Life Cycle Costing – Beyond The Payback Paradigm

Achieving High Performance Buildings: "Pay Me Now...or Pay Me Later!"

Construction Institute Owner's Forum
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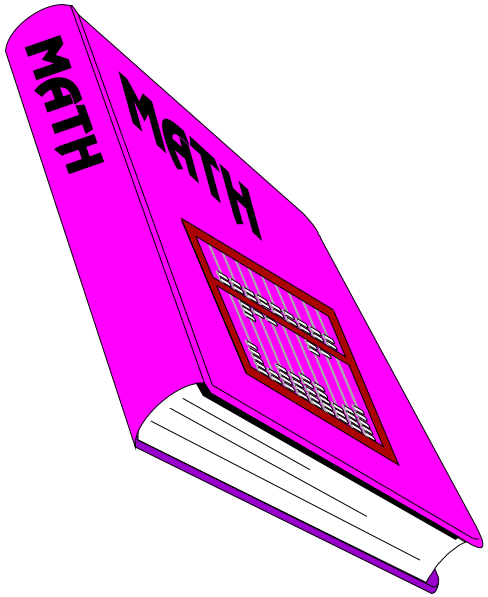
Outline

- **Project Analysis Criteria**
- **Life Cycle Costing**
- **Examples**

Simple Math??

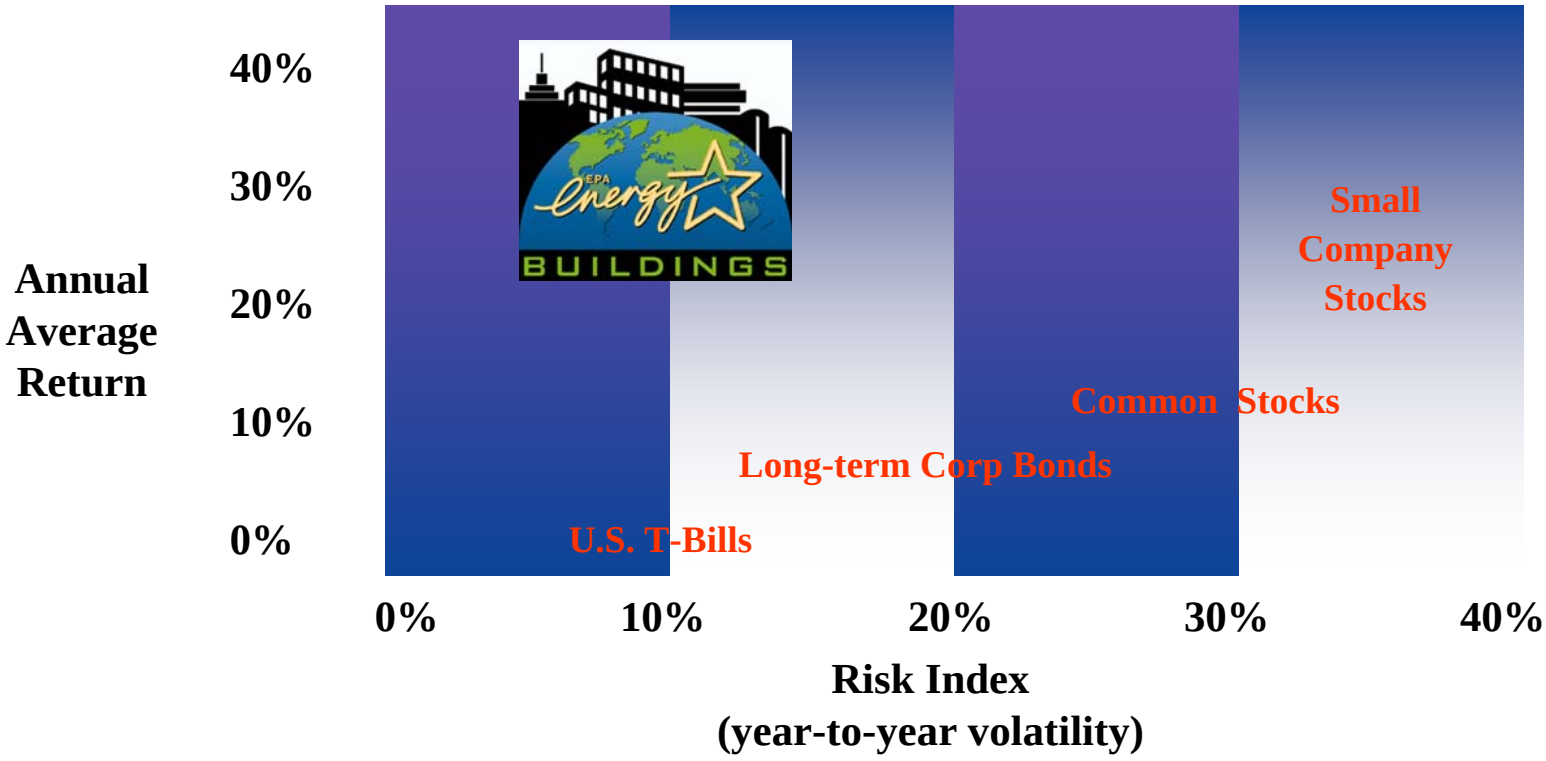
What does 2 + 2 Equal?



All Projects Are…

- **Unique**
- **Typically Evaluated on**
  - **Simple Payback**
  - **Energy**
  - **Maintenance**
- **Compared Against A “Do Nothing Alternative”**
- **Investments Not An Expense**

Consider Efficiency As An Investment



Source: The Vanguard Group

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Life Cycle Costing Principals

- **Analyzes Value of Money Over Fixed Period of Time**
- **Determine Annual Cashflow**
  - **Expenses = Cash Out**
    - **Energy**
    - **Maintenance/Repair**
    - **Financing**
  - **Income/Revenue = Cash In**
    - **Savings**
    - **Depreciation**
    - **Productivity Improvements**
- **Include Deferred Capital Expenditures**
- **Assume A Discount/ Interest Rate**
- **Must Include Escalation**

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Other Project LCC Elements

- **Repair Costs**
  - **Use past experience to predict future and escalate them**
- **“Real” Maintenance Costs**
  - **Budgeted and Unbudgeted**
  - **Service Agreements**
  - **In-House Staff & Administrative Costs**
  - **The Client Develops The “Real Costs”**
  - **ASHRAE Web Based Owning & Operating Costs Database (http://xp20.ashrae.org/publicdatabase/)**

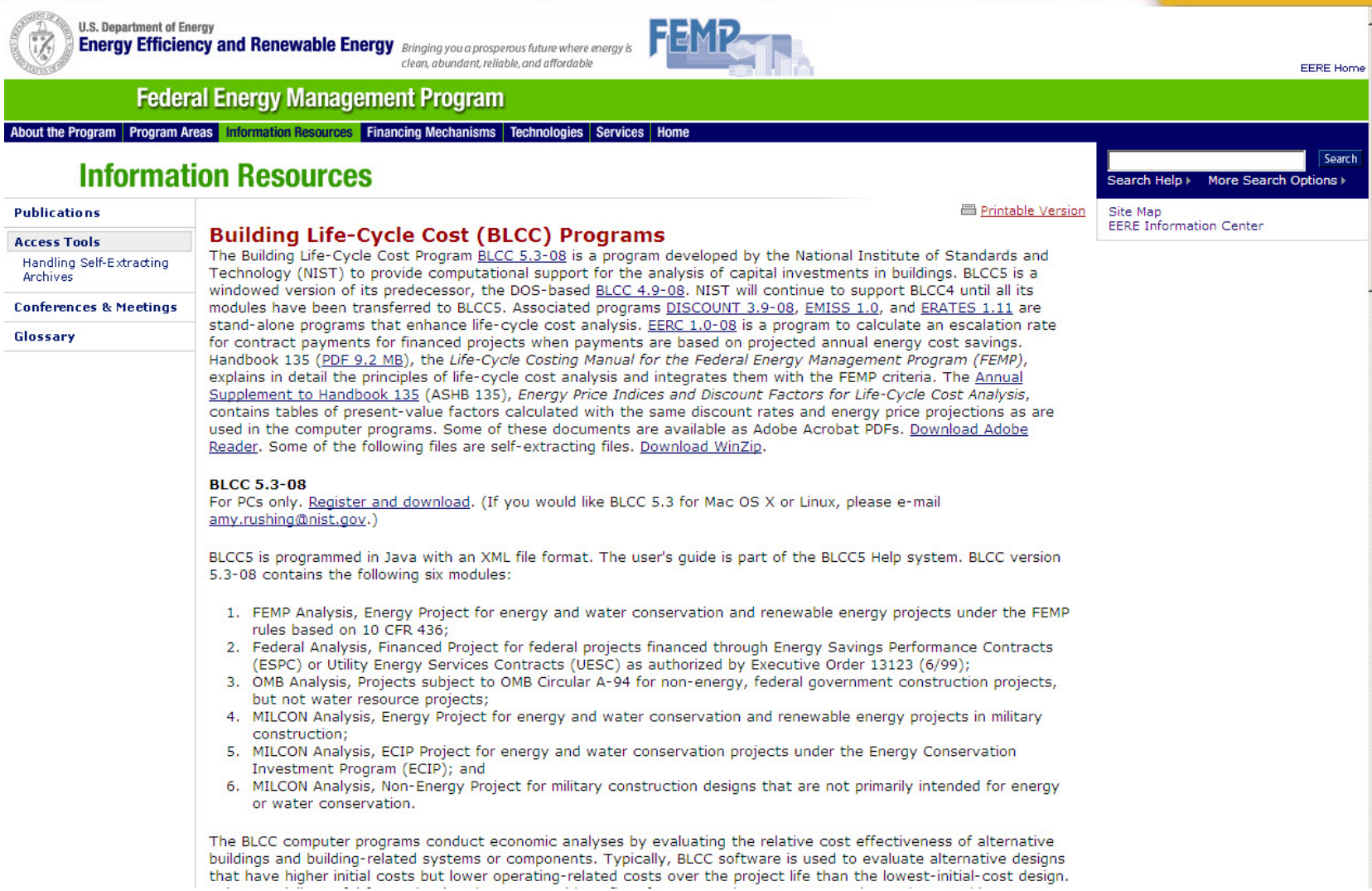
Other Project LCC Elements

- **Financing**
  - **Cash, Lease or Loan**
  - **Maximize Utility Incentives**
  - **Tax Credits**
- **What is The Real Business Issue?**
  - **Can a change Improve Productivity of Production/Process?**

Life Cycle Costing Methods

- **Energy Analysis Programs**
- **DOE-FEMP Free Tool**
  - **http://www1.eere.energy.gov/femp/information/download_blcc.html**

Free LCC Software Downloads



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Building Life-Cycle Cost (BLCC) Programs

The Building Life-Cycle Cost Program BLCC 5.3-08 is a program developed by the National Institute of Standards and Technology (NIST) to provide computational support for the analysis of capital investments in buildings. BLCC5 is a windowed version of its predecessor, the DOS-based BLCC 4.9-08. NIST will continue to support BLCC4 until all its modules have been transferred to BLCC5. Associated programs DISCOUNT 3.9-08, EMISS 1.0, and ERATES 1.11 are stand-alone programs that enhance life-cycle cost analysis. EERC 1.0-08 is a program to calculate an escalation rate for contract payments for financed projects when payments are based on projected annual energy cost savings. Handbook 135 (PDF 9.2 MB), the *Life-Cycle Costing Manual for the Federal Energy Management Program (FEMP)*, explains in detail the principles of life-cycle cost analysis and integrates them with the FEMP criteria. The Annual Supplement to Handbook 135 (ASHB 135), *Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis*, contains tables of present-value factors calculated with the same discount rates and energy price projections as are used in the computer programs. Some of these documents are available as Adobe Acrobat PDFs. Download Adobe Reader. Some of the following files are self-extracting files. Download WinZip.

BLCC 5.3-08
For PCs only. Register and download. (If you would like BLCC 5.3 for Mac OS X or Linux, please e-mail amy.rushing@nist.gov.)

BLCC5 is programmed in Java with an XML file format. The user's guide is part of the BLCC5 Help system. BLCC version 5.3-08 contains the following six modules:

1. FEMP Analysis, Energy Project for energy and water conservation and renewable energy projects under the FEMP rules based on 10 CFR 436;
2. Federal Analysis, Financed Project for federal projects financed through Energy Savings Performance Contracts (ESPC) or Utility Energy Services Contracts (UESC) as authorized by Executive Order 13123 (6/99);
3. OMB Analysis, Projects subject to OMB Circular A-94 for non-energy, federal government construction projects, but not water resource projects;
4. MILCON Analysis, Energy Project for energy and water conservation and renewable energy projects in military construction;
5. MILCON Analysis, ECIP Project for energy and water conservation projects under the Energy Conservation Investment Program (ECIP); and
6. MILCON Analysis, Non-Energy Project for military construction designs that are not primarily intended for energy or water conservation.

The BLCC computer programs conduct economic analyses by evaluating the relative cost effectiveness of alternative buildings and building-related systems or components. Typically, BLCC software is used to evaluate alternative designs that have higher initial costs but lower operating-related costs over the project life than the lowest-initial-cost design.

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Life Cycle Costing Methods

- **Energy Analysis Programs**
- **DOE-FEMP Free Tool**
  - **http://www1.eere.energy.gov/femp/information/download_blcc.html**
- **Simple Spreadsheet**

Life Cycle Costing Spreadsheet

Project Name

Projected Cash Flow

Do Nothing Alternative

	0	1	2	3	4	5	6	7	8	9	10	Total
Energy Costs		$169,863	$174,959	$180,208	$185,614	$191,182	$196,918	$202,826	$208,910	$215,178	$221,633	$1,947,291
Replacement Costs		$0	$0	$20,000	$0	$20,000	$250,000	$20,000	$0	$50,000	$0	$360,000
Maintenance Costs		$10,000	$10,300	$10,609	$10,927	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$114,639
Total Annual Costs		$179,863	$185,259	$210,817	$196,541	$222,438	$458,511	$234,766	$221,209	$277,845	$234,681	$2,421,930
Energy Savings		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Maintenance Savings		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Annual Savings		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Annual Cash Flow	$0	($179,863)	($185,259)	($210,817)	($196,541)	($222,438)	($458,511)	($234,766)	($221,209)	($277,845)	($234,681)	($2,421,930)

10 Year Life Cycle Cost = ($1,225,167) *20 Year Life Cycle Cost =* ($1,890,624)

Assumptions:

First Year Maintenance Cost	$10,000	*Total Financed Amount*	$0
Base Energy Costs w/o Savings	$169,863	*First Year Estimated Energy Savings*	$0
Maintenance & Energy Escalation Rate	3.00%	*First Year Operational Savings*	$0
Interest Rate	10.00%	*First Year Maintenance Savings*	$0
Financing Period (years)	1	*Annual Financing Payment*	$0

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Life Cycle Costing Spreadsheet

Project Name

Projected Cash Flow

Steam Boiler Replacement Gas & Dedicated DHW Heater for Pool & DHW

	0	1	2	3	4	5	6	7	8	9	10	Total
Energy Costs		$169,863	$174,959	$180,208	$185,614	$191,182	$196,918	$202,826	$208,910	$215,178	$221,633	$1,947,291
Replacement Costs		$0	$0	$20,000	$0	$20,000	$250,000	$20,000	$0	$50,000	$0	$360,000
Maintenance Costs		$10,000	$10,300	$10,609	$10,927	$11,255	$11,593	$11,941	$12,299	$12,668	$13,048	$114,639
Total Annual Costs		$179,863	$185,259	$210,817	$196,541	$222,438	$458,511	$234,766	$221,209	$277,845	$234,681	$2,421,930
Energy Savings		$118,660	$122,219	$125,886	$129,663	$133,552	$137,559	$141,686	$145,936	$150,314	$154,824	$1,360,300
Maintenance Savings		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Annual Savings		$118,660	$122,219	$125,886	$129,663	$133,552	$137,559	$0	$0	$0	$0	$767,539
Net Annual Cash Flow	($336,500)	($61,204)	($63,040)	($84,931)	($66,879)	($88,885)	($320,952)	($234,766)	($221,209)	($277,845)	($234,681)	($1,654,390)

10 Year Life Cycle Cost = ($1,028,716) *20 Year Life Cycle Cost =* ($1,694,173)

Assumptions:

First Year Maintenance Cost	$10,000	*Total Financed Amount*	$0
Base Energy Costs w/o Savings	$169,863	*First Year Estimated Energy Savings*	$118,660
Maintenance & Energy Escalation Rate	3.00%	*First Year Operational Savings*	$0
Interest Rate	10.00%	*First Year Maintenance Savings*	$0
Financing Period (years)	1	*Annual Financing Payment*	$0

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Life Cycle Costing Spreadsheet

Project Name

Summary of Options

Projected Costs and Resulting Cash Flows

		Year										Total Life Cycle Cost For 10 Years	Total Life Cycle Cost For 20 Years
Option	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*		
Do Nothing Alternative	$0	$179,863	$185,259	$210,817	$196,541	$222,438	$458,511	$234,766	$221,209	$277,845	$234,681	$1,225,167	$1,890,624
Steam Boiler Replacement & Insulate Piping	$236,500	$107,906	$111,143	$134,477	$117,911	$141,449	$375,092	$234,766	$221,209	$277,845	$234,681	$1,135,526	$1,800,983
Steam Gas Boiler Replacement with Dedicated Heater for DHW & Pool	$336,500	$61,204	$63,040	$84,931	$66,879	$88,885	$320,952	$234,766	$221,209	$277,845	$234,681	$1,028,716	$1,694,173
Hot Water Conversion (Heating Only)	$807,000	$57,418	$59,140	$60,914	$62,742	$64,624	$66,563	$68,560	$70,616	$72,735	$74,917	$1,092,953	$1,279,128
Hot Water Conversion With Cooling	$957,500	$57,418	$59,140	$60,914	$62,742	$64,624	$66,563	$68,560	$70,616	$72,735	$74,917	$1,229,771	$1,415,946
Hot Water Ready for Cooling With Cogeneration	$1,252,500	$60,828	$62,653	$64,533	$66,469	$68,463	$70,517	$72,632	$74,811	$77,055	$79,367	$1,519,296	$1,716,531

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LCC Example – R&D Company

Life Cycle Cost Element	Existing Conditions	Proposed Upgrade
Energy	**$550,000**	**$70,255 Savings**
Maintenance Costs	**$31,730**	**$15,169**
1st yr Capital Cost	**$105,000**	**$633,381**
2nd yr Capital Cost	**$55,000**	**$0**
Interest Rate	**9%**	**9%**
6 Year LCC	**$2,883,800**	**$2,687,780**
10 Year LCC	**$3,932,125**	**$3,676,218**
10 Year Internal Rate of Return	**3.4%**	**9.9%**

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LCC Example - Manufacturer

Life Cycle Cost Element	Existing Conditions	Revised Baseline	Proposed Upgrade
Energy	**$616,156**	**$623,684 ($56,000 Savings)**	**$178,000 Savings**
Operational Savings	**$0**	**$120,000**	**$133,850**
Capital Cost	**$0**	**$809,710**	**$1,354,815**
Utility Incentive	**$0**	**$0**	**$90,000**
Annual Financing/Rent Increase	**$0**	**$115,314**	**$192,945**
Annual Positive Cashflow	**N/A**	**$60,686**	**$120,905**
10 Year LCC	**$4,871,875**	**$3,999,889**	**$3,648,794**
20 Year LCC	**$7,392,146**	**$6,004,435**	**$4,980,337**

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LCC Example - Campus

Life Cycle Cost Element	Existing Conditions	Revised Baseline	Proposed Upgrade
Energy	**$711,303**	**$850,216**	**$267,783 Savings**
Maintenance Costs	**$14,828**	**$14,828**	**$82,828**
Operational Savings	**$0**	**$0**	**$44,850**
Capital Cost	**$0**	**$0**	**$1,400,000**
Utility Incentive	**$0**	**$0**	**$354,000**
Interest Rate	**N/A**	**N/A**	**16%**
10 Year LCC	**$3,952,609**	**$4,706,765**	**$3,549,852**
20 Year LCC	**$5,702,540**	**$6,799,428**	**$4,369,506**

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LCC Example - Large Office Building

Life Cycle Cost Element	Existing Conditions	Proposed Upgrade
Energy	**$1,340,488**	**$276,625 Savings**
Maintenance Costs	**$493,367**	**$200,000 Savings**
5th Yr Capital Cost	**$1,200,000**	**N/A**
1st Yr Capital Cost	**$0**	**$1,400,000**
Utility Incentive	**$0**	**$435,000**
Interest Rate	**N/A**	**9%**
10 Year LCC	**$13,993,307**	**$10,177,817**
20 Year LCC	**$40,269,521**	**$35,305,933**
10 Year IRR	**N/A**	**32.6%**

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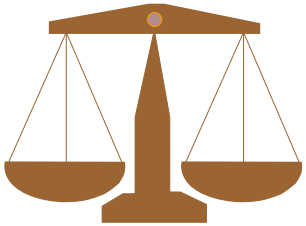
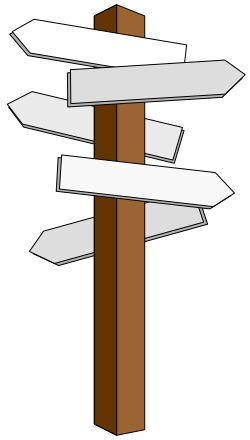
The Answer to What 2 + 2 = …

- **Look Outside the "Apparent" Project Scope**
- **The <u>REAL</u> Do-Nothing Approach Involves Some Capital or Expense**
- **Involve The Owner To Develop Maintenance and Operational Impacts**

Questions?

Thank You For Your Interest!





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