# Introduction to Sustainable Return on Investment (SROI)

## Green & Grub

## August 17, 2010

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**HDR Inc.**

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1. Introduce Sustainable Return on Investment (SROI)
2. Explain SROI Methodology
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# HDR is a National Expert

- **Founded in 1917**
- **Over 7,831 Employee-Owners**
- **More than 185 Offices World-Wide**
- **Headquartered in Omaha**
- **Specialize in Healthcare, Science and Technology and Civic Markets**
- **Over 80% of the Firm's Projects are from Repeat Clients**

*Our global perspective keeps us linked to the latest technology, trends and information while our local presence grounds us to the specific needs and concerns of our clients.*

# HDR's Integrated Team

Architecture

Medical Equipment Planning

Engineering

Energy Modeling

Interiors

Economic Modeling

Master Planning


Signage/Wayfinding

Security Design

Sustainable Design

Technology

Healthcare Consulting

# HDR Sustainable Design & LEED STATS

- 763 LEED Accredited Professionals
- 36.32 Million SF of Sustainable Design Projects (161 projects)
- 38 LEED Certified projects
  - 3 Platinum
  - 6 Gold
  - 14 Silver
  - 15 Certified
- 119 Registered Projects
  - 100 LEED-NC
  - 12 LEED-CI
  - 5 LEED-CX
  - 1 LEED for Homes
  - 1 LEED-ND
- 5 BREEAM Projects (542,000 SF)
  - 1 Completed
  - 4 Under Design

# Making Sustainable Decisions

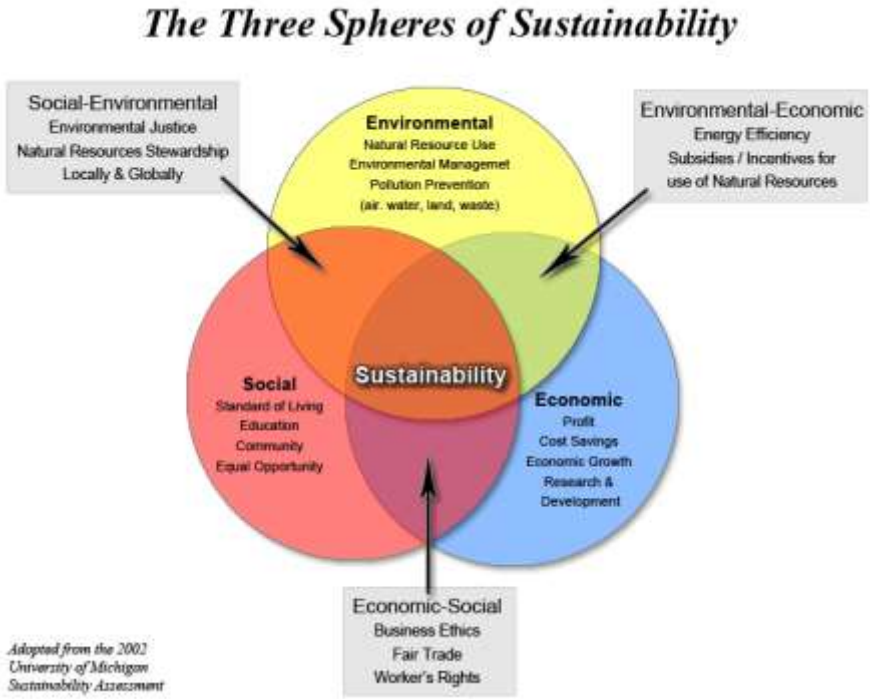
## Definition of Sustainability:

"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

The World Commission on Environment and Development, 1987 (Brundtland Commission)

**Traditional models such as Life-Cycle Cost Analysis (LCCA) often fall short:**

- Only consider cash impacts
- Lack transparency
- Do not account for uncertainty



# Life-Cycle Cost Analysis (LCCA)

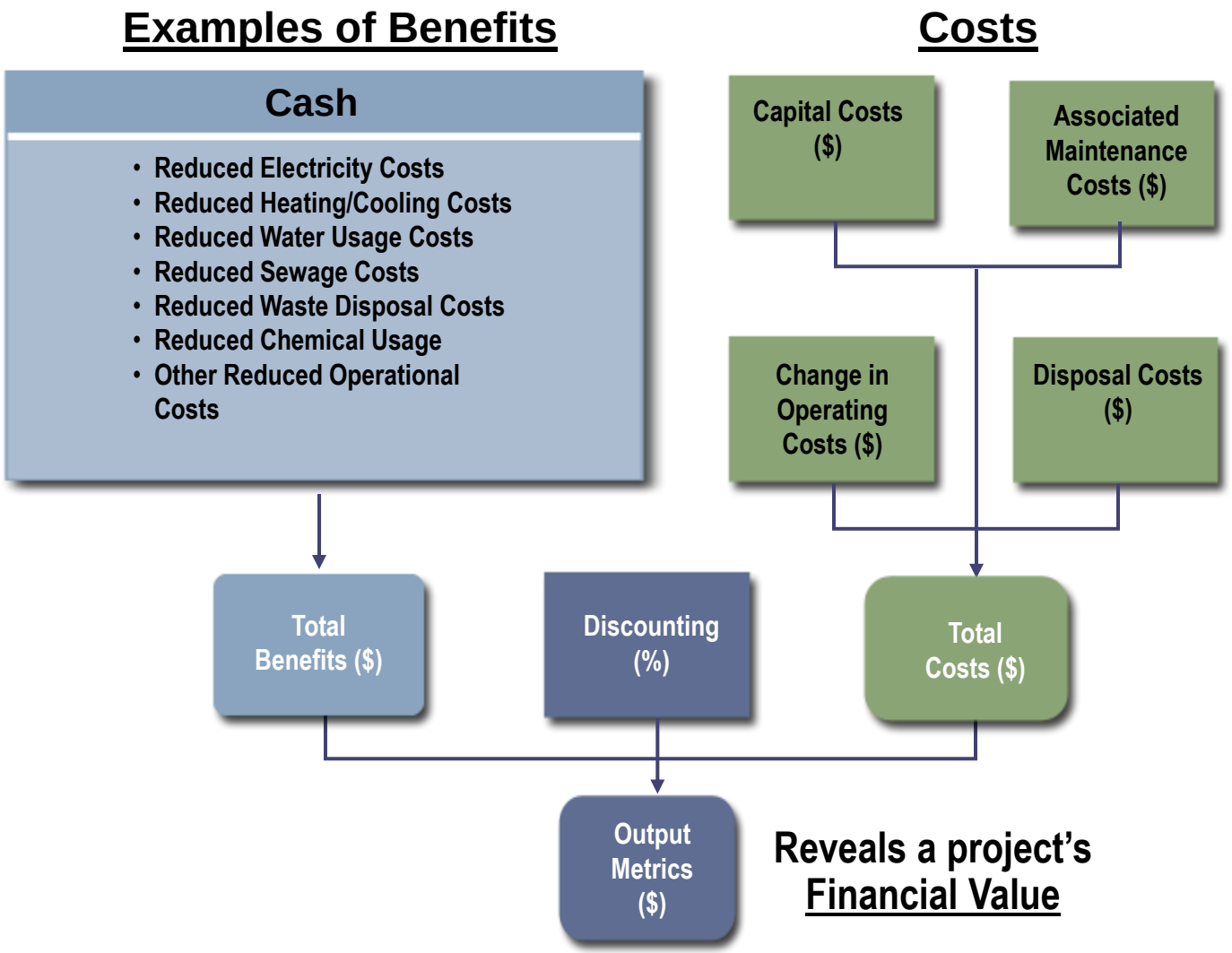
**Life-Cycle Cost Analysis involves the analysis of the costs of a system or a component over its entire life span**

- The Three Main Components Include:
  1. Acquisition Costs
  2. Operations & Maintenance Costs
     - Cost of Failure
     - Cost of Repair
     - Cost for Spare
     - Downtime Cost
     - Loss of Production
  3. Disposal Costs

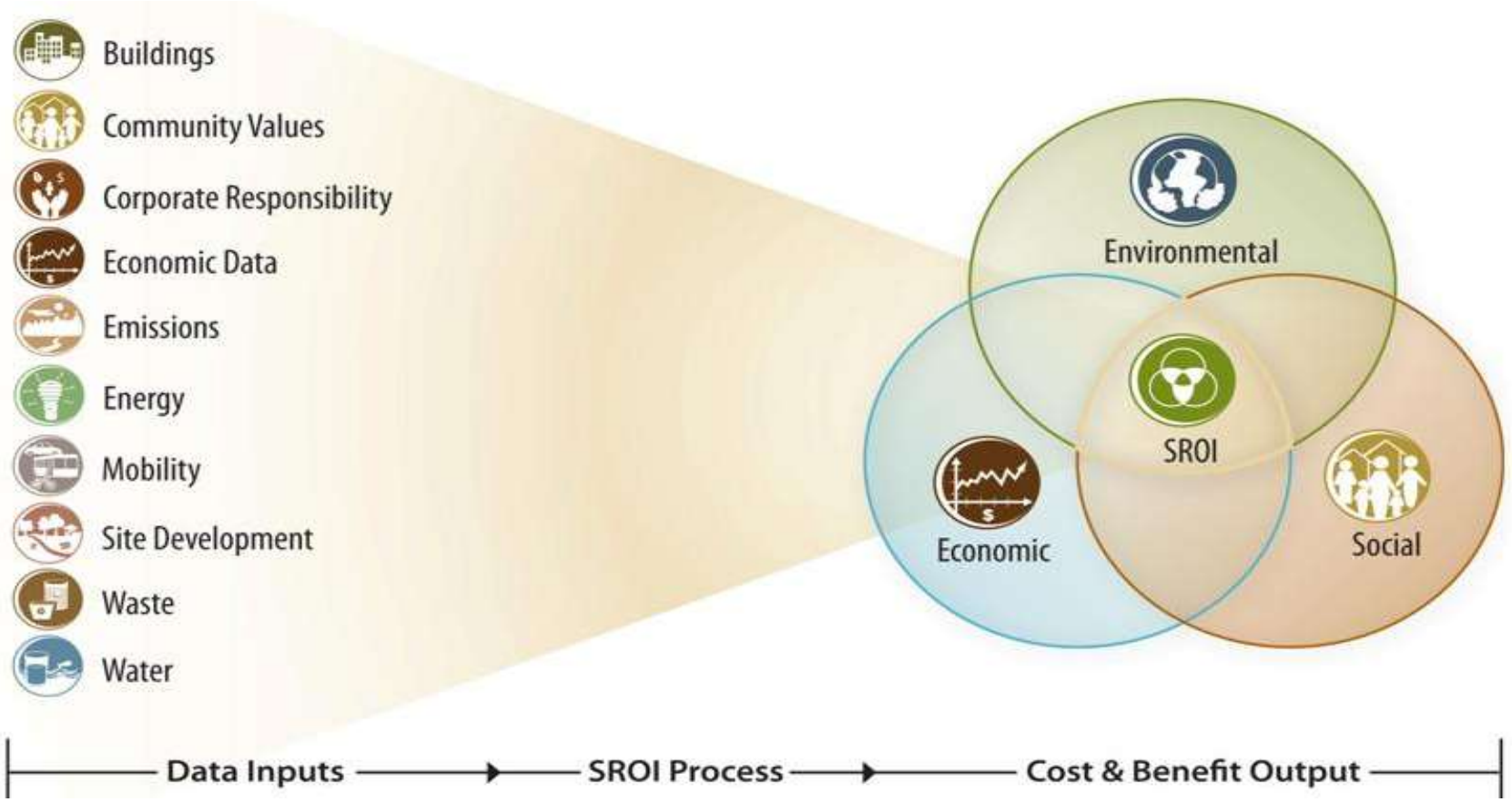
**The Life-Cycle Cost (LCC) of an asset is defined as:**

*" the total cost throughout its life including planning, design, acquisition and support costs and any other costs directly attributable to owning or using the asset"*

# Traditional LCCA Flow Diagram



# SROI = Calculating The Triple Bottom Line



# What is The SROI Process?

**It's a comprehensive Cost-Benefit Analysis study over a project's entire life-cycle**

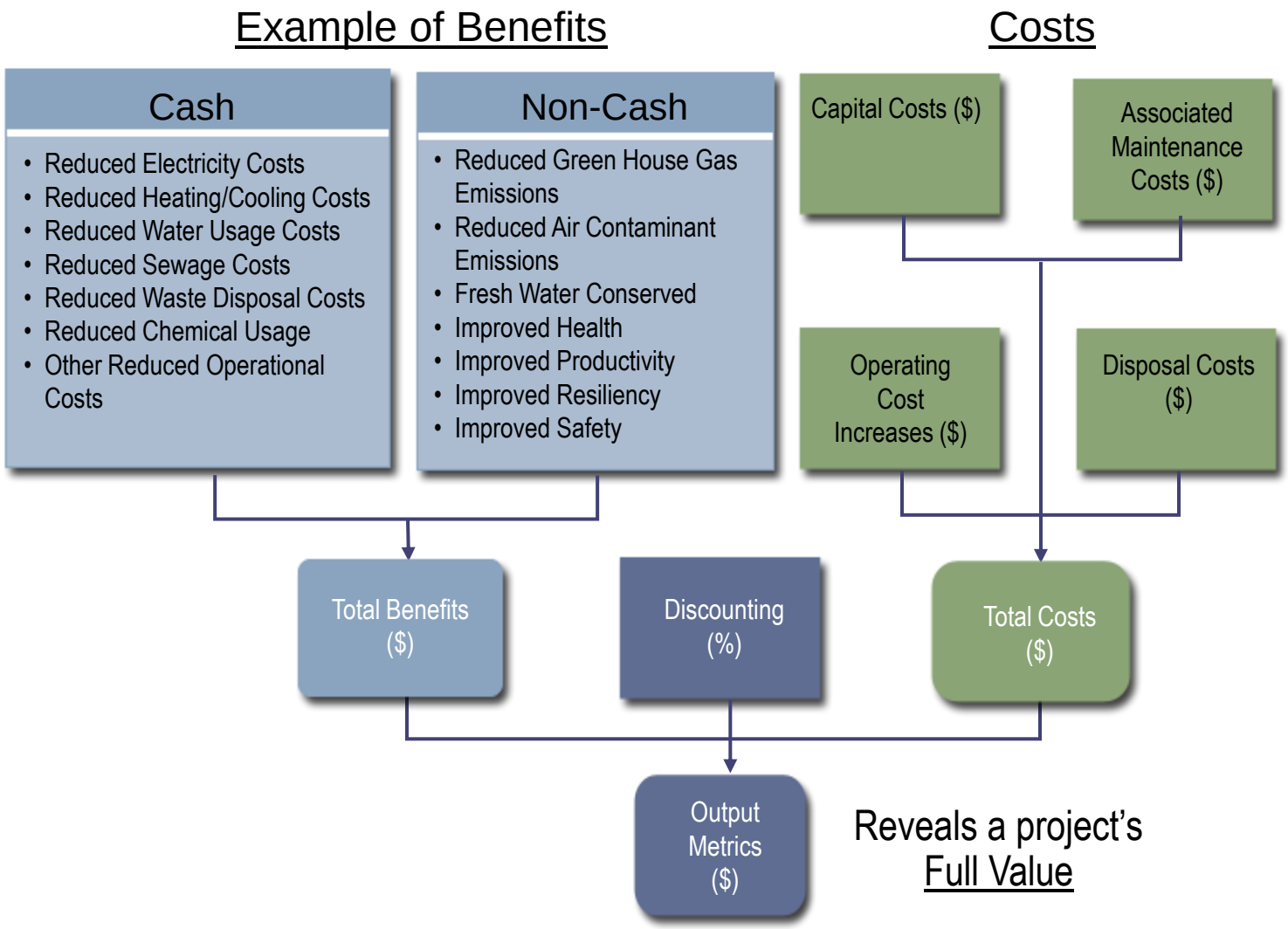
**Augmented by:**

- Accounting for uncertainty using state-of-the-art risk analysis techniques
- Engaging stakeholders directly in the process and generating transparency and consensus
- The SROI process can also incorporate Economic Impact Assessment to calculate jobs created, tax impacts, etc.

**Facilitates decision making by answering questions like:**

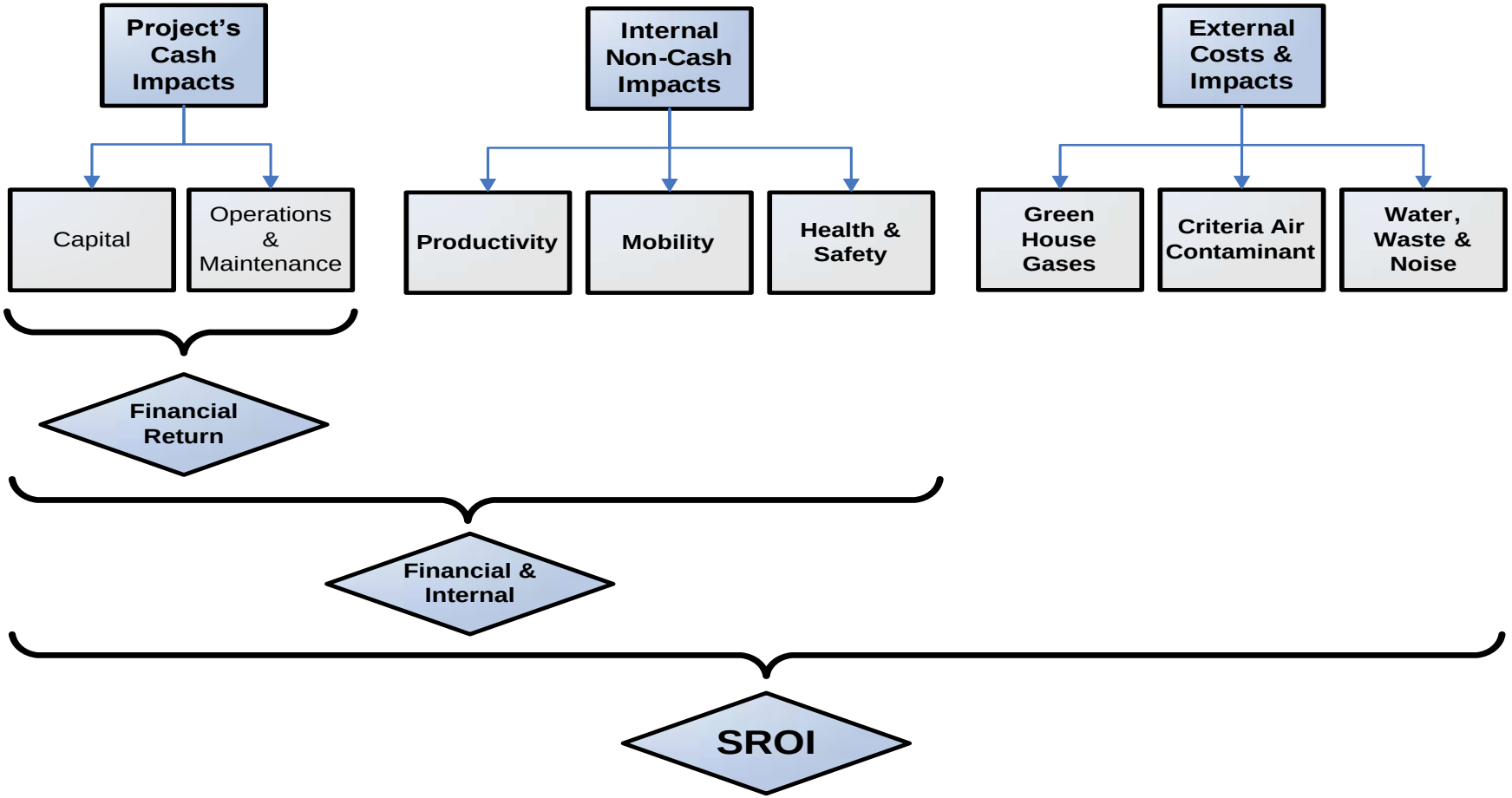
- What is the full true value of each alternative?
- Which alternatives are viable or have the best payoff?
- What's the probability of achieving a positive payoff?

# SROI Flow Diagram



# Sustainable Return on Investment

SROI adds to traditional financial analysis the monetized value of non-cash benefits and externalities



# Decision Metrics

## From Both a Financial & SROI Perspective

**Net Present Value (NPV):** The net value of an investment, calculated as benefits less costs, with both expressed in present-value monetary terms (PV of Benefits – PV Costs)

**Return on Investment (ROI):** The arithmetic average rate of return per year on capital invested

**Discounted Payback Period (DPP):** The period of time required for the discounted return on an investment to recover the sum of the original investment

**Internal Rate of Return (IRR):** The discount rate at which the net present value of a project would be zero

**Benefit to Cost Ratio (BCR):** The overall "value for money" of a project, expressed as the ratio of the benefits of a project relative to its costs, with both expressed in present-value monetary terms (PV Benefits / PV Costs)

# SROI Methodology

## A Four Step Process

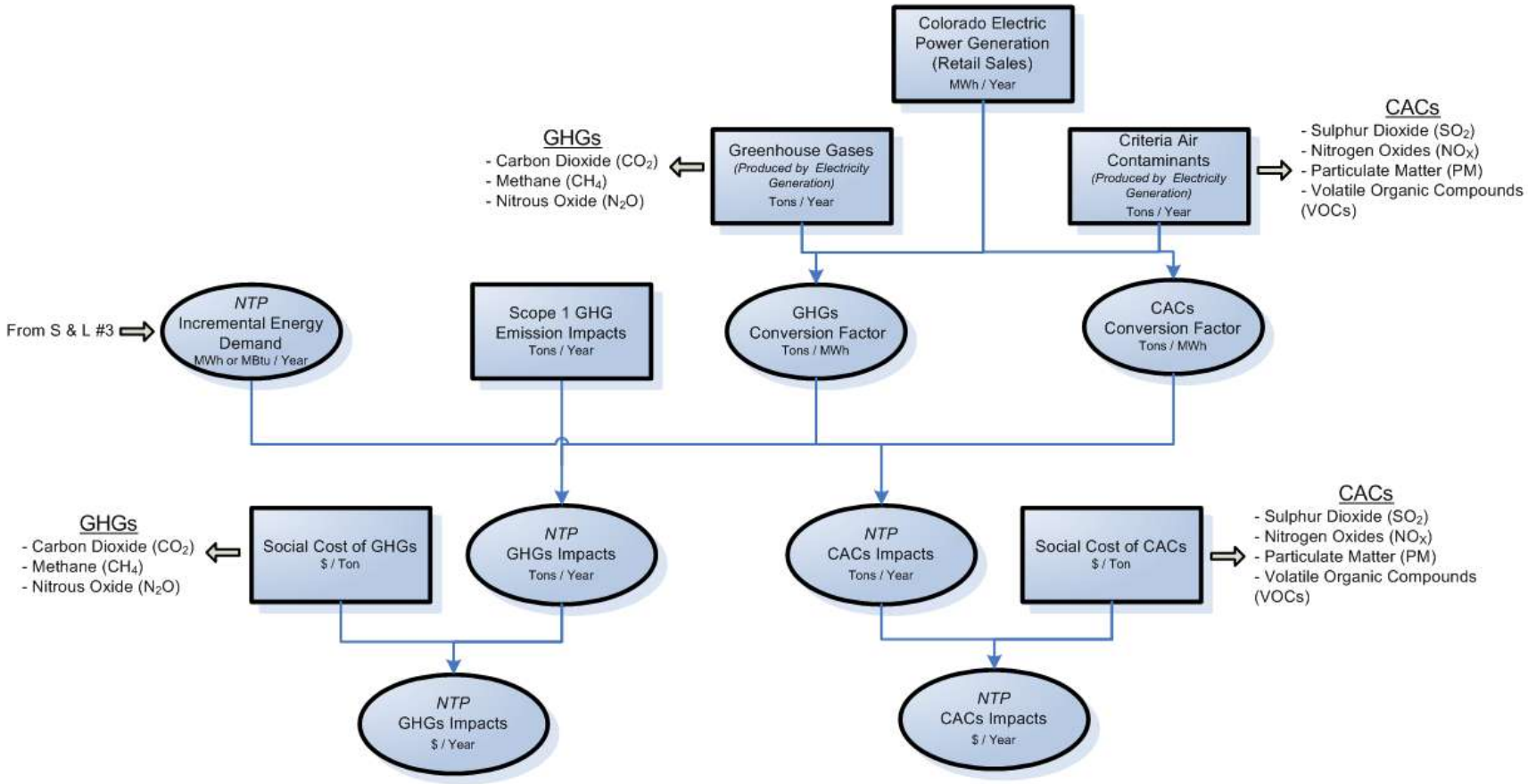

"**SROI** reveals the **hidden value** in projects."

David Lewis, PhD
HDR National Director, Economics & Finance

# SROI Methodology – Step 1

## Structure and Logic Diagrams

**S&L #4: Social Value of Greenhouse Gases (GHGs) & Criteria Air Contaminants (CACs) Impacts**



# SROI Methodology – Step 2

## Quantify Input Data Assumptions

**Quantify Input Data Distributions**

| Data Sources | |
|---|---|
| | • Architects & Engineers<br>• Meta-analysis of third party research & data<br>• Financial & insurance markets<br>• Contingent valuation i.e. willingness to pay surveys<br>• Bayesian analysis/expert opinion |

| Colorado Electric Power Generation (Year 2005) -- Total (All Plants) | | | |
|---|---|---|---|
| **Category** | **Metrics** | **Median** | **Comment** |
| Plant annual net generation | MWh | 49,632,186 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual total nonrenewable net generation | MWh | 47,528,394 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual total renewable net generation | MWh | 2,103,792 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual hydro net generation | MWh | 1,293,231 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual biomass net generation | MWh | 34,327 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual wind net generation | MWh | 776,234 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual solar net generation | MWh | 0 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual geothermal net generation | MWh | 0 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Total Retail Sales | MWh | 48,353,236 | Energy Information Administration (Year 2005) |
| Exported | MWh | 1,198,342 | Implied |
| Direct Use | MWh | 80,608 | Direct Use is commercial or industrial use of electricity that 1) |
| Plant annual net generation less Direct Use | MWh | 49,551,578 | Implied |
| **Colorado Electric Power Generation - GHG and CAC --Total (All Plants) 2005** | | | |
| **Category** | **Metrics** | **Median** | **Comment** |
| Plant annual NOx emissions | Tons | 72,523 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual SO2 emissions | Tons | 62,898 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual CO2 emissions | Tons | 46,988,461 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual CH4 emissions | Tons | 583 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual N2O emissions | Tons | 726 | EPA: eGRID2007 Version 1.0 Plant File (Year 2005 Data) |
| Plant annual PM2.5 emissions | Tons | 5,441 | EPA 2005 National Emissions Inventory. Tier Summaries. |
| Plant annual PM10 emissions | Tons | 7,391 | EPA 2005 National Emissions Inventory. Tier Summaries. |
| Plant annual VOC emissions | Tons | 887 | EPA 2005 National Emissions Inventory. Tier Summaries. |

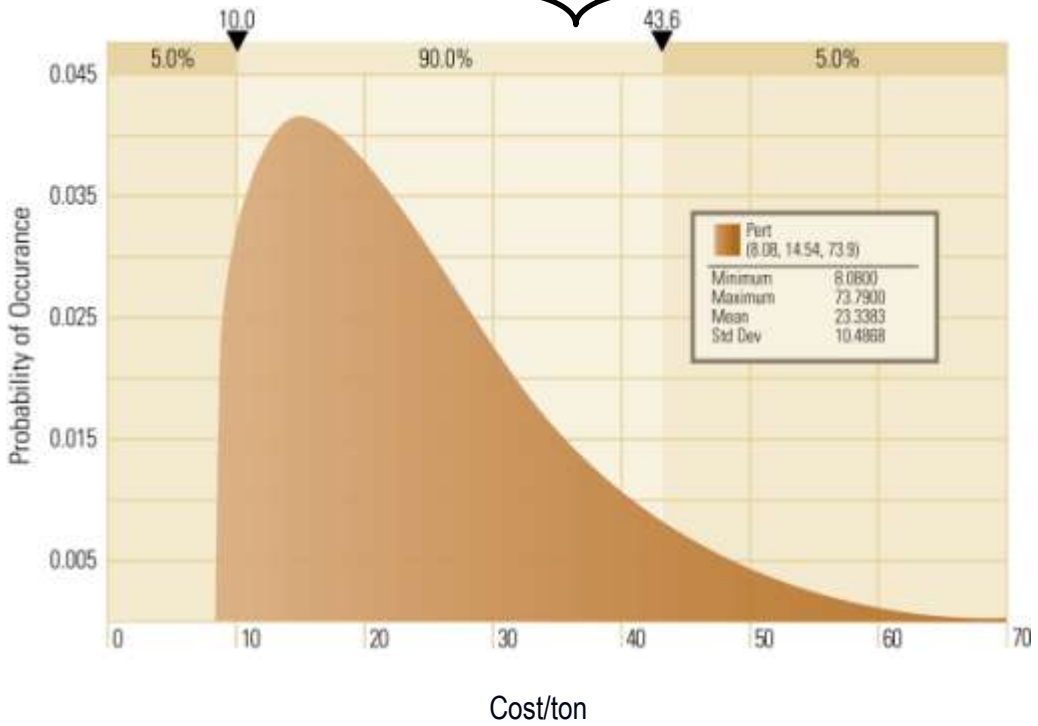
# SROI Methodology – Step 2

## Quantify Input Data Assumptions

**Quantify Input Data Distributions**

Example: Cost of $CO_2$ per Ton ($)

| Median | Lower Limit | Upper Limit |
|---|---|---|
| $19.86 | $8.08 | $73.79 |



# SROI Methodology – Step 2

## Quantify Input Data Assumptions

**Quantify Input Data Distributions**

### Example: Range of Values for CO2

- Median Value: We used the current market price as quoted on the European Climate Exchange based on the Cap and Trade system they have in place in Europe.
  - **As 17 Apr 2009 = $18.94 USD/ton**
- Low Value: We used **$8.08** USD/ton as calculated by William Nordhaus in his book A Question of Balance: Weighing the Options on Global Warming Policies, 2008
- High Value: We used **$73.79** USD/ton as calculated by Nicholas Stern in his book The Economics of Climate Change: The Stern Review, 2006

# SROI Methodology – Step 3

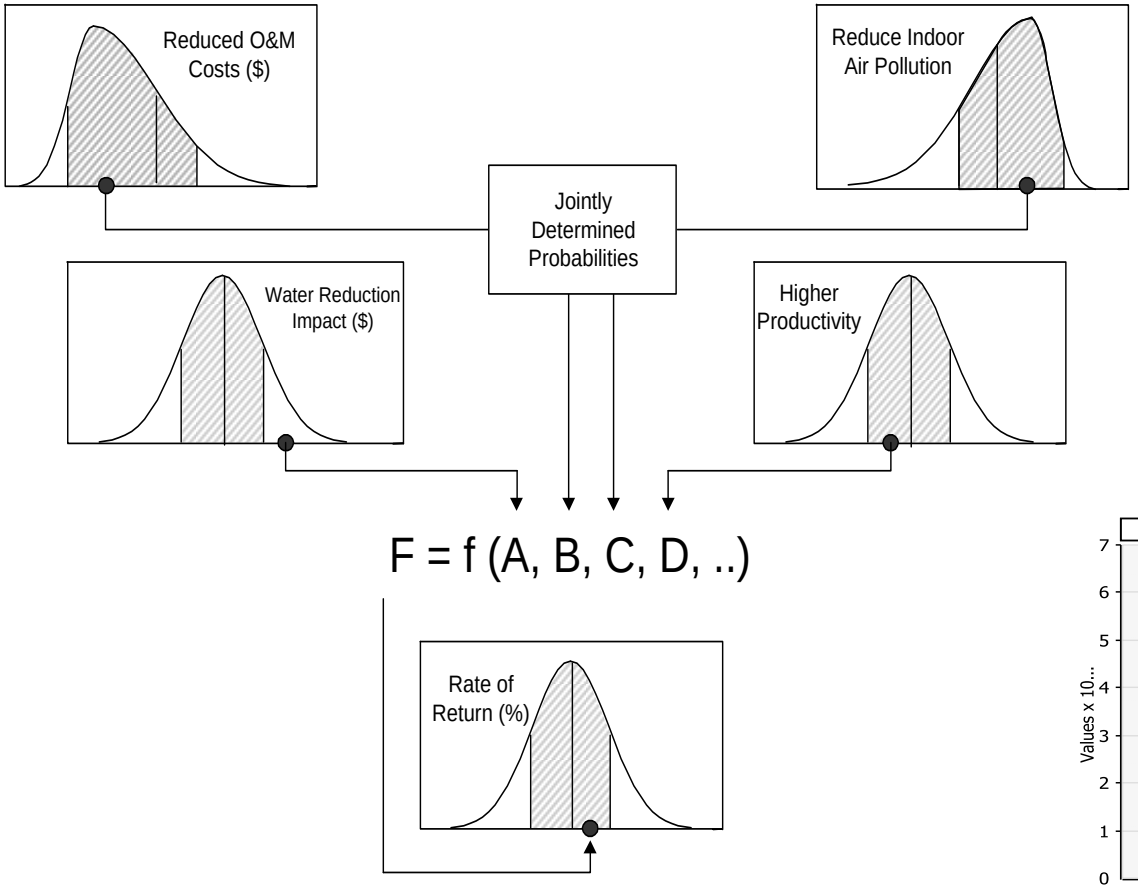
## Risk Analysis Process (RAP) Session

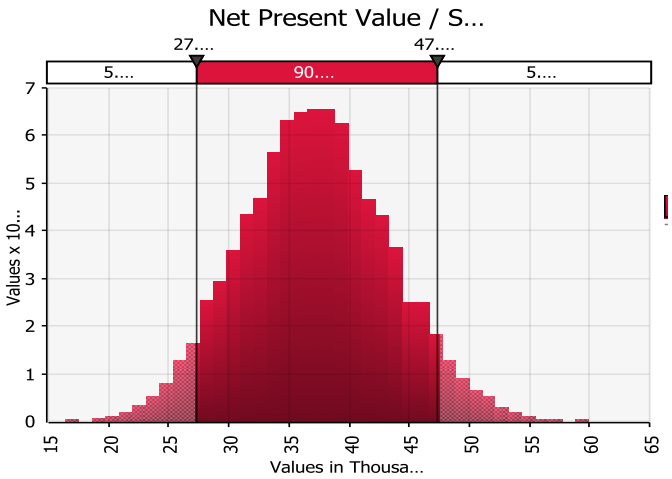
### Sample Participants

- Client:
  - Project team
  - Technical specialists
  - Financial experts
- HDR:
  - Facilitator
  - Economists
  - Technical specialists
- Outside Experts:
  - Costing Experts
  - Energy Modelers
  - Architects & Engineers
- Public Agencies & Officials


# SROI Methodology – Step 4

## Run the Model and Produce Results



# Examples of SROI Results

## Fort Belvoir Community Hospital, Virginia - US Army

| SROI | Alternative | Notes |
|---|---|---|
| Annual Value of Benefits | $930,485 | Total value of benefits in one year |
| *Energy Bill Reduction* | *369,591* | Cash Benefit |
| *Water Bill Reduction* | *80,039* | Cash Benefit |
| *Greenhouse Gases Savings* | *97,924* | Non-cash Benefit |
| *Air Pollutants Savings* | *374,844* | Non-cash Benefit |
| *Savings from Reduced Water Use* | *8,088* | Non-cash Benefit |
| Net Present Value | $10,194 | PV Benefits / PV All Costs |
| Return on Investment | 27% | Average Rate of Return on Capital Investment |
| Discounted Payback Period | 6 | Time in years to + discounted cash flow |
| Internal Rate of Return (%) | 23% | Discount rate making NPV = 0 |
| Benefit to Cost Ratio | 3.3 | PV Benefits / PV Costs |
| **FROI** | **Alternative** | **Notes** |
| Annual Value of Benefits | $449,537 | Total value of benefits in first year |
| Net Present Value | $2,660 | PV Benefits / PV All Costs |
| Return on Investment | 12% | Average Rate of Return on Capital Investment |
| Discounted Payback Period | 12 | Time in years to + discounted cash flow |
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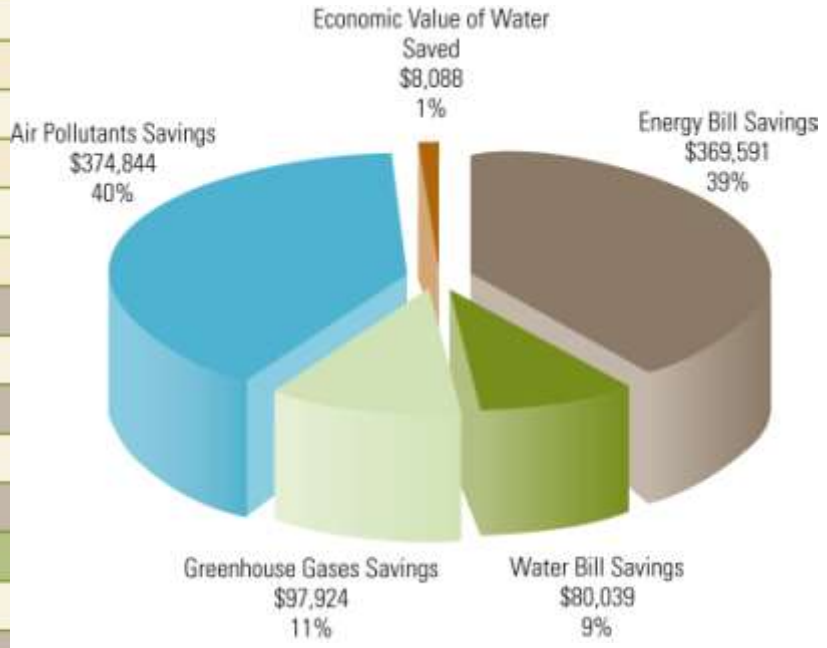
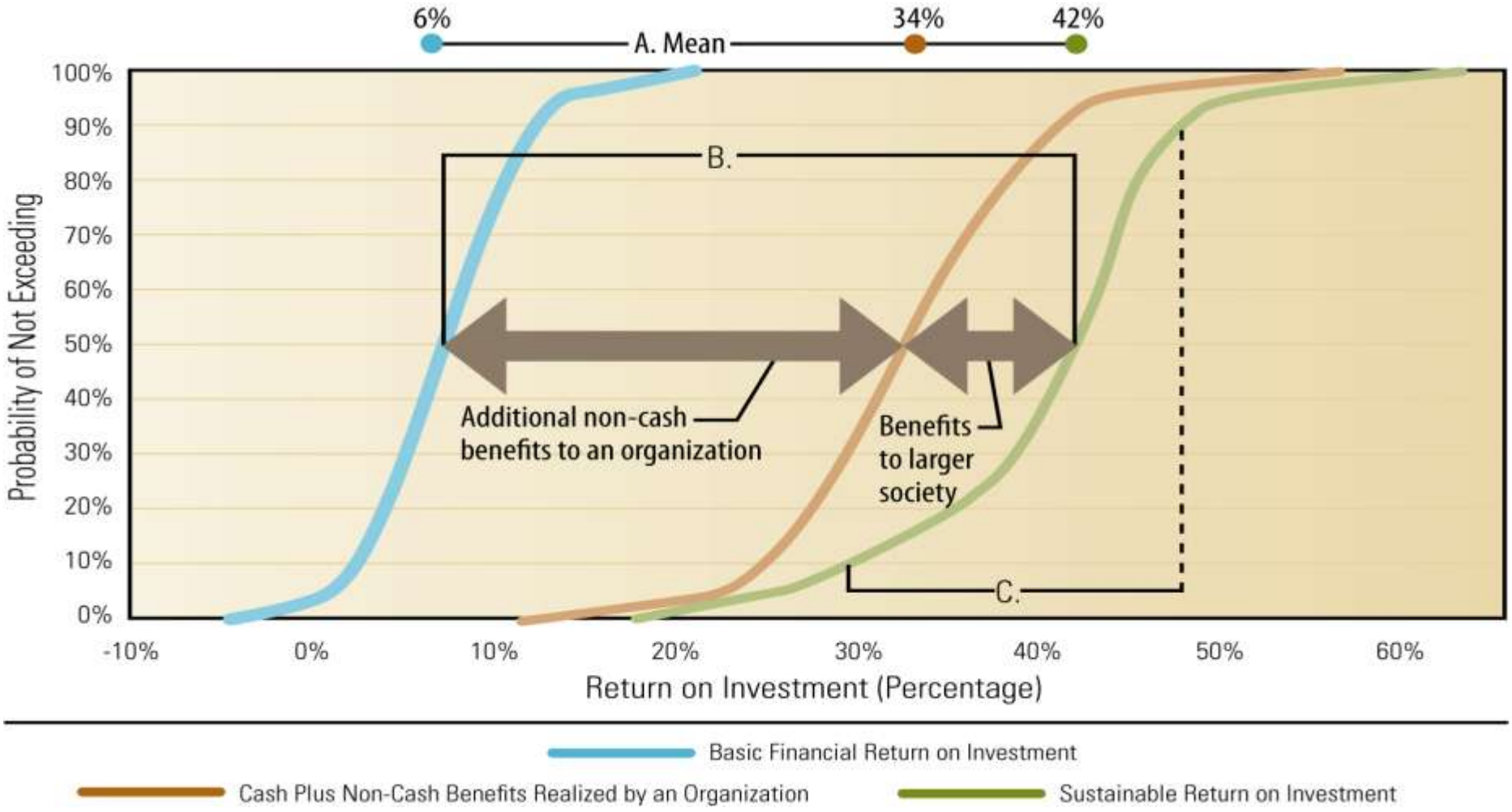
| Benefit to Cost Ratio | 1.6 | PV Benefits / PV Costs |



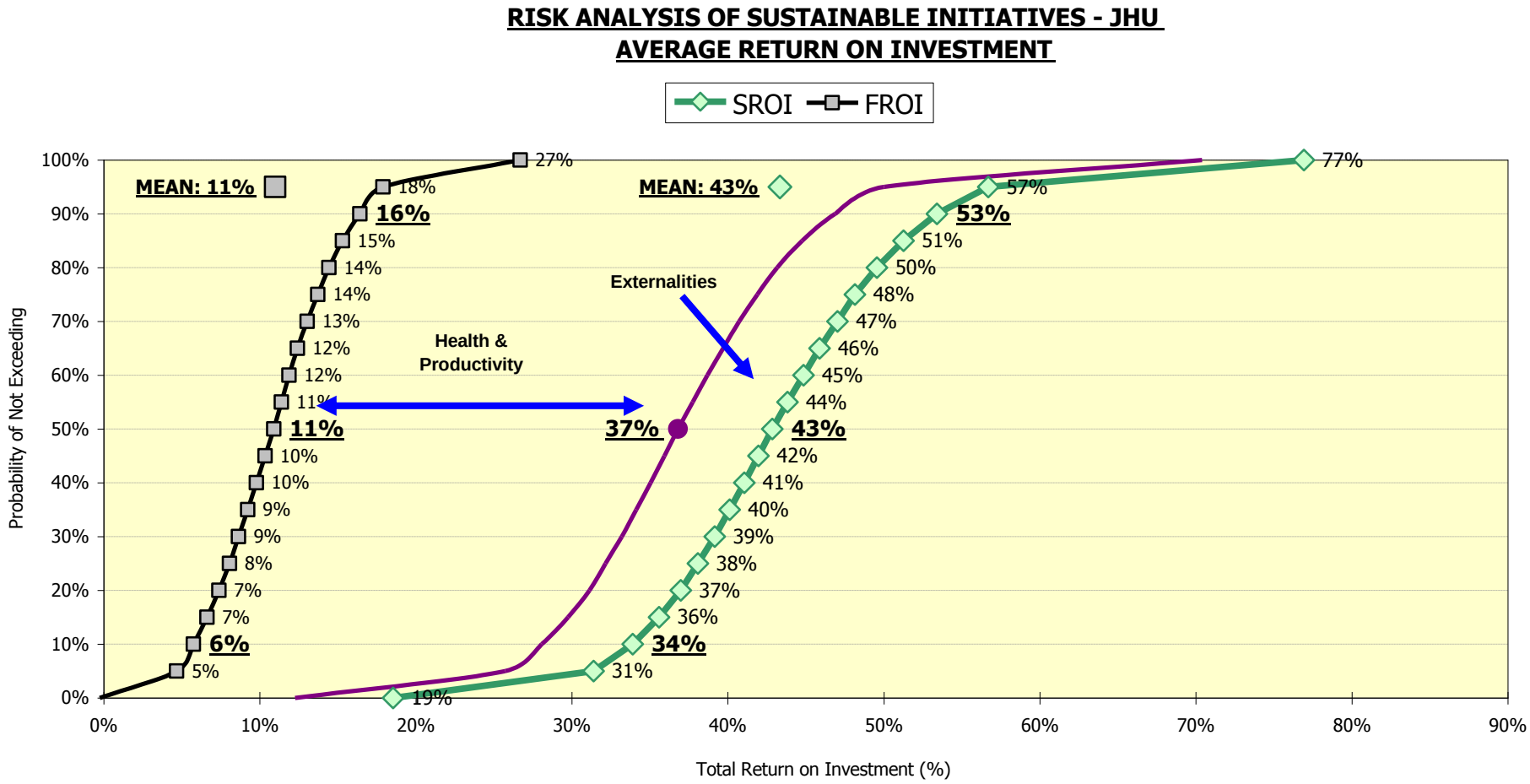
# Examples of SROI Results

## Explanation of the S-Curve Diagram

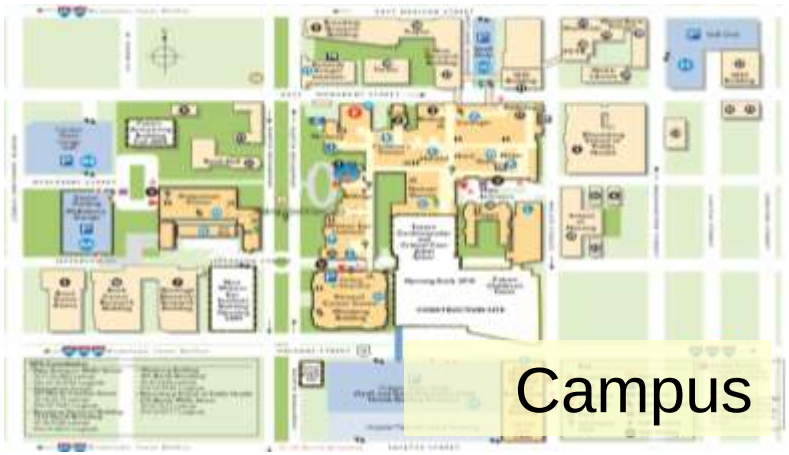


# Examples of SROI Results

## Campus Sustainability Initiative, Baltimore - John Hopkins University



# Scale of Application



# Examples of Recent SROI Projects

| Client | Project |
|---|---|
| **Army** | SROI business case for the Fort Belvoir Community Hospital, currently working on USAG Humphreys in Korea |
| **BNSF & UP Railroads** | Proved the public benefit of three new infrastructure projects resulting in $200M in grants from TCIF |
| **Boston Redevelopment Authority** | Performing SROI analysis on the city of Boston's portfolio of ARRA funding projects |
| **Denver Metro Wastewater Reclamation District** | Using SROI to make design & construction decisions on Denver's proposed new wastewater treatment facility |
| **Johns Hopkins University** | Provided SROI analysis of JHU's Campus Sustainability Initiative project in order to secure LEED certification |
| **Marine Corps** | SROI is being used in Iwakuni, Japan to assist with evaluating sustainable solutions at the base |
| **National Park Service** | Working with the Park Service to use SROI to help make sustainable transportation planning decisions |

# Standard vs. Green Design

## Fort Belvoir Community Hospital

**60 acres of land - 1.2 million SF medical center - 3,000 staff - 55 primary clinics**

# Fort Belvoir Community Hospital

**March 2010**

# Sustainability Drivers

## Fort Belvoir Community Hospital

### EBD

MHS has developed five EBD principles that have a positive impact on patients, staff, and resource:

1. Create a patient–and family-centered environment
2. Improve the quality and safety of healthcare
3. Enhance care of the whole person
4. Decrease back pain and work–related injuries
5. Design for maximum standardization, future flexibility and growth

### LEED


### EPAct 2005

Buildings shall be 30% more efficient than ASHRAE 90.1

# LEED Checklist

## Fort Belvoir Community Hospital

### Six Categories

**Sustainable Sites = 11**

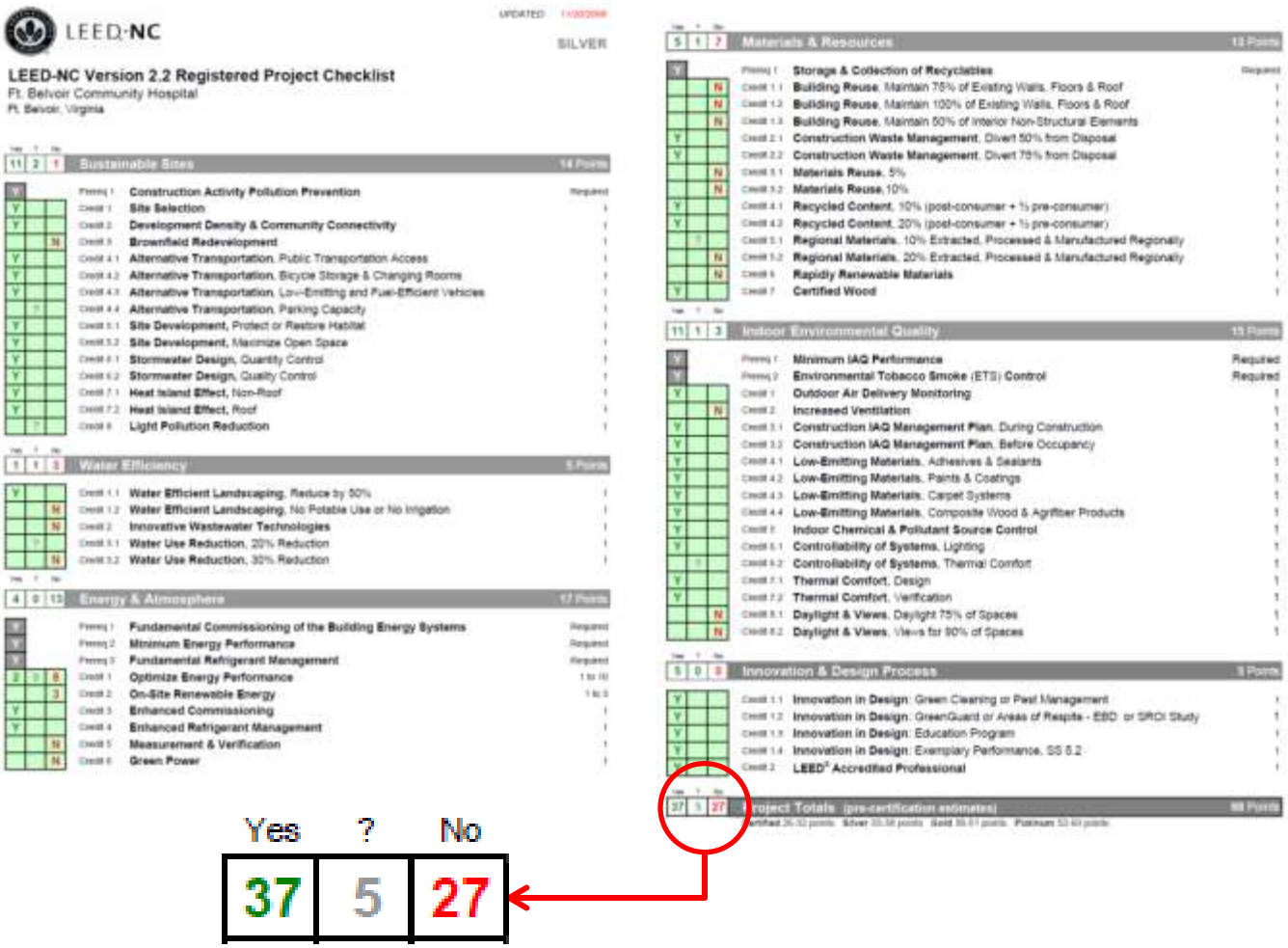
**Water Efficiency = 1**

**Energy and Atmosphere = 4**

**Materials and Resources = 5**

**Indoor Environmental = 11**

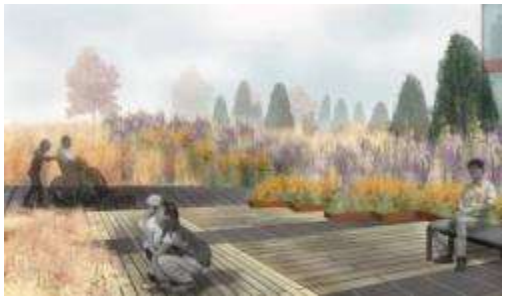
**Quality Innovation and Design Process = 5**



# Sustainable Sites - Landscape Design

## Fort Belvoir Community Hospital

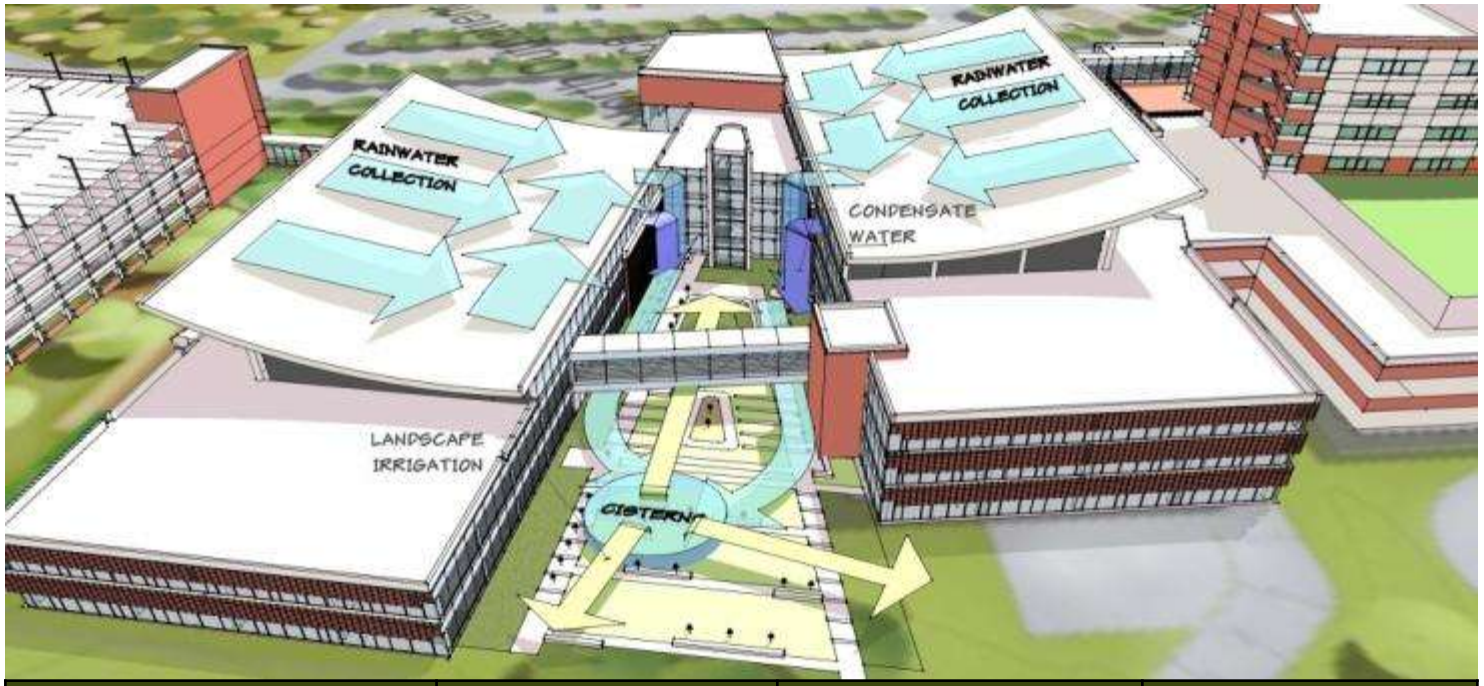
- Access to nature
- Native and adapted plants
- Permeable paving
- Rain gardens and river rock beds
- Green vegetated roofs
- Bioswale reducing storm water runoff
- 60% of the site will be restored with native planting
- 1,284,139 sq. ft. of open space



# Water Efficiency

## Rainwater Harvesting & Condensate Collection

Fort Belvoir Community Hospital



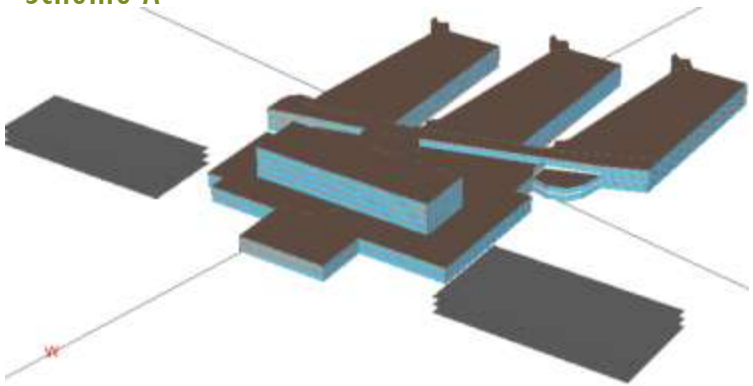

| Irrigation | Irrigation Demand | Inflow | Savings |
|---|---|---|---|
| **Permanent Irrigation (after first 2 years)** | **867, 444 gal** | **1, 640, 602 gal** | **100%** |

# Energy & Atmosphere

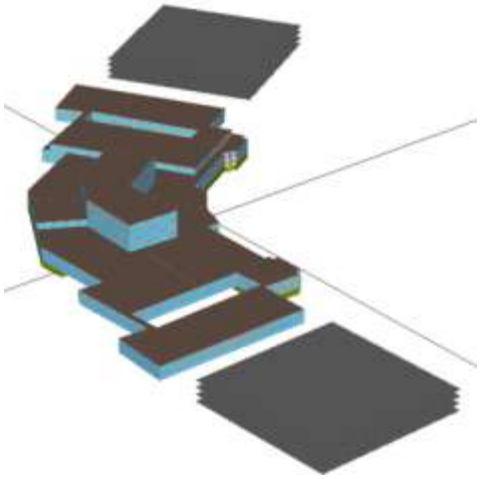
## Pre-Schematic Load Evaluation

Fort Belvoir Community Hospital

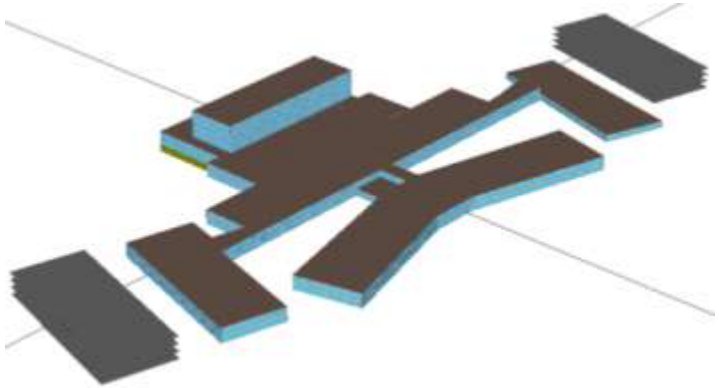
Scheme A



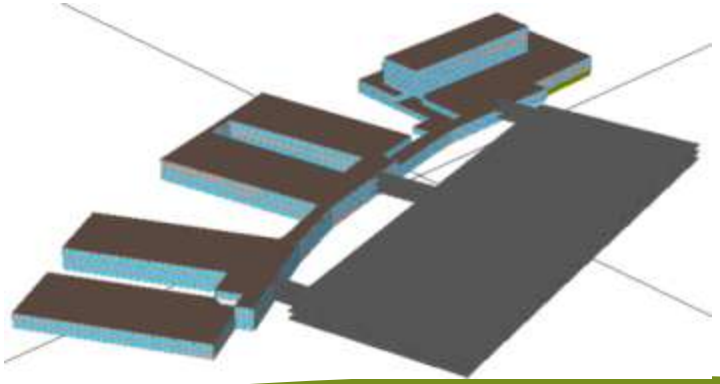
Scheme B



Scheme C



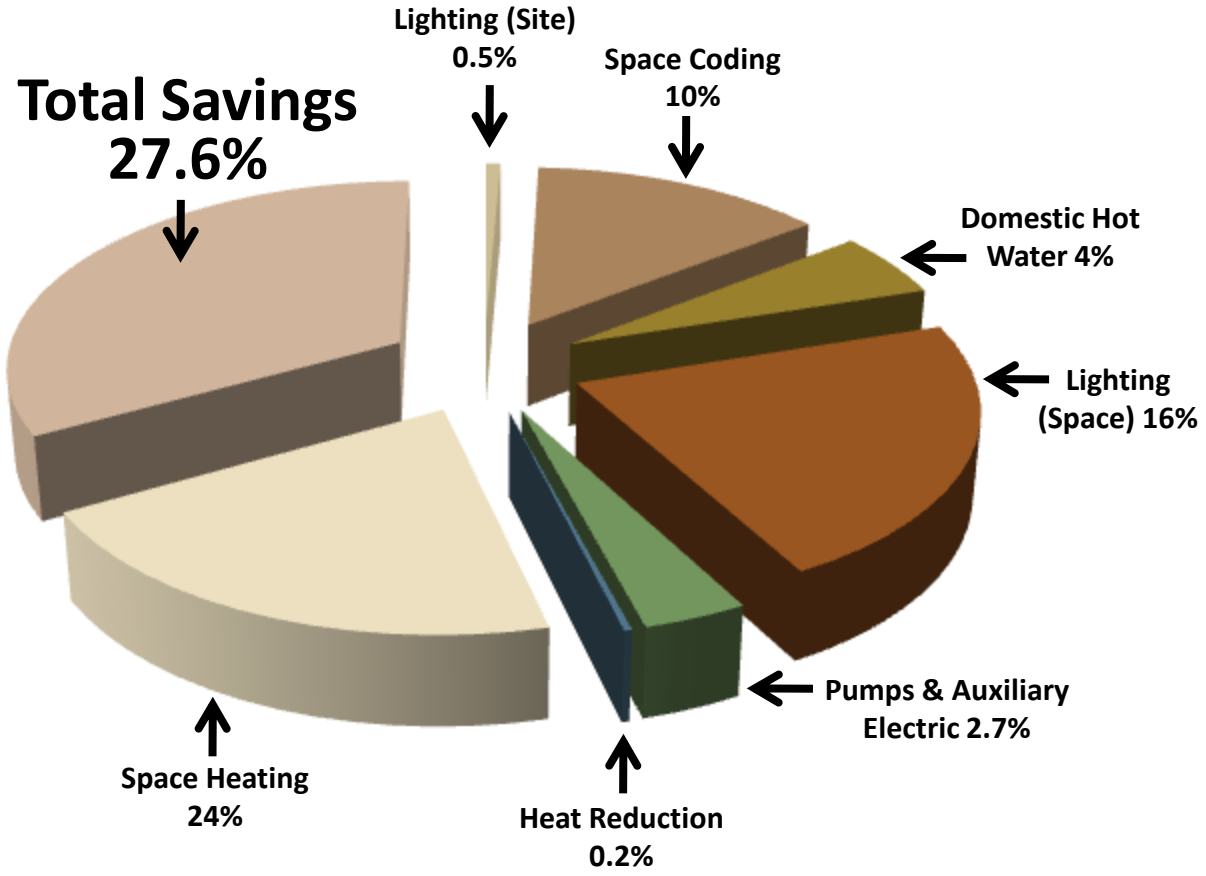
Scheme D



# Energy & Atmosphere

## EPAct Compliance

Fort Belvoir Community Hospital




**Total annual energy cost savings = $449,299**

# SROI Results
# Greenhouse Gases & Air Pollutants Avoided
## Fort Belvoir Community Hospital

**Non-Financial Metrics: Greenhouse Gases & Air Pollutants Avoided per Year**

| Resource Related | Current Design | Alternative | Notes |
|---|---|---|---|
| **Tons of CO2 Emissions Avoided** | 4,426 | 4,810 | The number of tons of carbon dioxide avoided based on the energy savings due to the project |
| **Tons of CH4 Emissions Avoided** | 0.16 | 0.17 | The number of tons of methane avoided based on the energy savings due to the project |
| **Tons of N2O Emissions Avoided** | 0.08 | 0.09 | The number of tons of nitrous oxide avoided based on the energy savings due to the project |
| **Notes**<br>Carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) are considered Greenhouse Gases (GHGs) | | | |

| | | | |
|---|---|---|---|
| **Tons of SO2 Emissions Avoided** | 16.0 | 17.4 | The number of tons of sulphur dioxide avoided based on the energy savings due to the project |
| **Tons of NOx Emissions Avoided** | 4.97 | 5.40 | The number of tons of nitrogen oxides avoided based on the energy savings due to the project |
| **Tons of PM2.5** Emissions Avoided** | 1.07 | 1.16 | The number of tons of particulate matter avoided based on the energy savings due to the project |
| **Tons of VOC*** Emissions Avoided** | 0.05 | 0.05 | The number of tons of volatile organic compounds avoided based on the energy savings due to the project |
| **Notes**<br>* Air pollutants cause smog, acid rain and other health hazards. EPA regulated six common air pollutants: particulate matter (PM), ground-level ozone, carbon monoxide (CO), Sulfur dioxide (SO2) (which belongs to the family of sulfur oxide gases, SOx), nitrogen oxides (NOx), and lead<br>** Particulate matter (PM) or fine particles, are tiny particles of solid or liquid suspended in a gas<br>*** Volatile Organic Compounds are hydrocarbon-based emissions released through evaporation or combustion. Many VOCs are harmful and are classified as hazardous air pollutants by US EPA | | | |

# Examples of SROI Results

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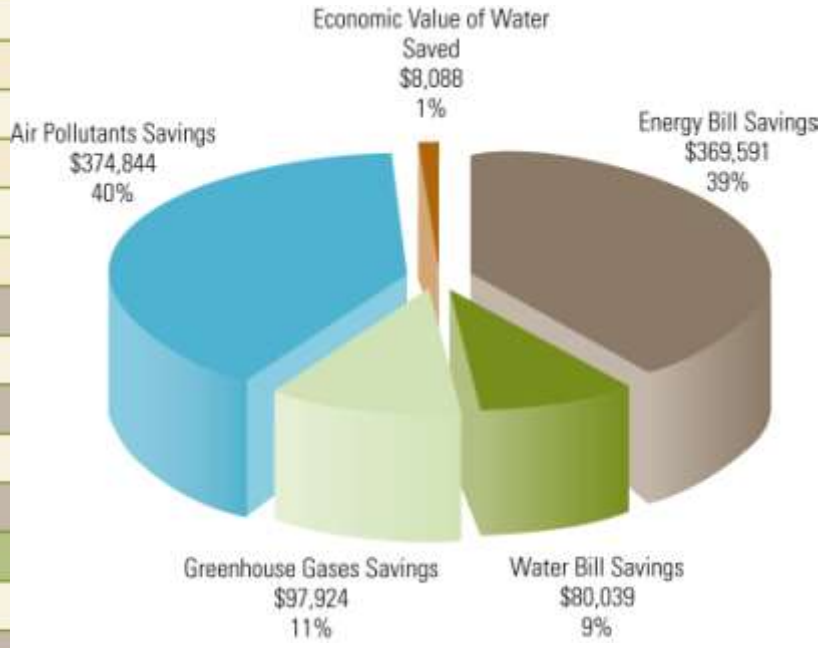

# So Why Use SROI?

- ✓ **It's a proven Cost-Benefit Analysis based approach to making planning & budgeting decisions**
- ✓ **It fully incorporates non-cash benefits and externalities into the decision making process**
- ✓ **It provides a full range of possible outcomes using state-of-the-art risk analysis techniques**
- ✓ **It helps generate consensus by being both interactive and transparent**
- ✓ **It is an invaluable tool to help projects secure internal approval, public support, funding, etc.**

# Contact?

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*“Doing the right thing is good. Doing the right thing for the right reason and with the right intention is even better.”*