none	Automatic no smoking in public buildings	as baseline	as baseline

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3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO					Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**			**14** Points				
			1	Credit 1	**Carbon Dioxide** (CO_2) **Monitoring**	1		minor			not targeted
			1	Credit 2	**Ventilation Effectiveness**	1		minor	not baseline Cost: delete costs for documentation from LEED Gold scenario	MINUS THIS CREDIT FOR COSTING Cost: delete costs for documentation from LEED Gold scenario	Targeted but not achieved - Cost: add costs for documentation
1				Credit 3.1	**Construction IAQ Management Plan**, During Construction	1		minor	Not baseline - osts of labour identified in contractors LEED costs	as LEED Gold	Contractor drew up IAQ plan and implemented it Costs: soft costs as identified in contractors LEED costs
1				Credit 3.2	**Construction IAQ Management Plan**, Flushout / Testing	1		minor	Not baseline	as LEED Gold	This was achieved by doing staggered flush outs (not testing) Cost: estimated adding 8 days to construction schedule
1				Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1		none	Not baseline	as LEED Gold	non toxic material specified and sourced cost: add 5% premium cost (architect estimated a premium as building built a few years back - market has changed now and premium does not exist)
1				Credit 4.2	**Low-Emitting Materials**, Paints	1		none	Not baseline	as LEED Gold	non toxic material specified and sourced cost: add 5% premium cost (architect estimated a premium as building built a few years back - market has changed now and premium does not exist)

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3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO	Sustainable Sites 14 Points		Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7						
1				Credit 4.3 **Low-Emitting Materials**, Carpet	1	none	Not baseline	as LEED Gold	non toxic material specified and sourced cost: add 5% premium cost (architect estimated a premium as building built a few years back - market has changed now and premium does not exist)
1				Credit 4.4 **Low-Emitting Materials**, Composite Wood & Agrifiber	1	none	Not baseline	as LEED Gold	non toxic material specified and sourced cost: add 5% premium cost (architect estimated a premium as building built a few years back - market has changed now but likely does still exist on composite wood)
1				Credit 5 **Indoor Chemical & Pollutant Source Control**	1	Minor	not baseline	as LEED Gold	Entrance mats provided at all major entrance area Copy rooms have separate rooms with exhaust and floor to u/s deck partitions Stored chemicals to have separate room with exhaust and floor to u/s deck partitions Cost: as outlined above
			1	Credit 6.1 **Controllability of Systems**, Perimeter	1	minor	not baseline	as LEED Gold	not targeted
			1	Credit 6.2 **Controllability of Systems**, Non-Perimeter	1	minor	not baseline	as LEED Gold	not targeted
1				Credit 7.1 **Thermal Comfort**, Comply with ASHRAE 55	1	none	baseline: based on climate in Alberta	as baseline	as baseline

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3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
1				Credit 7.2	**Thermal Comfort**, Permanent Monitoring System	1	none	as above	as baseline	as baseline
			1	Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1	none	not baseline	not baseline	not baseline
1				Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1	none	not baseline	as LEED Gold	Window sizes were increased to help achieve this credit as a result of the larger windows the structural costs to support the windows were increased windows added in gym, fitness window
YES	Y?	N?	NO							
5				**Innovation & Design Process**	5 Points					**Strategies**
1				Credit 1.1	**Innovation in Design**: Exemplary performance - Water Use Reduction - 40%	1	minor	not baseline	Strategies as WE3.1	Strategies as WE3.1
1				Credit 1.2	**Innovation in Design**: Exemplary Performance - Green Power - 5 Years	1	minor	not baseline	MINUS THIS CREDIT do not purchase the additional 3 years Cost: savings on 3 years buying green power = $7800	Additional 3 years of green power required for this credit was purchased Cost: 1c/kwh premium Information from Quinn Young states 1c/kwh premium = $2600 per year premium
1				Credit 1.3	**Innovation in Design**: Green Housekeeping	1	Minor	not baseline	As LEED Gold	Environmentally Friendly Housekeeping Program - Green Seal Certified cleaning products purchased Supplier did first draft so no cost to the project

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3. For LEED Silver column assume 36 points (ie identify 4 points to remove + the 2 denied credits). SSc4.4 Alternative Transport - Car Parking Capacity (1 Point), SSc7.2 heat island roof (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**		**14** Points				
1				Credit 1.4	**Innovation in Design** Green Building Education Program	1	Minor	not baseline deduct the $5000 from LEED Gold	As LEED Gold	Brochures, pamphlets, tours have been undertake (and ongoing) Cost - include an estimate of $5000 soft design cost
1				Credit 2	**LEED™ Accredited Professional**	1	none	no cost	no cost	no cost

YES	Y?	N?	NO	
40			30	**Project Totals** (pre-certification estimates)

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

LEED Canada-NC 1.0 Project Checklist
TABLE 2
Proposed LEED Silver
(this checklist identifies 36 points - 4 points removed from the original LEED Gold Certified project

Holy Trinity Academy

Yes	?	No			
5		**9**	**Sustainable Sites**		**14** Points
Y			Prereq 1	**Erosion & Sedimentation Control**	Required
		1	Credit 1	**Site Selection**	1
		1	Credit 2	**Development Density**	1
		1	Credit 3	**Redevelopment of Contaminated Site**	1
		1	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
1			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
		1	Credit 4.3	**Alternative Transportation**, Alternative Fuel Vehicles	1
		1	Credit 4.4	**Alternative Transportation**, Parking Capacity	1
		1	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space	1
1			Credit 5.2	**Reduced Site Disturbance**, Development Footprint	1
1			Credit 6.1	**Stormwater Management**, Rate and Quantity	1
1			Credit 6.2	**Stormwater Management**, Treatment	1
		1	Credit 7.1	**Heat Island Effect**, Non-Roof	1
		1	Credit 7.2	**Heat Island Effect**, Roof	1
1			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
4		**1**	**Water Efficiency**		**5** Points
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
		1	Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
1			Credit 3.2	**Water Use Reduction**, 30% Reduction	1

Yes	?	No			
7		**10**	**Energy & Atmosphere**		**17** Points
Y			Prereq 1	**Fundamental Building Systems Commissioning**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**CFC Reduction in HVAC&R Equipment**	Required
6		4	Credit 1	**Optimize Energy Performance**	1 to 10
		1	Credit 2.1	**Renewable Energy**, 5%	1
		1	Credit 2.2	**Renewable Energy**, 10%	1
		1	Credit 2.3	**Renewable Energy**, 20%	1
		1	Credit 3	**Best Practice Commissioning**	1
1			Credit 4	**Ozone Protection**	1
		1	Credit 5	**Measurement & Verification**	1
		1	Credit 6	**Green Power**	1

Yes	?	No			
6		8	**Materials & Resources**		**14** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse:** Maintain 75% of Existing Walls, Floors, and Roof	1
		1	Credit 1.2	**Building Reuse:** Maintain 95% of Existing Walls, Floors, and Roof	1
		1	Credit 1.3	**Building Reuse:** Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management:** Divert 50% from Landfill	1
1			Credit 2.2	**Construction Waste Management:** Divert 75% from Landfill	1
		1	Credit 3.1	**Resource Reuse:** 5%	1
		1	Credit 3.2	**Resource Reuse:** 10%	1
1			Credit 4.1	**Recycled Content:** 7.5% (post-consumer + ½ post-industrial)	1
1			Credit 4.2	**Recycled Content:** 15% (post-consumer + ½ post-industrial)	1
1			Credit 5.1	**Regional Materials:** 10% Extracted and Manufactured Regionally	1
1			Credit 5.2	**Regional Materials:** 20% Extracted and Manufactured Regionally	1
		1	Credit 6	**Rapidly Renewable Materials**	1
		1	Credit 7	**Certified Wood**	1
		1	Credit 8	**Durable Building**	1

Yes	?	No			
10		5	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	Required
		1	Credit 1	**Carbon Dioxide (CO_2) Monitoring**	1
		1	Credit 2	**Ventilation Effectiveness**	1
1			Credit 3.1	**Construction IAQ Management Plan:** During Construction	1
1			Credit 3.2	**Construction IAQ Management Plan:** Testing Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials:** Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials:** Paints and Coating	1
1			Credit 4.3	**Low-Emitting Materials:** Carpet	1
1			Credit 4.4	**Low-Emitting Materials:** Composite Wood and Laminate Adhesives	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
		1	Credit 6.1	**Controllability of Systems:** Perimeter Spaces	1
		1	Credit 6.2	**Controllability of Systems:** Non-Perimeter Spaces	1
1			Credit 7.1	**Thermal Comfort:** Compliance	1
1			Credit 7.2	**Thermal Comfort:** Monitoring	1
		1	Credit 8.1	**Daylight & Views:** Daylight 75% of Spaces	1
1			Credit 8.2	**Daylight & Views:** Views 90% of Spaces	1

Yes	?	No			
4		1	**Innovation & Design Process**		**5** Points
1			Credit 1.1	**Innovation in Design Exemplary performance - Water use reduction 40%**	1
		1	Credit 1.2	**Innovation in Design - Exemplary performance - green power 5 years**	1
1			Credit 1.3	**Innovation in Design: Green Housekeeping**	1
1			Credit 1.4	**Innovation in Design: Green Building Education Program**	1
1			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
36		34	**Project Totals (pre-certification estimates)**	**70** Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-70 points

LEED Canada-NC 1.0 Project Checklist
TABLE 3
Actual LEED Gold

Holy Trinity Academy

Yes	?	No				
7		7	**Sustainable Sites**		**14** Points	
Y			Prereq 1	**Erosion & Sedimentation Control**	Required	
		1	Credit 1	**Site Selection**	1	
		1	Credit 2	**Development Density**	1	
		1	Credit 3	**Redevelopment of Contaminated Site**	1	
		1	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1	
1			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1	
		1	Credit 4.3	**Alternative Transportation**, Alternative Fuel Vehicles	1	
1			Credit 4.4	**Alternative Transportation**, Parking Capacity	1	
		1	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space	1	
1			Credit 5.2	**Reduced Site Disturbance**, Development Footprint	1	
1			Credit 6.1	**Stormwater Management**, Rate and Quantity	1	
1			Credit 6.2	**Stormwater Management**, Treatment	1	
		1	Credit 7.1	**Heat Island Effect**, Non-Roof	1	
1			Credit 7.2	**Heat Island Effect**, Roof	1	
1			Credit 8	**Light Pollution Reduction**	1	

Yes	?	No				
4		1	**Water Efficiency**		**5** Points	
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1	
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1	
		1	Credit 2	**Innovative Wastewater Technologies**	1	
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1	
1			Credit 3.2	**Water Use Reduction**, 30% Reduction	1	

Yes	?	No				
8		9	**Energy & Atmosphere**		**17** Points	
Y			Prereq 1	**Fundamental Building Systems Commissioning**	Required	
Y			Prereq 2	**Minimum Energy Performance**	Required	
Y			Prereq 3	**CFC Reduction in HVAC&R Equipment**	Required	
6		4	Credit 1	**Optimize Energy Performance**	1 to 10	
		1	Credit 2.1	**Renewable Energy**, 5%	1	
		1	Credit 2.2	**Renewable Energy**, 10%	1	
		1	Credit 2.3	**Renewable Energy**, 20%	1	
		1	Credit 3	**Best Practice Commissioning**	1	
1			Credit 4	**Ozone Protection**	1	
		1	Credit 5	**Measurement & Verification**	1	
1			Credit 6	**Green Power**	1	

Yes	?	No			
6		8	**Materials & Resources**		**14** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse:** Maintain 75% of Existing Walls, Floors, and Roof	1
		1	Credit 1.2	**Building Reuse:** Maintain 95% of Existing Walls, Floors, and Roof	1
		1	Credit 1.3	**Building Reuse:** Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management:** Divert 50% from Landfill	1
1			Credit 2.2	**Construction Waste Management:** Divert 75% from Landfill	1
		1	Credit 3.1	**Resource Reuse:** 5%	1
		1	Credit 3.2	**Resource Reuse:** 10%	1
1			Credit 4.1	**Recycled Content:** 7.5% (post-consumer + ½ post-industrial)	1
1			Credit 4.2	**Recycled Content:** 15% (post-consumer + ½ post-industrial)	1
1			Credit 5.1	**Regional Materials:** 10% Extracted and Manufactured Regionally	1
1			Credit 5.2	**Regional Materials:** 20% Extracted and Manufactured Regionally	1
		1	Credit 6	**Rapidly Renewable Materials**	1
		1	Credit 7	**Certified Wood**	1
		1	Credit 8	**Durable Building**	1

Yes	?	No			
10		5	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	Required
		1	Credit 1	**Carbon Dioxide (CO_2) Monitoring**	1
		1	Credit 2	**Ventilation Effectiveness**	1
1			Credit 3.1	**Construction IAQ Management Plan:** During Construction	1
1			Credit 3.2	**Construction IAQ Management Plan:** Testing Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials:** Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials:** Paints and Coating	1
1			Credit 4.3	**Low-Emitting Materials:** Carpet	1
1			Credit 4.4	**Low-Emitting Materials:** Composite Wood and Laminate Adhesives	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
		1	Credit 6.1	**Controllability of Systems:** Perimeter Spaces	1
		1	Credit 6.2	**Controllability of Systems:** Non-Perimeter Spaces	1
1			Credit 7.1	**Thermal Comfort:** Compliance	1
1			Credit 7.2	**Thermal Comfort:** Monitoring	1
		1	Credit 8.1	**Daylight & Views:** Daylight 75% of Spaces	1
1			Credit 8.2	**Daylight & Views:** Views 90% of Spaces	1

Yes	?	No			
5			**Innovation & Design Process**		**5** Points
1			Credit 1.1	**Innovation in Design Exemplary performance - Water use reduction 40%**	1
1			Credit 1.2	**Innovation in Design - Exemplary performance - green power 5 years**	1
1			Credit 1.3	**Innovation in Design - Green Housekeeping**	1
1			Credit 1.4	**Innovation in Design - Green Building Education Program**	1
1			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
40		30	**Project Totals (pre-certification estimates)**	**70** Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-70 points

Appendix B –
Capital Cost Supporting Analysis

(Alternative LEED Silver)

Alberta Infrastructure

Holy Trinity Academy

Report 2a – Capital Cost Analysis

(Alternative LEED Silver)

April 24, 2009

BTY.COM

1.0 INTRODUCTION

In May 2008, Deloitte and BTY Group were retained by Alberta Infrastructure to undertake a "LEED Certification Cost Analysis" for three completed projects; Deloitte reported to Alberta Infrastructure in July 2008. In February 2009, Deloitte, BTY Group and Eco-Integration were retained by Alberta Infrastructure to undertake a further study of additional projects to provide more data for their analysis. This report addresses the Holy Trinity Academy located near the town of Okotoks in the Municipal District of Foothills, Alberta.

2.0 PURPOSE OF REPORT

Alberta Infrastructure wishes to identify all of the premium or extra over costs associated with the funding of projects that would be certified as LEED Silver or LEED Gold as compared to a baseline non-LEED certified project. The costs to be considered are to include both the Hard costs (direct construction costs) and the Soft costs (the design and administration costs associated with achieving the LEED certification). The baseline project costs are to be considered to be based upon best practice design, but without incurring the particular costs for achieving LEED certification. The findings of this study are to be utilized by Alberta Infrastructure and the Alberta Treasury Board as a resource for considering funding commitments for future social infrastructure projects.

3.0 EXECUTIVE SUMMARY

We estimate that the additional costs to deliver the Holy Trinity Academy Project with LEED Silver certification or LEED Gold certification, compared to a baseline non-LEED certified project, are:

HOLY TRINITY ACADEMY PREMIUM (EXTRA OVER) COSTS (Baseline non LEED design)	**LEED SILVER $**	**LEED GOLD $**
HARD costs - Building & Site	$212,800 or 2.3% of the baseline cost.	$330,100 or 3.5% of the baseline cost.
SOFT costs - Administration and Commissioning	$138,100	$198,700
Total HARD & SOFT Costs	**$350,900**	**$528,800**

4.0 PROJECT DESCRIPTION

The project that has been analyzed is a new High School commisioned by Christ the Redeemer Catholic Schools and located near the town of Okotoks in the Municipal District of Foothills, Alberta. The project is a two storey building plus a mezzanine floor; total Gross Floor Area is measured at 6,793 m^2. The construction commenced in December 2004 and was substantially completed in May of 2006. The project was designed to achieve LEED Gold certification; this designation was confirmed in October 2008 with a total LEED point score of 40. (Note: minimum point score for LEED Gold is 39 points).

5.0 METHODOLOGY

Since the project was designed and constructed with the goal of achieving LEED Gold the methodology that we have employed is to reverse engineer the design strategies to provide for a LEED Silver certification and a baseline non-LEED certified project. We have then reported the design strategies, and their estimated cost, as premium or extra over costs from the baseline case.

The team reviewed the tender documents, the actual tendered amount, the LEED rating/score sheet compiled for the project together with the contractor's cost breakdown for the Holy Trinity Academy project. Estimated costs were then apportioned to the various building elements to allow a detailed analysis of the appropriate design strategies.

Since there was very little capital cost difference between the LEED Silver and LEED Gold strategies we have considered different credits to achieve LEED Silver than were developed during the workshop session. The result of utilizing these revised strategies is to reduce the LEED Silver premium costs and to demonstrate a more representative result. The strategies being considered are listed in Tables 1A and 2A in **Section 8.0 LEED CHECKLIST.**

5.0 METHODOLOGY (continued)

Representatives from Deloitte, BTY and Eco-Integration (The 'Deloitte team') met for a half day workshop with the design teams. The purpose of the workshops was to establish the following:

- Baseline strategies: what would the project brief have been if LEED certification had not been a requirement;
- LEED Silver: what would the strategies have been, over and above the baseline considerations, to achieve at least 33 LEED points so as to ensure that the project would qualify for LEED Silver (for Holy Trinity Academy project, the workshop design team targeted 36 LEED points for Silver Certificate).
- LEED Gold: what would the strategies have been, over and above the baseline considerations, to achieve at least 39 LEED points so as to ensure that the project would qualify for LEED Gold (for Holy Trinity Academy project, the design team targeted 40 LEED points for Gold Certificate).

As noted above the workshops were directed towards understanding the LEED Gold strategies that were actually employed and to determine which strategies should be eliminated or reduced to bring the project back to a reduced (Silver), or non, LEED rating.

Following the workshops, the elemental cost analysis prepared for the High School was then adjusted to establish the "Baseline Cost" for the building.

6.0 CASE STUDY ANALYSIS

Project Background

Holy Trinity Academy, Okotos, Alberta
Workshop Date: March 2, 2009

These notes are to be read in conjunction with Table 1A, attached LEED scorecard in Section 7.0 indicating the strategies for Baseline, LEED Silver and LEED Gold; the LEED checklists; Table 2A Alternate A proposed LEED Silver and Table 3 Actual LEED Gold achieved (at 40 points).

Holy Trinity Academy is a new secondary school that is owned and operated by Christ the Redeemer Catholic Schools. The project was tendered using a Stipulated Lump Sum form of contract; the final construction cost as certified by the architect in November 3, 2006 was **$9,705,313. or $1,428.72/m^2 ($132.80/sq. ft).**

Christ the Redeemer Catholic Schools has a philosophy of designing robust, durable buildings with good envelope performance and child resistant materials; past project design has employed "best practice sustainable design". Some of the design strategies employed are consistent with LEED philosophy; but some of the possible site strategies (such as stormwater management, pervious surfaces, shading, use of trees and landscaping) have not been part of the design toolbox. This has resulted in design challenges to obtain LEED recognition.

6.0 CASE STUDY ANALYSIS (continued)

The strategies, and costs associated with these strategies, to achieve LEED ratings, compared to the baseline design are:

LEED Requirement	Design Strategies	Non-LEED $	LEED Silver $	LEED Gold $
Hard Cost				
Substainable Site	Cost saving for smaller parking, gravel parking surface and PVC membrane roofing	-	($119,900)	($119,900)
Water Management	low flow fixtures	-	$10,700	$10,700
Optimize Energy Performance	Lighting sensors, HCFC free equipment, air displacement ventilation, heat recovery, and high performance glazing system	-	$104,600	$125,000
Indoor environment	Staged flush out, low-emitting materials, entrance mats, partitions & ventilation to copies rooms	-	$35,700	$35,700
	Additional windows for increased daylight	-	$0	$96,900
Contractor Administration	LEED coordination during construction, construction waste & recycle management	-	$181,700	$181,700
Hard Costs Total			**$212,800**	**$330,100**
Soft Costs				
LEED Administration Documentation	LEED Registration; Additional Professional Design co-coordinators, LEED Consultant; Energy Modeler.	-	$58,100	$105,700
	Commissioning Fundamental	-	$75,000	$75,000
	Green power purchase contract & Green building education	-	$5,000	$18,000
Soft Cost Total			**$138,100**	**$198,700**
TOTAL			**$350,900**	**$528,800**

7.0 Eco-Integration's Commentary

CASE STUDY ANALYSIS

Project Background

Holy Trinity Academy High School (HTA)
Workshop Date: March 2, 2009

These notes are to be read in conjunction with attached Table 1A LEED Scorecard Cost Analysis Holy Trinity Academy in Section 8.0 indicating the strategies for Alberta Infrastructure Baseline, Proposed alternate LEED Silver, and LEED Gold Actual.

Also the LEED checklists are included for the following levels of LEED:

- Table 2A Alternate A proposed LEED Silver and
- Table 3 LEED Gold Actual.

The project HTA achieved LEED Gold Certification with 40 points (>39 is LEED Gold). At the workshop we met with the design team to establish firstly what sustainable strategies would have been included at the AI baseline level (ie No LEED rating targeted). Then we discussed what strategies may not have been undertaken if only LEED Silver was targeted and finally we reviewed the strategies that achieved the LEED Gold certification. These have all been outlined in Table 1 LEED Scorecard Cost Analysis Holy Trinity Academy. At the meeting there were a few sustainable strategies discussed that the design team deemed would not have been baseline for AI. However unique to this project was the fact that undertaking these strategies to achieve LEED ***reduced the project first costs***. This is not typical, more commonly incorporation of sustainable strategies may increase first costs but provide benefits in terms of life cycle costing, reduced maintenance, reduction in ghg, better indoor environment etc. The strategies included:

- SSc5.1 Alternate Transportation. Parking Capacity – a fairly common sustainable strategy is to reduce the number of parking stalls so it becomes harder to park and alternate methods of transportation happen (car pool, bus etc. ***However removing car spaces to meet this LEED credit results in cost savings to the project*** (as reflected in the data). This strategy would not have been pursued for the AI baseline and LEED Silver (ie more parking would have been provided) resulting in a cost increase for Baseline and LEED Silver.
- SSc6.1 Stormwater Management, Rate and Quantity - Due to the location of the site and the sustainable goals (large rural open space), the site needed to manage its own Stormwater (and not connect to a municipal system). Pervious paving (gravel) was used on the parking area to reduce run-off and decrease heat island effect. By using gravel the stormwater was managed and directed to detention ponds and grass swales. However at the workshop it was established that asphalt (non-pervious) paving would have been the AI baseline for the project had LEED not been undertaken. If asphalt surface parking was used (instead of gravel) it is also likely that the detention ponds and grass swales would have increased to deal with the greater stormwater loads. ***Therefore designing a gravel parking lot to manage the stormwater for LEED resulted in cost savings to the project***. This credit is removed for the AI baseline resulting in a cost increase for the baseline. For LEED Silver the gravel parking remains.

- SSc7.2 Landscape and Exterior Design to Reduce Heat Islands, Roof – in order to achieve this credit high albedo roofing was incorporated over 80% of the roof surface. This roofing was Co-polymer alloy roofing. At the workshop the design team identified that they were not happy with the quality of the roofing and would not use it again. For the AI baseline and the proposed LEED Silver the roofing would have been 2 ply SBS - which is more expensive than the Co-polymer alloy roofing. ***Therefore using the co-polymer alloy roofing results in a cost savings for LEED Gold***

All 3 of these strategies listed have ***decreased the baseline cost (and in some cases the LEED Silver cost).*** This will provide in the analysis a lower bound LEED Silver cost.

The report also includes Table 2A Alternate A Proposed LEED Silver with 36 points. In this table we have indicated different credits (than table 2) to achieve LEED silver. These credits increase cost (or neutral) for achieving the LEED Gold strategy. Therefore the LEED Silver cost in this scenario will provide an upper bound LEED Silver cost. With this upper and lower bound cost for LEED Silver this will provide a range more representative of other projects.

The following strategies were revised for the alternate LEED Silver analysis:

SS Credit 4.4:	Same Strategy to LEED Gold
SS Credit 7.2:	Same Strategy to LEED Gold
EA Credit 1:	Same Strategy to LEED Gold except delete Heat Recovery
IE Credit 8.2:	Delete additional windows required for LEED Gold

8.0 LEED CHECKLISTS

-Holy Trinity Academy

Holy Trinity Academy
TABLE 1A
LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
Y				Prereq 1	**Erosion & Sedimentation Control**	Req'd	Minor to none	standard requirement for baseline		
			1	Credit 1	**Site Selection**	1	None	not a project design choice (either receive credit or not depending on site conditions)		
			1	Credit 2	**Urban Redevelopment**	1	none	not a project design choice (either receive credit or not depending on site conditions)		
			1	Credit 3	**Redevelopment of Contaminated Sites**	1	None	not a project design choice (either receive credit or not depending on site conditions)		
			1	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1	None	not a project design choice (either receive credit or not depending on site conditions)		
1				Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1	Minor	bike storage and showers provided as baseline	bike storage and showers provided as baseline	bike storage and showers provided as baseline

Holy Trinity Academy
TABLE 1A
LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
			1	Credit 4.3	**Alternative Transportation**, Alternative Fuel Vehicles	1	Minor			
1				Credit 4.4	**Alternative Transportation**, Parking Capacity and Carpooling	1	Minor	For Baseline likely MORE parking would have been provided (80 more stalls) and not carpooling (so no signage required) Cost: 80 additional surface parking stalls No signage for carpooling	DO NOT DELETE CREDIT FOR LEED SILVER KEEP PRICING AS LEED GOLD	provided parking to meet minimum local zoning requirements and provided designated parking for carpools equal to 10% of non-visitor parking Cost: Signage for carpool parking
			1	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space	1				
1				Credit 5.2	**Reduced Site Disturbance**, Development Footprint	1	No Cost	This is baseline due to the site size and building footprint size No Cost	This is baseline due to the site size and building footprint size No Cost	This is baseline due to the site size and building footprint size No Cost
1				Credit 6.1	**Stormwater Management**, Rate and Quantity	1	none to moderate	If no LEED likely that the surface parking would have been ashpalt and not gravel. The stormwater strategy would still have been dry detention ponds and grass swales but they would have been bigger to deal with the greater flow from the impervious parking surfaces Cost: Asphalt surface parking not gravel 10% bigger dry detention ponds and swales	Gravel surface parking Dry detention ponds and grass swales Cost: cost savings for gravel surface parking (versus ashpalt) cost savings for smaller size of dry detention ponds and grass swales	Gravel surface parking Dry detention ponds and grass swales Cost: cost savings for gravel surface parking (versus ashpalt) cost savings for smaller size of dry detention ponds and grass swales

Holy Trinity Academy
TABLE 1A
LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
1				Credit 6.2	**Stormwater Management**, Treatment	1	moderate	Dry detendion ponds and grass swales Cost neutral to baseline	Dry detendion ponds and grass swales Landscape/Building plan includes phosporous free fertilizers, cleaners etc. Cost neutral to baseline	Dry detendion ponds and grass swales Landscape/Building plan includes phosporous free fertilizers, cleaners etc. Cost neutral to baseline
			1	Credit 7.1	**Landscape & Exterior Design to Reduce Heat Islands**, Non-Roof	1	moderate			
1				Credit 7.2	**Landscape & Exterior Design to Reduce Heat Islands**, Roof	1	moderate	If no LEED roof specified would have been 2 ply SBS	DO NOT DELETE CREDIT FOR LEED SILVER KEEP PRICING AS LEED GOLD	Energy Star- compliant , high Albedo roofing over 81% of roof Note: design team would NOT recommend specifying this roof for future buildings Cost: (savings) Energy star roof cheaper than the baseline 2 ply SBS
1				Credit 8	**Light Pollution Reduction**	1	Minor	If no LEED only standard lighting fixures would be specified	Specified more energy efficient fixures with cut offs (not uplighting). Possibly less fixtures though Cost: same as LEED Gold	Specified more energy efficient fixures with cut offs (not uplighting). Possibly less fixtures though Cost: Possible cost differential for "LEED compliant" fixtures - Erik Heck at Quinn Young to confirm

Holy Trinity Academy
TABLE 1A
LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
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2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
YES	?	?	NO							
4			1	**Water Efficiency**	5 Points					**Available Strategies**
1				Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1	Minor			
1				Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1	Minor	No Irrigation of landscape would be provided regardless of LEED No Cost	No irrigation provided, drought tolerant and moisture tolerant plants and native grass No Cost	No irrigation provided, drought tolerant and moisture tolerant plants and native grass No Cost
			1	Credit 2	**Innovative Wastewater Technologies**	1	moderate			
1				Credit 3.1	**Water Use Reduction**, 20% Reduction	1	None to Minor	conventional toilets (6 litres) for students and staff Full flow 3.8l urinals Lavatory 9.5lpm standard system with no sensor Janitor sink no change Shower 9.5lpm no flow restrictor Kitchen sink 9.5lpm Cost: Switching from standard fixtures to low flow fixtures with sensors and waterless urinals as listed	As LEED Gold	conventional toilets (6 litres) for students Waterless urinals for students Dual flush toilet for staff 4.7 litres average Lavatory 1.9lpm Janitor sink no change Shower 7.5lpm and shorter duration Kitchen sink 8.3lpm Cost: Switching from standard fixtures to low flow fixtures with sensors and waterless urinals as listed
1				Credit 3.2	**Water Use Reduction**, 30% Reduction	1	Minor	Strategies as listed above	Strategies as listed above	Strategies as listed above

Holy Trinity Academy
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LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO			Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points				
8			9	**Energy & Atmosphere**	17 Points				**Strategies**
Y				Prereq 1 **Fundamental Building Systems Commissioning**	Req'd	None	No Commissining Authority (CA) would be engaged Cost: no CA required	As LEED Gold	Engaging a Commissioning Authority Cost (soft cost): Approximately $75,000
Y				Prereq 2 **Minimum Energy Performance**	Req'd	minor	Energy modeling would not have taken place Cost: energy modeler not required	As LEED Gold	Energy modeling requried Cost: (Soft cost) energy modeling $20,000-$25,000
Y				Prereq 3 **CFC Reduction in HVAC&R Equipment**	Req'd	None	CFC's banned in Canada	CFC's banned in Canada	CFC's banned in Canada

Holy Trinity Academy
TABLE 1A
LEED Canada Scorecard Cost Analysis
As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**		14 Points				
6			4	Credit 1	**Optimize Energy Performance**	1 to 10	moderate to high (first costs)	**Lighting**: standard, no sensors, no special lighting **Heating and Ventilation**: conventional ventilation, perimeter radiant (probably wider as poorer quality envelope), standard efficiency boiler, no heat recovery **Envelope:** 4" insulation roof, 2" insulation walls, Windows standard double glazed (no low E or argon) (MINUS 3 POINTS for BASELINE)	MINUS 1 POINT Systems as LEED Gold EXCEPT delete heat recovery system	**Lighting**: controls and sensors, energy efficient lighting (lower lighting levels) **Heating and Ventilation**: air displacement ventilation, perimeter radiant, standard efficiency boiler, heat recovery **Envelope:** 6" insulation roof, 4" insulation walls, Windows low E, argon filled, thermally broken Cost: **Lighting**: upcharge for controls and sensors and energy efficient technology **Heating and Ventilation**: cost differential for ventilation system, cost saving on perimeter radiant, heat recovery system **Envelope:** Cost of additional insulations and associated supports
			1	Credit 2.1	**Renewable Energy**, 5%	1	High (first costs)			Not targeted and achieved
			1	Credit 2.2	**Renewable Energy**, 10%	1		see above	see above	see above
			1	Credit 2.3	**Renewable Energy**, 20%	1		see above	see above	see above
			1	Credit 3	**Best Practice Commissioning**	1	none to minor			Not targeted and achieved (though Quinn Young commented they would target this if they were doing a LEED Gold building)

Holy Trinity Academy
TABLE 1A
LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
1				Credit 4	**Ozone Depletion**	1	none to minor	Would possibly have equipment with HCFC's	As LEED Gold	Equipment specified to be HCFC free Cost: upcharge on equipment HCFC free
			1	Credit 5	**Measurement & Verification**	1	moderate			Not targeted and achieved
1				Credit 6	**Green Power**	1	Minor	Not baseline to buy green power	MINUS 1 CREDIT do not buy green power for 2 years Cost: of not buying green power for 2 years = $5200	2 year purchase of green power required for this credit Cost: 1.5c/kwh premium (actual cost premium to be confirmed by Quinn Young) Information from Quinn Young states 1c/kwh premium = $2600 per year premium
YES	Y?	N?	NO							
6			8	**Materials & Resources**	13 Points					**Strategies**
Y				Prereq 1	**Storage & Collection of Recyclables**	Req'd	none to minor	Not baseline to provide recycling areas - normally would be just garbase dumsters outside	As LEED Gold	storage room has to be assigned for recycling - this is taken from school program space Cost: cost of area of recycling that would otherwise have made up program area
			1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors, & Roof	1		n/a	n/a	n/a

Holy Trinity Academy
TABLE 1A
LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites** 14 Points						
			1	Credit 1.2	**Building Reuse**, Maintain 95% of Existing Walls, Floors, & Roof	1		n/a	n/a	n/a
			1	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-structural Elements	1		n/a	n/a	n/a
1				Credit 2.1	**Construction Waste Management**, Divert 50%	1	none	Not baseline to do construction waste recycling: would be a soft cost from construction company	As LEED Gold	Contractor would have drawn up construction waste management plan and implemented recycling on site. May be associated soft costs to sort recycling that would not be offset by dumping fees in Alberta Cost: soft costs identified in contractor LEED costs
1				Credit 2.2	**Construction Waste Management**, Divert 75%	1	none	As above	As LEED Gold	As above
			1	Credit 3.1	**Resource Reuse**, Specify 5%	1	minor	not baseline	not targeted	Not targeted
			1	Credit 3.2	**Resource Reuse**, Specify 10%	1	minor	not baseline	not targeted	Not targeted
1				Credit 4.1	**Recycled Content**, Specify 7.5% (post-consumer + ½ post-industrial)	1	none	Not baseline but many recycled content choices are cost neutral	As LEED Gold	Recycled content materials specified and sourced Cost: minimal to none (architect estimates a possible 2% upcharge above baseline
1				Credit 4.2	**Recycled Content**, Specify 15% (post-consumer + ½ post-industrial)	1	none	As above	As LEED Gold	As above
1				Credit 5.1	**Regional Materials**, 10% Extracted & Manufactured Regionally	1	none	Not baseline but many local choice materials are cost neutral	As LEED Gold	Local materials specified and sourced No additional cost
1				Credit 5.2	**Regional Materials**, 20% Extracted & Manufactured Regionally	1	none	As above	As LEED Gold	As above

Holy Trinity Academy
TABLE 1A
LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
1. Credits shown (left hand column) are *actual* LEED Gold points achieved (40 Points)

2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
			1	Credit 6	**Rapidly Renewable Materials**	1				Not targeted
			1	Credit 7	**Certified Wood**	1	none to high			Not targeted
			1	Credit 8	**Durable Building**	1	minor	Not baseline	MINUS THIS CREDIT FOR COSTING Cost: delete costs for documentation and design changes 1 and 2 in LEED Gold column	Targeted but not achieved - cost of documentation already in place - what would it take to achieve the credit (denied based on BE qualifications/EIFS detailing and single ply roofing membrane) Would have likely achieved this credit if: 1. 2-ply SBS roofing instead of single ply roofing 2. At low level (first storey) block was substituted for EIFS Cost: Add costs for documentation + changes to design (1 and 2) as above
YES	Y?	N?	NO							
10			5	**Indoor Environmental Quality**	15 Points					**Strategies**
Y				Prereq 1	**Minimum IAQ Performance**	Req'd	none	Baseline: Mandatory compliance with ASHRAE 62-1999 standard.	as baseline	as baseline
Y				Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Req'd	none	Automatic no smoking in public buildings	as baseline	as baseline

Holy Trinity Academy
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LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
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2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO					Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**			14 Points				
			1	Credit 1	**Carbon Dioxide** (CO_2) **Monitoring**	1		minor			not targeted
			1	Credit 2	**Ventilation Effectiveness**	1		minor	not baseline	MINUS THIS CREDIT FOR COSTING	Targeted but not achieved - is there cost already built it? - what would it have taken to achieve it?
1				Credit 3.1	**Construction IAQ Management Plan**, During Construction	1		minor	Not baseline - soft costs of labour identified in contractors LEED costs	as LEED Gold	Contractor drew up IAQ plan and implemented it Costs: soft costs as identified in contractors LEED costs
1				Credit 3.2	**Construction IAQ Management Plan**, Flushout / Testing	1		minor	Not baseline	as LEED Gold	This was achieved by doing staggered flush outs (not testing) Cost: estimated adding 8 days to construction schedule
1				Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1		none	Not baseline	as LEED Gold	non toxic material specified and sourced cost: add 5% premium cost (architect estimated a premium as building built a few years back - market has changed now and premium does not exist)
1				Credit 4.2	**Low-Emitting Materials**, Paints	1		none	Not baseline	as LEED Gold	non toxic material specified and sourced cost: add 5% premium cost (architect estimated a premium as building built a few years back - market has changed now and premium does not exist)

Holy Trinity Academy
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LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
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2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
1				Credit 4.3	**Low-Emitting Materials**, Carpet	1	none	Not baseline	as LEED Gold	non toxic material specified and sourced cost: add 5% premium cost (architect estimated a premium as building built a few years back - market has changed now and premium does not exist)
1				Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber	1	none	Not baseline	as LEED Gold	non toxic material specified and sourced cost: add 5% premium cost (architect estimated a premium as building built a few years back - market has changed now but likely does still exist on composite wood)
1				Credit 5	**Indoor Chemical & Pollutant Source Control**	1	Minor	not baseline	as LEED Gold	Entrance mats provided at all major entrance area Copy rooms have separate rooms with exhaust and floor to u/s deck partitions Stored chemicals to have separate room with exhaust and floor to u/s deck partitions Cost: as outlined above
			1	Credit 6.1	**Controllability of Systems**, Perimeter	1	minor	not baseline	as LEED Gold	not targeted
			1	Credit 6.2	**Controllability of Systems**, Non-Perimeter	1	minor	not baseline	as LEED Gold	not targeted

Holy Trinity Academy
TABLE 1A
LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
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Note:
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2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO				Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
7			7	**Sustainable Sites**	14 Points					
1				Credit 7.1 **Thermal Comfort**, Comply with ASHRAE 55	1	none	baseline: based on climate in Alberta	as baseline	as baseline
1				Credit 7.2 **Thermal Comfort**, Permanent Monitoring System	1	none	as above	as baseline	as baseline
			1	Credit 8.1 **Daylight & Views**, Daylight 75% of Spaces	1	none	not baseline	not baseline	not basline
1				Credit 8.2 **Daylight & Views**, Views for 90% of Spaces	1	none	not baseline	MINUS THIS CREDIT FOR COSTING DELETE ADDITIONAL COST AS IDENTIFIED IN LEED GOLD	Window sizes were increased to help achieve this credit as a result of the larger windows the structural costs to support the windows were increased windows added in gym, fitness windown
YES	Y?	N?	NO							
5				**Innovation & Design Process**	5 Points					**Strategies**
1				Credit 1.1 **Innovation in Design**: Exemplary performance - Water Use Reduction - 40%	1	minor	not baseline	Strategies as WE3.1	Strategies as WE3.1
1				Credit 1.2 **Innovation in Design**: Exemplary Performance - Green Power - 5 Years	1	minor	not baseline	MINUS THIS CREDIT do not purcahse the additional 3 years Cost: savings on 3 years buying green power = $7800	Additional 3 years of green power required for this credit was purchased Cost: 1c/kwh premium Information from Quinn Young states 1c/kwh premium = $2600 per year premium

Holy Trinity Academy
TABLE 1A
LEED Canada Scorecard Cost Analysis

As Table 1 except for LEED Silver column
Prepared: Feb 2009

Note:
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2. Notes in LEED Gold column are identifying pricing items (above baseline). 40 points were achieved for LEED Gold certification (2 points were denied by CaGBC). For pricing purposes include the costs associated with targeting the 2 denied points since the design/documentation was implemented (MRc8 and EQc2)

3. For LEED Silver column ALTERNATE 1 assume 36 points (ie identify 4 points to remove + the 2 denied credits). EAc1 Optimize energy performance (1 Points), IEQc8.2 Views (1 point), and EAc6 Green power (2 points)

4. For baseline column strip costing back to the building AI/Catholic School Board baseline standards as outlined

YES	Y?	N?	NO	Sustainable Sites 14 Points			Additional cost req'd to achieve LEED none minor moderate high	BASELINE	LEED SILVER Target 36 points ie Minus 4 Points costs and minus 2 denied credit costs	LEED GOLD Achieved (40 Points) Include in pricing 2 points denied MRc8 and EQc2
1				Credit 1.3	**Innovation in Design**: Green Housekeeping	1	Minor	not baseline	As LEED Gold	Environmentally Friendly Housekeeping Program - Green Seal Certified cleaning products purchased Supplier did first draft so no cost to the project
1				Credit 1.4	**Innovation in Design** Green Building Education Program	1	Minor	not baseline	AS LEED Gold	Brochures, pamphlets, tours have been undertaken (and ongoing) Cost - soft cost
1				Credit 2	**LEED™ Accredited Professional**	1	none	no cost	no cost	no cost

YES	Y?	N?	NO	
40			30	**Project Totals** (pre-certification estimates)

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

LEED Canada-NC 1.0 Project Checklist
TABLE 2A
Alternate A Proposed Silver

this checklist identifies 36 points - 4 points removed from
LEED Gold Certified project ***but an alternate version***

Holy Trinity Academy

Yes	?	No			
7		**7**	**Sustainable Sites**		**14** Points
Y			Prereq 1	**Erosion & Sedimentation Control**	Required
		1	Credit 1	**Site Selection**	1
		1	Credit 2	**Development Density**	1
		1	Credit 3	**Redevelopment of Contaminated Site**	1
		1	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
1			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
		1	Credit 4.3	**Alternative Transportation**, Alternative Fuel Vehicles	1
1			Credit 4.4	**Alternative Transportation**, Parking Capacity	1
		1	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space	1
1			Credit 5.2	**Reduced Site Disturbance**, Development Footprint	1
1			Credit 6.1	**Stormwater Management**, Rate and Quantity	1
1			Credit 6.2	**Stormwater Management**, Treatment	1
		1	Credit 7.1	**Heat Island Effect**, Non-Roof	1
1			Credit 7.2	**Heat Island Effect**, Roof	1
1			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
4		**1**	**Water Efficiency**		**5** Points
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
		1	Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
1			Credit 3.2	**Water Use Reduction**, 30% Reduction	1

Yes	?	No			
6		**11**	**Energy & Atmosphere**		**17** Points
Y			Prereq 1	**Fundamental Building Systems Commissioning**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**CFC Reduction in HVAC&R Equipment**	Required
5		5	Credit 1	**Optimize Energy Performance**	1 to 10
		1	Credit 2.1	**Renewable Energy**, 5%	1
		1	Credit 2.2	**Renewable Energy**, 10%	1
		1	Credit 2.3	**Renewable Energy**, 20%	1
		1	Credit 3	**Best Practice Commissioning**	1
1			Credit 4	**Ozone Protection**	1
		1	Credit 5	**Measurement & Verification**	1
		1	Credit 6	**Green Power**	1

Yes	?	No			
6		8	**Materials & Resources**		**14** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse:** Maintain 75% of Existing Walls, Floors, and Roof	1
		1	Credit 1.2	**Building Reuse:** Maintain 95% of Existing Walls, Floors, and Roof	1
		1	Credit 1.3	**Building Reuse:** Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management:** Divert 50% from Landfill	1
1			Credit 2.2	**Construction Waste Management:** Divert 75% from Landfill	1
		1	Credit 3.1	**Resource Reuse:** 5%	1
		1	Credit 3.2	**Resource Reuse:** 10%	1
1			Credit 4.1	**Recycled Content:** 7.5% (post-consumer + ½ post-industrial)	1
1			Credit 4.2	**Recycled Content:** 15% (post-consumer + ½ post-industrial)	1
1			Credit 5.1	**Regional Materials:** 10% Extracted and Manufactured Regionally	1
1			Credit 5.2	**Regional Materials:** 20% Extracted and Manufactured Regionally	1
		1	Credit 6	**Rapidly Renewable Materials**	1
		1	Credit 7	**Certified Wood**	1
		1	Credit 8	**Durable Building**	1

Yes	?	No			
9		6	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	Required
		1	Credit 1	**Carbon Dioxide (CO_2) Monitoring**	1
		1	Credit 2	**Ventilation Effectiveness**	1
1			Credit 3.1	**Construction IAQ Management Plan:** During Construction	1
1			Credit 3.2	**Construction IAQ Management Plan:** Testing Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials:** Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials:** Paints and Coating	1
1			Credit 4.3	**Low-Emitting Materials:** Carpet	1
1			Credit 4.4	**Low-Emitting Materials:** Composite Wood and Laminate Adhesives	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
		1	Credit 6.1	**Controllability of Systems:** Perimeter Spaces	1
		1	Credit 6.2	**Controllability of Systems:** Non-Perimeter Spaces	1
1			Credit 7.1	**Thermal Comfort:** Compliance	1
1			Credit 7.2	**Thermal Comfort:** Monitoring	1
		1	Credit 8.1	**Daylight & Views:** Daylight 75% of Spaces	1
		1	Credit 8.2	**Daylight & Views:** Views 90% of Spaces	1

Yes	?	No			
4		1	**Innovation & Design Process**		**5** Points
1			Credit 1.1	**Innovation in Design Exemplary performance - Water use reduction 40%**	1
		1	Credit 1.2	**Innovation in Design - Exemplary performance - green power 5 years**	1
1			Credit 1.3	**Innovation in Design - Green Housekeeping**	1
1			Credit 1.4	**Innovation in Design - Green Building Education Program**	1
1			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
36		34	**Project Totals (pre-certification estimates)**	**70** Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-70 points

LEED Canada-NC 1.0 Project Checklist
TABLE 3
Actual LEED Gold

Holy Trinity Academy

Yes	?	No				
7		7	**Sustainable Sites**		**14** Points	
Y			Prereq 1	**Erosion & Sedimentation Control**	Required	
		1	Credit 1	**Site Selection**	1	
		1	Credit 2	**Development Density**	1	
		1	Credit 3	**Redevelopment of Contaminated Site**	1	
		1	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1	
1			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1	
		1	Credit 4.3	**Alternative Transportation**, Alternative Fuel Vehicles	1	
1			Credit 4.4	**Alternative Transportation**, Parking Capacity	1	
		1	Credit 5.1	**Reduced Site Disturbance**, Protect or Restore Open Space	1	
1			Credit 5.2	**Reduced Site Disturbance**, Development Footprint	1	
1			Credit 6.1	**Stormwater Management**, Rate and Quantity	1	
1			Credit 6.2	**Stormwater Management**, Treatment	1	
		1	Credit 7.1	**Heat Island Effect**, Non-Roof	1	
1			Credit 7.2	**Heat Island Effect**, Roof	1	
1			Credit 8	**Light Pollution Reduction**	1	

Yes	?	No				
4		1	**Water Efficiency**		**5** Points	
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1	
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1	
		1	Credit 2	**Innovative Wastewater Technologies**	1	
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1	
1			Credit 3.2	**Water Use Reduction**, 30% Reduction	1	

Yes	?	No				
8		9	**Energy & Atmosphere**		**17** Points	
Y			Prereq 1	**Fundamental Building Systems Commissioning**	Required	
Y			Prereq 2	**Minimum Energy Performance**	Required	
Y			Prereq 3	**CFC Reduction in HVAC&R Equipment**	Required	
6		4	Credit 1	**Optimize Energy Performance**	1 to 10	
		1	Credit 2.1	**Renewable Energy**, 5%	1	
		1	Credit 2.2	**Renewable Energy**, 10%	1	
		1	Credit 2.3	**Renewable Energy**, 20%	1	
		1	Credit 3	**Best Practice Commissioning**	1	
1			Credit 4	**Ozone Protection**	1	
		1	Credit 5	**Measurement & Verification**	1	
1			Credit 6	**Green Power**	1	

Yes	?	No			
6		8	**Materials & Resources**		**14** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse:** Maintain 75% of Existing Walls, Floors, and Roof	1
		1	Credit 1.2	**Building Reuse:** Maintain 95% of Existing Walls, Floors, and Roof	1
		1	Credit 1.3	**Building Reuse:** Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management:** Divert 50% from Landfill	1
1			Credit 2.2	**Construction Waste Management:** Divert 75% from Landfill	1
		1	Credit 3.1	**Resource Reuse:** 5%	1
		1	Credit 3.2	**Resource Reuse:** 10%	1
1			Credit 4.1	**Recycled Content:** 7.5% (post-consumer + ½ post-industrial)	1
1			Credit 4.2	**Recycled Content:** 15% (post-consumer + ½ post-industrial)	1
1			Credit 5.1	**Regional Materials:** 10% Extracted and Manufactured Regionally	1
1			Credit 5.2	**Regional Materials:** 20% Extracted and Manufactured Regionally	1
		1	Credit 6	**Rapidly Renewable Materials**	1
		1	Credit 7	**Certified Wood**	1
		1	Credit 8	**Durable Building**	1

Yes	?	No			
10		5	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	Required
		1	Credit 1	**Carbon Dioxide (CO_2) Monitoring**	1
		1	Credit 2	**Ventilation Effectiveness**	1
1			Credit 3.1	**Construction IAQ Management Plan:** During Construction	1
1			Credit 3.2	**Construction IAQ Management Plan:** Testing Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials:** Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials:** Paints and Coating	1
1			Credit 4.3	**Low-Emitting Materials:** Carpet	1
1			Credit 4.4	**Low-Emitting Materials:** Composite Wood and Laminate Adhesives	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
		1	Credit 6.1	**Controllability of Systems:** Perimeter Spaces	1
		1	Credit 6.2	**Controllability of Systems:** Non-Perimeter Spaces	1
1			Credit 7.1	**Thermal Comfort:** Compliance	1
1			Credit 7.2	**Thermal Comfort:** Monitoring	1
		1	Credit 8.1	**Daylight & Views:** Daylight 75% of Spaces	1
1			Credit 8.2	**Daylight & Views:** Views 90% of Spaces	1

Yes	?	No			
5			**Innovation & Design Process**		**5** Points
1			Credit 1.1	**Innovation in Design Exemplary performance - Water use reduction 40%**	1
1			Credit 1.2	**Innovation in Design - Exemplary performance - green power 5 years**	1
1			Credit 1.3	**Innovation in Design - Green Housekeeping**	1
1			Credit 1.4	**Innovation in Design - Green Building Education Program**	1
1			Credit 2	**LEED® Accredited Professional**	1

Yes	?	No		
40		30	**Project Totals (pre-certification estimates)**	**70** Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-70 points

Appendix C –
Lifecycle Cost Supporting Analysis

Alberta Infrastructure

Holy Trinity Academy

Report 1b – Life Cycle Cost Analysis

April 24, 2009

BTY.COM

1.0 INTRODUCTION

In February 2009, Deloitte, BTY Group and Eco-Integration were retained by Alberta Infrastructure to undertake a "LEED Certification Cost Analysis" for the Holy Trinity Academy located near the town of Okotoks in the Municipal District of Foothills, Alberta. This study was to include an analysis of Life Cycle Costing to determine the premium cost and payback period for the extra over expenditures.

2.0 EXECUTIVE SUMMARY

BTY Group has estimated the 30-year Life-Cycle Cost premiums for LEED Silver and LEED Gold certification, compared with a "Non-LEED" baseline, as follows:

PROJECT	COST SAVINGS			
	SILVER		GOLD	
	$	pay back (years)	$	pay back (years)
- Holy Trinity Academy	652,000	12	641,700	12

Notes:

The detailed calculation of these figures is shown in the Appendices of this report.

An annual rate of 5% has been included for escalation and a 6% real discount rate has been used to calculate the present value of future cash flows.

3.0 METHODOLOGY

This Life Cycle Cost analysis includes elements of capital costs, periodic replacement costs, maintenance and energy costs.

The capital costs for three design scenarios namely Base Design, LEED Silver, and LEED Gold are extracted from the "LEED Certification Cost Analysis" prepared separately.

The replacement costs are estimated based on the building system descriptions for the three different designs prepared by the consultants during the first stage of this analysis.

The yearly maintenance costs are estimated based on historical cost data of buildings of similar nature and size.

The yearly energy costs are estimated based on the Energy Modeling and Water Usage calculation prepared by the mechanical engineers in the early stage of the building design.

An escalation rate of 5% has been included in the Life Cycle Costing exercise to cover cost escalation over the assumed 30 years of building life.

The Future Costs have been expressed in terms of Equivalent Cost by using a discounted cash flow method to allow Future Costs to be compared to Present Values in constant dollars for cost comparison purposes. In this particular cost analysis, a 6% real discount rate has been used to calculate the present value of future cash flows.

APPENDIX 1

- Life Cycle Costing Breakdown

Alberta Infrastructure Projects
Holy Trinity Academy

24-Apr-09

LIFE CYCLE COST ANALYSIS	Base Design		LEED Silver		LEED Gold	
Element : **Overall Building** **Gross Floor Area:** 6,793 m² **Discount Rate:** 6% **Escalation Rate:** 5% **Life Cycle Period :** **30** **years**	Estimated Cost $	Present Worth $	Estimated Cost $	Present Worth $	Estimated Cost $	Present Worth $
1.0 INITIAL COSTS						
Construction Cost	9,375,200	9,375,200	9,375,200	9,375,200	9,375,200	9,375,200
Premium for LEED (Hard Cost)	0	0	380,400	380,400	330,100	330,100
Premium for LEED (Soft Cost)	0	0	138,100	138,100	198,700	198,700
TOTAL INITIAL COST (A) :		**$9,375,200**		**$9,893,700**		**$9,904,000**
2.0 REPLACEMENT COSTS						
Replacement cost over 30 years:		472,000		487,100		487,100
TOTAL REPLACEMENT COST (B) :		**$472,000**		**$487,100**		**$487,100**
3.0 ANNUAL COSTS						
Maintenance cost :						
- yearly capital expenditure on maintenance	152,800	3,879,500	160,400	4,072,500	160,400	4,072,500
Operating cost :						
- yearly energy cost (Water, Gas & Electricity)	140,650 100%	3,571,000	86,350 100%	2,192,400	86,350 100%	2,192,400
TOTAL ANNUAL COST (C) :		**$7,450,500**		**$6,264,900**		**$6,264,900**
4.0 SUMMARY						
Total Life Cycle Cost (A+B+C) ($)		**$17,297,700**		**$16,645,700**		**$16,656,000**
Variance ($) (LEED - Base)		**base**		**($652,000)**		**($641,700)**
Pay back (years)				**12**		**12**

Appendix D –
Lifecycle Cost Supporting Analysis

(Alternative LEED Silver)

Alberta Infrastructure

Holy Trinity Academy

Report 2b – Life Cycle Cost Analysis

(Alternative LEED Silver)

April 24, 2009

BTY.COM

1.0 INTRODUCTION

In February 2009, Deloitte, BTY Group and Eco-Integration were retained by Alberta Infrastructure to undertake a "LEED Certification Cost Analysis" for the Holy Trinity Academy located near the town of Okotoks in the Municipal District of Foothills, Alberta. This study was to include an analysis of Life Cycle Costing to determine the premium cost and payback period for the extra over expenditures.

2.0 EXECUTIVE SUMMARY

BTY Group has estimated the 30-year Life-Cycle Cost premiums for LEED Silver and LEED Gold certification, compared with a "Non-LEED" baseline, as follows:

PROJECT	COST SAVINGS			
	SILVER		GOLD	
	$	pay back (years)	$	pay back (years)
- Holy Trinity Academy	169,500	18	641,700	12

Notes:

The detailed calculation of these figures is shown in the Appendices of this report.

An annual rate of 5% has been included for escalation and a 6% real discount rate has been used to calculate the present value of future cash flows.

3.0 METHODOLOGY

This Life Cycle Cost analysis includes elements of capital costs, periodic replacement costs, maintenance and energy costs.

The capital costs for three design scenarios namely Base Design, LEED Silver, and LEED Gold are extracted from the "LEED Certification Cost Analysis" prepared separately.

The replacement costs are estimated based on the building system descriptions for the three different designs prepared by the consultants during the first stage of this analysis.

The yearly maintenance costs are estimated based on historical cost data of buildings of similar nature and size.

The yearly energy costs are estimated based on the Energy Modeling and Water Usage calculation prepared by the mechanical engineers in the early stage of the building design.

An escalation rate of 5% has been included in the Life Cycle Costing exercise to cover cost escalation over the assumed 30 years of building life.

The Future Costs have been expressed in terms of Equivalent Cost by using a discounted cash flow method to allow Future Costs to be compared to Present Values in constant dollars for cost comparison purposes. In this particular cost analysis, a 6% real discount rate has been used to calculate the present value of future cash flows.

APPENDIX 1

- Life Cycle Costing Breakdown

Alberta Infrastructure Projects
Holy Trinity Academy

24-Apr-09

LIFE CYCLE COST ANALYSIS	Base Design		LEED Silver		LEED Gold	
Element : **Overall Building** **Gross Floor Area:** 6,793 m² **Discount Rate:** 6% **Escalation Rate:** 5% **Life Cycle Period :** **30** **years**	Estimated Cost $	Present Worth $	Estimated Cost $	Present Worth $	Estimated Cost $	Present Worth $
1.0 INITIAL COSTS						
Construction Cost	9,375,200	9,375,200	9,375,200	9,375,200	9,375,200	9,375,200
Premium for LEED (Hard Cost)	0	0	212,800	212,800	330,100	330,100
Premium for LEED (Soft Cost)	0	0	138,100	138,100	198,700	198,700
TOTAL INITIAL COST (A) :		**$9,375,200**		**$9,726,100**		**$9,904,000**
2.0 REPLACEMENT COSTS						
Replacement cost over 30 years:		472,000		441,600		487,100
TOTAL REPLACEMENT COST (B) :		**$472,000**		**$441,600**		**$487,100**
3.0 ANNUAL COSTS						
Maintenance cost :						
- yearly capital expenditure on maintenance	152,800	3,879,500	152,800	3,879,500	160,400	4,072,500
Operating cost :						
- yearly energy cost (Water, Gas & Electricity)	140,650 100%	3,571,000	121,350 100%	3,081,000	86,350 100%	2,192,400
TOTAL ANNUAL COST (C) :		**$7,450,500**		**$6,960,500**		**$6,264,900**
4.0 SUMMARY						
Total Life Cycle Cost (A+B+C) ($)		**$17,297,700**		**$17,128,200**		**$16,656,000**
Variance ($) (LEED - Base)		**base**		**($169,500)**		**($641,700)**
Pay back (years)				**18**		**12**

Appendix E – Water and Energy Consumption Analysis

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sustainable design consulting

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Building Designs to Enhance Life

Report on Environmental Issues **April 24, 2009**
LEED Gold Certification Analysis

Holy Trinity Academy
The following environmental areas were addressed for the case study building; Holy Trinity Academy:
1.0 Water Consumption
2.0 Energy Consumption and Green House Gas Emissions

In our analysis of each of these areas we have compared back to our identified project descriptions:

- Baseline: what would the project brief have been if there was no LEED requirement
- Silver LEED: what strategies would have been undertaken for the project and what possible 36 points would have been targeted for LEED Silver
- Gold LEED: what strategies were undertaken for the project and what 40 points were achieved

1.0 WATER CONSUMPTION

Holy Trinity Academy

Irrigation: The baseline is to not provide any irrigation on school grounds therefore the potable water use for irrigation is zero.

Building Use: Quinn Young provided us with the LEED Calculation Template for building use water (LEED: Water Efficiency Credit 3). The calculations show that there is a 40.7% savings in water compared to the ***LEED Baseline*** *(not the AI Baseline).* This results in achievement of 3 LEED credits (Credits WEc3.1, WEc3.2 and IDc1.1) as indicated in the LEED Cost Analysis section of the report. For this study however we are not comparing to the LEED Baseline but to the baseline described above.
Therefore our analysis below includes the estimated water consumption for the building to achieve the LEED Gold certification, estimated water consumption to only meet the defined baseline. Quinn Young architects at our workshop meeting informed us that for LEED Silver there would have been no changes to the building use water design from LEED Gold. The following summary indicated no. of occupant, total annual water consumption and savings in water consumption for toilets (staff and students), urinals (for students), student lavatories, Kitchen sink, showers, janitor sink and staff lavatory. It does not include any building process water consumption.

Holy Trinity Academy			
	Water Consumption (Irrigation Use)		
	Baseline	**Silver**	**Gold**
Total Water Use (Litres)	No water used for irrigation	0	0

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	Water Consumption (Building Use)		
Total Occupants = 542	**Baseline**	**Silver**	**Gold**
Description	conventional toilets (6 Litres) for students and staff Full flow 3.8l urinals Lavatory 9.5lpm standard system with no sensor Janitor sink 9.5lpm Shower 9.5lpm no flow restrictor Kitchen sink 9.5lpm	As LEED Gold	conventional toilets (6 Litres) for students Waterless urinals for students Dual flush toilet for staff 4.7 Litres average Lavatory 1.9lpm Janitor sink 9.5lpm Shower 7.5lpm and shorter duration Kitchen sink 8.3lpm
Total Annual Volume (Litres)	**3,023,158**	**1,811,802**	**1,811,802**

Total Water Consumption for Irrigation Use	0	0	0
Total Water Consumption for Building Use	**3,023,158**	**1,811,802**	**1,811,802**
Grand Total (Irrigation and Building Use)	**3,023,158**	**1,811,802**	**1,811,802**
Water Savings Compared to the Defined Baseline (Annual L)	**0**	**1,211,356**	**1,211,356**

2.0 ENERGY CONSUMPTION AND GHG

Holy Trinity Academy

The energy consumption numbers used in the following estimate are from the LEED template for credit EAc1 Optimize Energy Performance. Energy modeling has not been done for our defined baseline, our estimate for the number of LEED credits our baseline would have achieved is based on discussion with the HTA design team at our workshop meeting. The following numbers are therefore only an approximation estimating the energy savings and GHG emissions for LEED Gold (LEED Silver as LEED Gold) from our defined baseline.

The following spreadsheet is a summary of our estimate:

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Holy Trinity Academy Energy Consumption (Annual)					
Area = 6793 sqm	**Baseline**	**Silver**	**Gold**	**% Consumption Savings (energy modeled bldg compared to LEED Ref bldg**	**LEED Reference bldg**
Description	**Lighting:** standard, no sensors, no special lighting **Heating and Ventilation:** conventional ventilation, perimeter radiant (probably wider as poorer quality envelope), standard efficiency boiler, no heat recovery **Envelope:** 4" insulation roof, 2" insulation walls, Windows standard double glazed (no low E or argon)	As Gold	**Lighting**: controls and sensors, energy efficient lighting (lower lighting levels) **Heating and Ventilation**: air displacement ventilation, perimeter radiant, standard efficiency boiler, heat recovery **Envelope:** 6" insulation roof, 4" insulation walls, Windows low E, argon filled, thermally broken		
	Estimated based on 33% better than MNECB ie 3 LEED points	As LEED Gold	Estimated based on 47% better than MNECB ie 6 LEED points		
Energy Consumption – Electricity (MJ)	2,288,028	2,070,121	2,070,121	20%	2,575,572
Energy Consumption – Natural Gas (MJ)	3,260,283	2,949,780	2,949,780	61%	7,545,571
Total	5,548,311	5,019,901	5,019,901	50%	10,121,143
Energy Savings: Electricity MJ (compared to defined baseline)	0	217,907	217,907		
50% of the electrical energy supplied for LEED Gold is renewable (therefore no ghg emissions) Therefore electrical		0 (no green power for Silver)	1,035,061		

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MJ **not** from coal fired plants					
GHG Savings: Electricity tonnes of CO2 (compared to defined baseline)		60.4	60.4		
GHG Savings: green power for 50% for LEED Gold		0	287		
Energy Savings: Natural Gas MJ (compared to defined baseline)		310,503	310,503		
GHG Savings: Natural Gas tonnes of CO2 (compared to defined baseline)		15.3	15.3		
TOTAL GHG Savings tonnes of CO2 (compared to defined baseline)		75.7	362.4		
Tonnes of CO2/sqm savings (compared to defined baseline)		0.011	0.053		

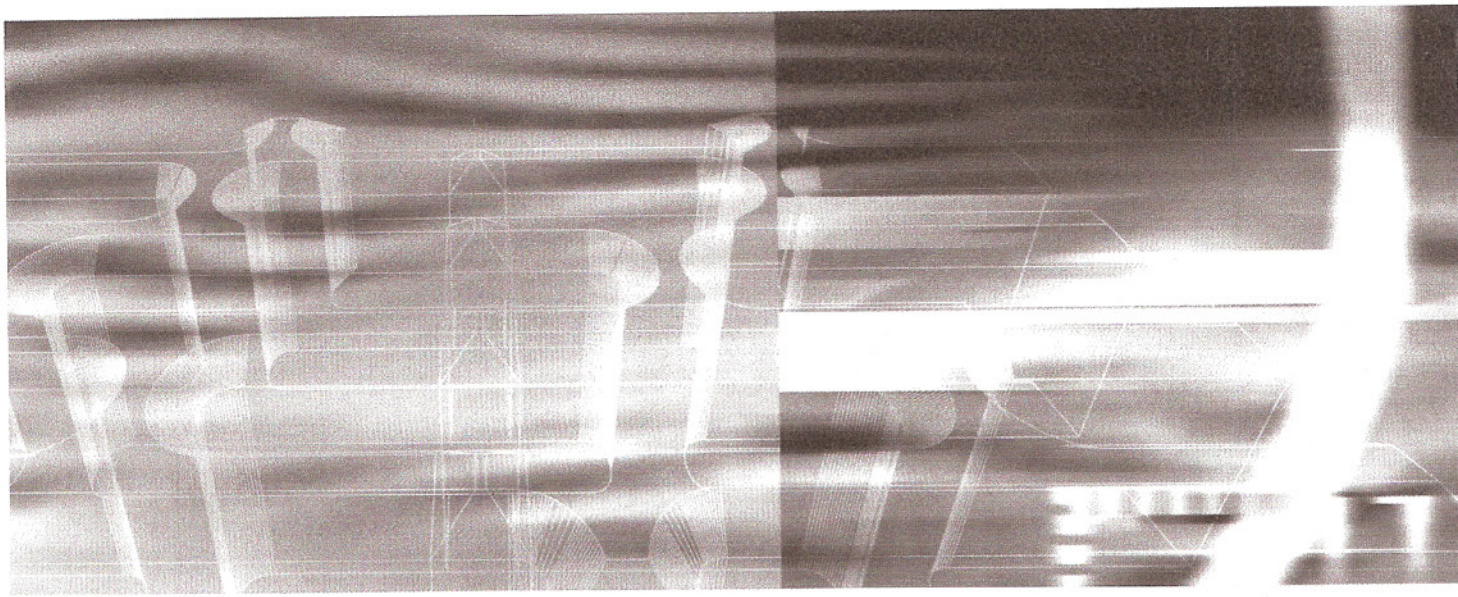
NOTE these numbers are estimates only based on an estimated % better than the reference building. Modeling of the actual systems proposed would need to be done to verify these estimated numbers. It would be useful to compare these numbers to the actual building energy performance.

GHG Emissions		
Electricity (coal fired generation)	1000 tons/GWh	277x10-6 tonnes/MJ
Natural Gas	0.0494 tonnes /GJ	49.4x10-6 tonnes/MJ

References for GHG numbers
Environment Canada
(http://www.ec.gc.ca/pdb/ghg/inventory_report/2004_report/ann13_e.cfm#sa13_6_2)

Environment Canada: NATIONAL INVENTORY REPORT, 1990-2005: GREENHOUSE GAS SOURCES AND SINKS IN CANADA
Alberta: 1000tones of CO2/GWH

Appendix F – Paper: “The Costs and Financial Benefits of High Performance Buildings”, Greg Kats



THE COSTS AND FINANCIAL BENEFITS OF HIGH PERFORMANCE BUILDINGS

Greg Kats, Capital E

This article draws heavily on a Report to California's Sustainable Building Task Force, October 2003, California Sustainable Building Task Force, available at www.cap-e.com.

"Green" or "high performance" buildings use key resources including energy, water, materials and land more efficiently than buildings that are just built to code. With more natural light, better air quality and greater comfort, green buildings typically also contribute to improved occupant health, comfort and productivity.

The benefits of high performance buildings are relatively clear but thorough analysis of the cost implications has not been available until recently. "The Costs and Financial Benefits of Green Buildings, A Report to California's Sustainable Building Task Force"[1] was released in October 2003 and was the first attempt to develop a rigorous analysis of the costs and benefits of green buildings. A draft of the report helped persuade the University of California Board of Regents to adopt a university-wide policy for the design of green buildings. Since then, the report has been widely circulated and highly influential (e.g., as a rationale for the 2004 legislation in New York City that mandates green design for all public buildings).

The analysis outlined below assumes a discount rate of 7%, including 2% inflation, and a 20 year term in developing a present value and net present value estimate for green buildings. This is conservative since many buildings last 50 years or longer.

Analyzing the Costs

Cost data was gathered on 40 individual LEED® registered projects (32 office buildings and 8 school buildings) with actual or projected dates of completion between 1995 and 2004. These 40 projects were chosen because relatively solid cost data for both actual green design and conventional design was available for the same building.[2]

The eight Bronze or Certified buildings had an average cost premium of 0.7%. Twenty-one Silver-level buildings averaged a 1.9% cost premium. The nine Gold buildings had an average premium of 2.2%, and the

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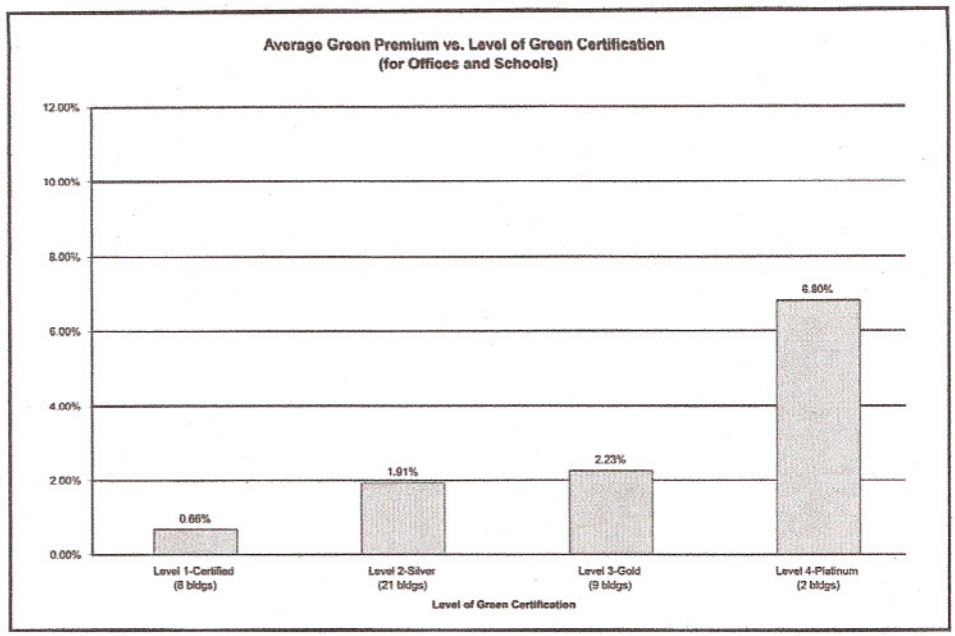
[1] "Principal Author: Greg Kats, Capital E, Contributing Authors: Leon Alevantis, Department of Health Services, Adam Berman, Capital E, Evan Mills, Lawrence Berkeley National Laboratory, and Jeff Perlman, Capital E. The report was developed for the Sustainable Building Task Force, a group of over 40 California state government agencies. Funding for this study was provided by the Air Resources Board (ARB), California Integrated Waste Management Board (CIWMB), Department of Finance (DOF), Department of General Services (DGS), Department of Transportation (Caltrans), Department of Water Resources (DWR), and Division of the State Architect (DSA). This collaborative effort was made possible through the contributions of Capital E, Future Resources Associates, Task Force members, and the United States Green Building Council.

[2] See the chapter "Valuing Green Buildings" in Greg Kats' forthcoming untitled book to be published by the US Green Building Council, which reviews 40 buildings (The California Sustainable Building Task Force report contains cost data for 33 green buildings).



A clear trend of declining costs associated with increased experience in building green has been experienced in Pennsylvania,[3] as well as in Portland and Seattle. Portland's three completed LEED Silver buildings were finished in 1995, 1997, and 2000. They incurred cost premiums of 2%, 1% and 0% respectively.[4] Seattle has seen the cost of LEED Silver buildings drop from 3-4% several years ago to 1-2% today.[5]

two Platinum buildings were at 6.8%. The average reported cost premium for all 40 buildings is almost 2%. Assuming conservative, relatively high commercial construction costs of $150/ft² to 250/ft², a 2% green building premium is equivalent to $3-5/ft².

Reduced Energy Use

The green buildings in the study used an average of 28% less purchased energy than conventional buildings. For energy costs of $1.47/ft²/yr for California public buildings, this indicates savings of about $0.44/ft²/yr,[6] with a 20-year present value of $5.48/ft². The national average was $1.55/ft² for commercial buildings, or an NPV of $5.78/ft².

By encouraging integrated design and awarding credit for optimization of energy systems, LEED buildings substantially cut peak demand. In addition, LEED buildings were more likely to purchase "green power" or green certificates for electricity generated from

Reduced Energy Use in Green Buildings as Compared with Conventional Buildings

	Certified	Silver	Gold	Average
Energy Efficiency (above standard code)	18%	30%	37%	28%
On-Site Renewable Energy	0%	0%	4%	2%
Green Power	10%	0%	7%	6%
Total	**28%**	**30%**	**48%**	**36%**

Source: USGBC, Capital E Analysis

[3] Data provided by John Boecker, L. Robert Kimball and Associates, A/E Firm for the Pennsylvania Department of the Environment Cambria Office Building, Ebensburg, PA, the PA Department of Environmental Protection Southeast Regional Office. Norristown, PA, and the Clearview Elementary School, York, PA.
See: http://www.lrkimball.com/Architecture%20and%20Engineering/ae_experience_green.htm.

[4] Data provided by Heinz Rudolf, BOORA Architects. See Portfolio/Schools at: http://www.boora.com/

[5] Lucia Athens, Seattle Green Building Program, Nov. 2002. See: http://www.cityofseattle.net/light/conserve/sustainability/. Seattle is undertaking a review of over a dozen green Seattle buildings and specific costs premiums for these buildings.

[6] 30% of $1.47/ft²/yr total energy costs at 5% discount rate over 20 year term.

renewable energy sources. For example:

- ***High Performance Lighting:*** Incorporation of more efficient lights, task lighting, use of sensors to cut unnecessary lighting, use of daylight harvesting and other advanced lighting techniques and technologies. These measures can significantly reduce power demand and heating loads in a building, which in turn reduces required air conditioning.
- ***Increased Ventilation Effectiveness:*** Helps cut air conditioning load during peak times through improved system optimization.
- ***Heat Island Reduction Measures:*** By increasing the reflectivity of roofs and other typically dark surfaces, it is possible to lower building and urban temperatures, in turn reducing air conditioning loads and peak demand.

Evaluation of LEED documentation for over a dozen buildings[7] indicates an average reduction in energy use of 30%, but an average peak reduction of about 40%.[8] The data set is limited and this is a rough estimate. Nonetheless it seems clear that green buildings reduce peak demand to a greater degree than total energy consumption.

The benefits of reduced energy use are greatest during periods of peak power consumption – helping to avoid congestion costs, fewer power quality and reliability problems, pollution, and less capital investment needed to expand generation and transmission and distribution infrastructure.

The study estimates the 20-year present value of the peak demand reduction attribute of green buildings at $0.31/ft² ($0.025/year, at 5% real discount rate over 20 years). These are preliminary approximations based on limited data. The value of peak demand and peak capacity reduction is likely to be higher than estimated here.

Together, the total 20-year present value of financial energy benefits from a typical green California public building is $5.79/ft². For US commercial buildings, the NPV of energy savings is $6.09/ft². Thus, on the basis of energy savings alone, investing in green buildings appears to be cost-effective.

Reduced Pollution

Buildings use 70% of the nation's electricity. Air pollution from burning fossil fuels to generate electricity imposes very large health, environmental and property damage costs. Demonstrated health costs include tens of thousands of additional deaths per year and tens of millions of respiratory incidents and ailments.[9] The health, environmental and property damages associated with pollution from burning fossil fuels – commonly referred to as externalities – are only very partially reflected in the price of energy.[10]

A report published in July 2002 for the United Nations Environmental Program's Finance Initiatives Climate Change Working Group, Climate Change and the Financial Services Industry, warns that the "increasing frequency of severe climatic events, coupled with

20-Year PV of 36% Pollution Reduction for California Buildings ($/ft²)

	CO_2 PRICE	
Pollutant	**$5/ton**	**$10/ton**
NOx	$0.54	$0.54
PM10	$0.41	$0.41
SOx	$0.16	$0.16
CO2	$0.07	$0.14
Total	**$1.18**	**$1.25**

Source: Capital E Analysis

[7] Data provided by the USGBC, analysis by Capital E with USGBC. November and December, 2002.

[8] Because USGBC does not require that peak load reduction data be submitted, the data quality is mixed and includes some buildings that specify peak load demand reduction and some building data that indicates this indirectly (e.g., through large reductions in air conditioning load).

[9] See, for example: "The Benefits and Costs of Clean Air Act 1990 to 2010," 1991. Available at: http://www.epa.gov/air/sect812/1990-2010/fullrept.pdf and Jonathan Samet et al., "The National Morbidity, Mortality, and Air Pollution Study – Part II: Morbidity and Mortality From Air Pollution In the United States," Health Effects Institute, 2000. Available at: http://www.healtheffects.org/Pubs/Samet2.pdf.

[10] For a valuable introduction and overview of past studies on externality cost and costs of emissions reductions, see Jonathan Koomey and Florentin Krause, "Introduction to Externality Costs," LBNL, 1997. Available at: http://enduse.lbl.gov/Info/Externalities.pdf.

social trends, has the potential to stress insurers, reinsurers and banks to the point of impaired viability or even insolvency."[11] The United Nations estimates the potential cost of global warming at over $300 billion per year, and insurance firms are becoming concerned about the possibility of lawsuits due to damage from human-induced global warming.[12]

Recognizing the cost of global warming by assigning a dollar value of some amount is preferable to the current practice of assigning no value – effectively $0 – to CO_2 reductions. It is also economically efficient for States and public bodies to explicitly recognize a value for CO_2 in order to ensure a more cost-effective decision making process about building design choices, but determining a value for CO_2 reduction is a difficult proposition. For example, a recent Intergovernmental Panel on Climate Change (IPCC) report cites a range of values between $5 and $125 per ton of CO_2.[13] This analysis assumed the lowest estimates of $5 and $10 per ton for CO_2.

Detailed calculations in the Task Force Report indicate a present value of reduction in emissions of the four pollutants discussed above of about $1 per ft^2. This is almost certainly very low.

Reduced Water Use

Much of the United States is facing the prospect of worsening water shortages and sinking aquifers. Green buildings typically use half as much water as conventional buildings and can therefore play a substantial role in cutting the costs of water supply and the costs of waste water treatment.

Green building water conservation strategies generally fall into four categories:

- Efficiency of potable water use through better design/technology;
- Capture of gray water – non-fecal waste water from bathroom sinks, bathtubs, showers, washing machines, etc. – and use for irrigation;
- On-site stormwater capture for use or groundwater recharge; and
- Recycled/reclaimed water use.

Taken together, these strategies can reduce water use below code/common practice by over 30% indoors and over 50% for landscaping.[14] Of 21 reviewed green buildings submitted to the USGBC for LEED certificatior all but one used water efficient landscaping, cutting outdoor water use by at least 50%. Seventeen buildings, or 81%, used no potable water for landscaping. Over half cut water use inside buildings by at least 30%. Typical green buildings cut water use by about half.

The California report provides an estimate 20-year PV of $0.51/ft^2 for water savings from green buildings in California. These costs are very likely conservative.

Reduced Waste

Green buildings recycle and divert substantially higher levels of waste, and incorporate greater amounts of recycled or "re-used" materials than conventional buildings. Waste reduction strategies such as reuse and recycling, as promoted in green buildings, help to divert waste from being disposed of in landfills and result in savings associated with avoided disposal costs as well as in reduced societal costs of landfill creation and maintenance.

Of 21 green buildings submitted to USGBC for certification, seventeen, or 81%, reduced construction waste by at least 50%, while 38% reduced construction waste by 75% or more.[15]

In the absence of good data on present rates of waste diversion in green and conventional buildings during both their construction and operation, it is impossible to quantify the full value of green building resulting from lower waste generation. The one year value of reduced construction waste from green buildings in California is estimated to be $0.03/ft^2 and this (very low) waste benefit number is included in this report. A thorough analysis is likely to find average national waste related financial benefits over $0.50/ ft^2.

Improved Productivity and Health

There is growing recognition of the large health and productivity costs imposed by poor indoor environmental quality (IEQ) in commercial buildings. This is not surprising as people typically spend 90% of their time indoors, and the concentration of pollutants indoors is typically higher than outdoors, sometimes by as much as 10 or even 100 times.[16] The costs of

[11] Innovest, for the United Nations Environmental Program. Finance Initiatives Climate Change Working Group. "Climate Change and the Financial Services Industry," 2002. Available at: http://www.unepfi.net/.

[12] Katharine Q. Seeley, Global Warming May Bring New Variety of Class Action," New York Times, September 6, 2001. Available at: http://www.commondreams.org/headlines01/0906-03.htm.

[13] IPCC Working Group III, "Summary for Policymakers: The Economic and social Dimensions of Climate Change," 2001. Available at: http://www.ipcc.ch/pub/sarsum3.htm.

[14] US Green Building Council LEED Reference Package, Version 2.0, June 2001, p. 65, and analysis of green buildings submitted to USGBC. Available for purchase at: http://www.usgbc.org/LEED/publications.asp.

[15] Data provided by USGBC.

[16] US Environmental Protection Agency, "Indoor Air Quality," January 6, 2003. Available at: http://www.epa.gov/iaq/.

poor indoor environmental and air quality – including higher absenteeism and increased respiratory ailments, allergies and asthma – are hard to measure and have generally been "hidden" in sick days, lower productivity, unemployment insurance and medical costs. Health and productivity issues, often addressed separately, are combined here because both relate directly to worker well-being and comfort and both can be measured by their impacts on productivity.

The discussion of indoor environmental quality (IEQ) and productivity issues in industry publications expanded rapidly in the last decade and has spilled over into popular media. Business Week's cover for its June 5, 2000 issue, for example, features a picture of a large menacing office building to accompany the feature story: "Is Your Office Killing You? The Dangers of Sick Buildings."[17] The article cites potential benefits of up to $250 billion per year from improved indoor air quality in US office buildings.

Gary Jay Saulson, the Senior VP and Director of Corporate Real Estate for PNC Realty Services, describes the benefits of the LEED Silver PNC Firstside Center building in Pittsburgh as follows: "People want to work here, even to the point of seeking employment just to work in our building. Absenteeism has decreased, productivity has increased, recruitment is better and turnover less." Two business units experienced 83% and 57% reductions in voluntary terminations after moving into the new Firstside facility.[18]

Attributes common in green buildings that promote healthier work environments include more daylighting, and improved thermal and ventilation control and comfort. Much better indoor air quality is provided by measures such as better siting (e.g., avoiding locating air intakes near parking garages), and better building material source controls. Certified and Silver level green buildings achieved 55% and Gold level LEED buildings achieved 88% of possible LEED credits for use of a range of IEQ related measures, including the following:[19]

a. less toxic materials
b. low-emitting adhesives & sealants
c. low-emitting paints
d. low-emitting carpets
e. low-emitting composite wood
f. indoor chemical & pollutant source control

There is a large body of technically sound studies and documentation linking health and productivity with specific building design operation attributes – e.g., indoor air quality and tenant control over work environment, including lighting levels, air flow, humidity and temperature. For example, two studies of over 11,000 workers in 107 European buildings analyzed the health effect of worker-controlled temperature and ventilation. They found significantly reduced illness symptoms, reduced absenteeism and increases in perceived productivity over workers in a group that lacked these features.[20]

Productivity Benefits

One of the leading national centers of expertise on the benefits of high performance buildings is the Center for Building Performance at Carnegie Mellon University. They have reviewed over 1000 studies that relate technical characteristics of buildings, in areas such as lighting and ventilation, to tenant responses, such as productivity. Collectively, these studies demonstrate that better building design and performance in areas such as lighting, ventilation and thermal control correlate to increases in tenant/worker well-being and productivity.[21]

Increases in tenant control over ventilation, temperature and lighting each provide measured benefits from 0.5% up to 34%, with average measured workforce productivity gains of 7.1% with lighting control, 1.8% with ventilation control, and 1.2% with thermal control. Additionally, measured improvements have been found with increased daylighting, as discussed in the following section.

Eight studies measured the relationship between increased lighting control and productivity, finding productivity gains ranging from 3% up to 34%, with a mean of 7.1%. The subsequent figure was supplied by the Department of Architecture at Carnegie Mellon

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[17] Michelle Conlin, "Is Your Office Killing You?" *Business Week*, June 5, 2000, http://www.businessweek.com/2000/00_23/b3684001.htm

[18] Compared with a control group that experiences an 11% reduction. "Shades of Green: 2002 Report of the Pittsburgh Green Building Alliance," http://www.gbapgh.org. See also: William Browning, "Successful Strategies for Planning a Green Building" *Planning for Higher Education*, Society of College and University Planners, March-May 2003, pp. 78-86.

[19] Capital E analysis of USGBC data (based on analysis of points actually achieved in building performance data submitted to USGBC), November and December 2002. For more detail on achievable reductions from some of these indoor emissions sources, please see: Hodgson AT. "Common Indoor Sources of Volatile Organic Compounds: Emissions Rates and Techniques for Reducing Consumer Exposures." University of California, Lawrence Berkeley National Laboratory. 1999. Prepared for California Air Resources Board. Available at: http://www.arb.ca.gov/research/apr/past/indoor.htm#Toxic%20Air%20Contaminants

[20] Judith Heerwagen, "Sustainable Design Can Be an Asset to the Bottom Line - expanded internet edition," *Environmental Design & Construction*, Posted 07/15/02. Available at: http://www.edcmag.com/CDA/ArticleInformation/features/BNP__Features__Item/0,4120,80724,00.html.

[21] Communication with Vivian Loftness, CMU, February 2003.

University. This represents ongoing research, and as such should be considered interim. [22]

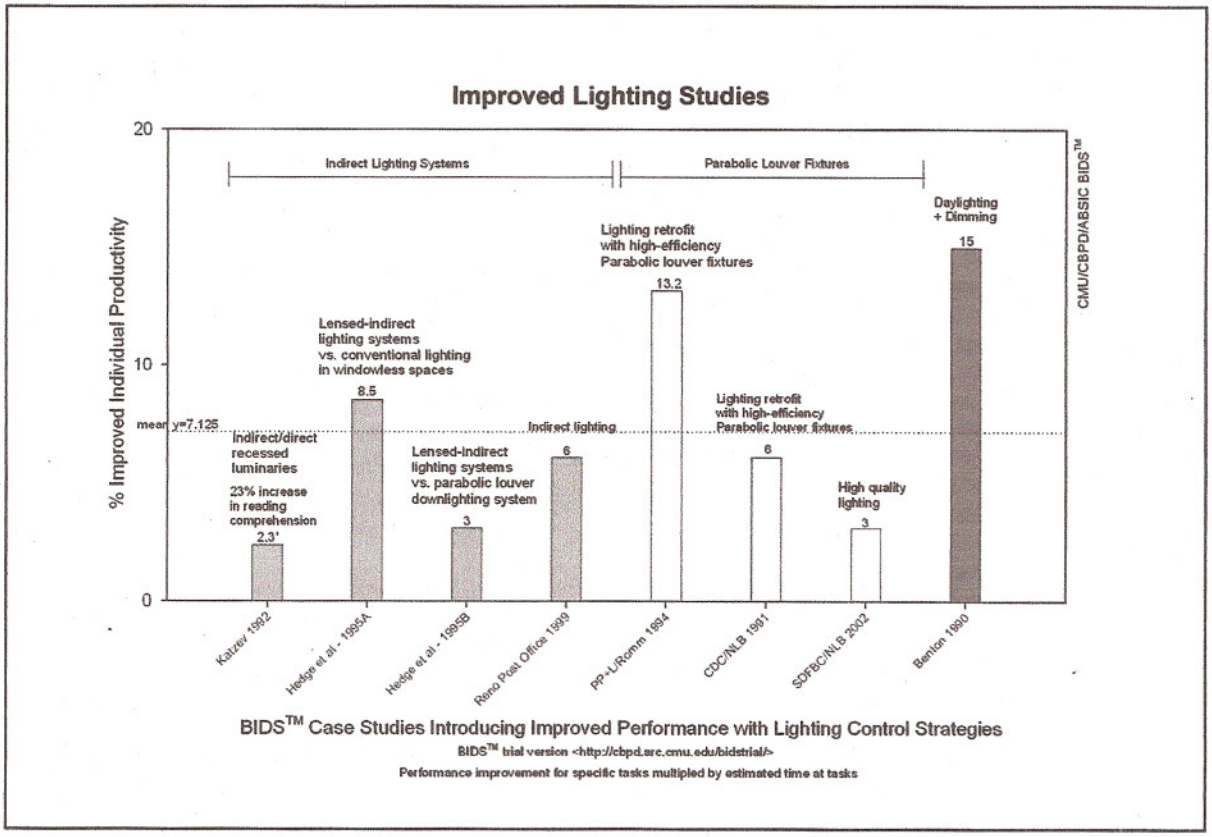
Improved Lighting Studies

A study by the Heschong Mahone Group evaluated the test score performance of over 21,000 students in three school districts in California, Colorado and Washington. The study found that in classrooms with the most daylighting, students' learning progressed 20% faster in math and 26% faster in reading than similar students in classrooms with the least daylighting.[23] A follow up study, employing an independent technical advisory group to reanalyze the data confirmed the initial study's findings with a 99.9% confidence level.[24]

At least four of the attributes associated with green building design – increased ventilation control, increased temperature control, increased lighting control and increased daylighting – have been positively and significantly correlated with increased productivity. There are also quantifiable green building gains in attracting and retaining a committed workforce – an aspect beyond the scope of this report.

Given the studies and data reviewed above, this report attributes a 1% productivity and health gain to Certified and Silver level buildings and a 1.5% gain to Gold and Platinum level buildings. These percentages are at the low end of the range of productivity gains for each of the individual specific building measures – ventilation, thermal control, light control and daylighting – analyzed above. They are consistent with or well below the range of additional studies cited above.

For state of California employees, a 1% increase in productivity (equal to about 5 minutes per working day) is equal to $665 per employee per year, or $2.96/ft² per year.[25] A 1.5 % increase in productivity (or a little over seven minutes each working day) is equal to $998 per year, or $4.44/ft² per year. The PV of the productivity benefits is about $35/ft2 for Certified and Silver level buildings, and $55/ft² for Gold and Platinum level buildings. Assuming a longer building operational life, such as 30 or even 50 years, would result in substantially larger benefits.



[22] Data extracted from BIDS™. Carnegie Mellon University Department of Architecture. February 2003.

[23] Heschong Mahone Group, "Daylighting in Schools: An Investigation into the Relationship Between Daylight and Human Performance," 1999. Available at: http://www.h-m-g.com

[24] Heschong Mahone Group. 2002. "Daylighting in Schools Re-Analysis." Available at: http://www.newbuildings.org/pier/index.html

[25] Average 2002 California employee compensation is $66,469 and average space per employee is 225 ft². Both numbers are discussed earlier in this section.

Operations and Maintenance

LEED requires measurement and verification and "Fundamental Building Systems Commissioning," which currently entails hiring a commissioning expert, developing a commissioning plan and completing a commissioning report.[26] Detailed analysis of several hundred million dollars of energy building upgrades demonstrate that rigorous measurement and verification of energy and water efficiency and system retrofits tend to[27]:

- Increase initial savings level
- Increase persistence of savings
- Reduce variability on energy and water savings

Commissioning and metering allows building staff to better manage upgrades and maintenance, helping to anticipate and avoid equipment failure, leaks and other costly operations and maintenance (O&M) problems.

O&M costs in California state buildings are about $3,000 per person per year[28] or nearly ten times larger than energy costs. There is not enough data to estimate with any precision the reduction in O&M costs that would occur in green buildings. This analysis conservatively assumes that green buildings experience an O&M cost decline of 5% per year. This equals a savings of $0.68/ft^2 per year, for a 20-year PV savings of $8.47/ft^2.

Valuing Green Buildings

Pension funds are beginning to recognize that green and energy efficient design can provide higher return, greater asset appreciation and lower risk to their real estate holdings. Notably, Phil Angelides, California Treasurer, recently announced that $1.5 billion (1-2%) of the state pension funds may be shifted to invest in more environmental and greener technologies.[29] For pension funds and real estate owners, high performance and energy efficient buildings can provide higher net operating margins, increased asset value and lower risk.

Can we develop this argument for private entities? Public institutions, including cities, states and local entities can also potentially gain a great deal from increasing the portion of new construction and retrofits of existing buildings to meet green standards. These benefits may include:

- Lower operating costs
- Lower peak demand and reduced pressure on transmission and distribution systems, including lower line losses and avoided or delayed construction;
- Improved power quality and reliability
- Reduced emissions (including NO_X and particulates) both from lower energy use and lower peak and consequently lower use of sometimes relatively dirty peaking and back up power
- Lower water use and water treatment and avoided or delayed required investment in water treatment and supply costs
- Improved health and productivity of occupants, including student test performance on standard tests
- Greater grid-wide and system reliability and security

Tools that public institutions can use or have used include accelerated permitting, allowing increased density of construction – floor area ratio (FAR) and permitting increased construction density around public transport nodes (metro stops) and corridors (bus lines).

Lawrence Berkeley National Laboratory has mapped approximately 80 energy efficiency and renewable energy measures onto specific "lines" of insurance benefited by their use.[30] Of the 64 LEED points possible in Design Areas 1-5 (excluding the Innovation and Design Process category, which is non-specific), 49 (77%) are associated with measures that have potential risk-management. Doing so would increase the recognized financial benefits of green design.

Conclusions

Most benefits described in this report, including lower energy and water costs, lower operations and maintenance costs, some waste reduction benefits and most health and productivity benefits accrue to owner occupants of buildings. For non-occupying owners, many of these benefits may not be experienced. As the brand value of LEED buildings increase, builders may be more likely to expect to have their green building investment translate into higher occupancy, higher lease rate, lower operations and maintenance costs and/or higher asset value.

This report began with an aggregation of data on actual or modeled costs for 40 green buildings. Largely derived from several dozen conversations with architects, developers and a literature search, the data indicates that the average construction cost premium for green buildings is about 2%, or about $4/ft^2, substantially less than is generally perceived.

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[26] See www.ipmvp.org. For purposes of disclosure, the principal author of the present report, Greg Kats, co-founded the IPMVP and served as its Chairman until 2001.

[27] Greg Kats, Art Rosenfeld, and Scott McGaraghan, "Energy Efficiency as a Commodity: The Emergence of a Secondary Market for Efficiency Savings in Commercial Buildings," *1997 ECEEE Conference Proceedings*. Available at: http://www.ipmvp.org/info/ccc397.pdf

[28] Data provided by the California Department of General Services, Real Estate Services Division, December 2002.

[29] See: http://sanjose.bizjournals.com/sanjose/stories/2004/02/02/daily30.html

[30] Edward Vine, LBNL Report No. 41432, 1998. Available at: http://eetd.lbl.gov/insurance/LBNL-41432.html. Extensive discussion and references on the subject can be found at http://eetd.lbl.gov/ea/mills/insurance/cifram.html.

Summary of Findings (per ft²)

Category	20-year NPV
Energy Value	$5.79
Emissions Value	$1.18
Water Value	$0.51
Waste Value (construction only) - 1 year	$0.03
Commissioning O&M Value	$8.47
Productivity and Health Value (Certified and Silver)	$36.89
Productivity and Health Value (Gold and Platinum)	$55.33
Less Green Cost Premium	($4.00)
Total 20-year NPV (Certified and Silver)	**$48.87**
Total 20-year NPV (Gold and Platinum)	**$67.31**

Source: Capital E Analysis

As summarized above, net financial benefits of green design are estimated to be about $50/ft² for Certified and Silver level green buildings, and about $65/ft² for Gold and Platinum level buildings. This is over ten times larger than the average 2% cost premium (about $4/ft²) for the 40 green buildings analyzed. Despite gaps in data and analysis, the findings of this report point to a clear conclusion: building green up to and including the LEED Gold level generally makes financial sense today.

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