VALUE BY DESIGN

INTEGRATION OF VALUE ENGINEERING & SUSTAINABILITY

with case studies of Hydro Electric Infrastructure Projects

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SCAV
CSVA
SOCIÉTÉ CANADIENNE D'ANALYSE DE LA VALEUR
CANADIAN SOCIETY OF VALUE ANALYSIS

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25 October 2012

Value by Design has no *Value* if this was your project……

VALUE BY DESIGN

INTEGRATION OF VALUE ENGINEERING & SUSTAINABILITY

Presentation Outline

- Value & Sustainability
- Triple Bottom Line
- Infrastructure project Footprint
- Value by Design
- Sustainable strategies
- Value based Sustainable Design
- Knowledge Transfer
- Value Strategies

- Case Studies of Large Power Projects
  - Process followed
  - Significant Proposals – Sustainable appraisal
  - Accomplishments
  - Sustainability Appraisals

Value by Design

combines the concepts of INTEGRATED VALUE with CREATIVITY in a Group setting through facilitated brain steering

- **Low / Optimum cost**
- **Sustainable Development**
- **Corporate Responsibility**

Optimum Value by Design is achieved when the necessary performance of a system is defined and delivered at the lowest life cycle cost by balancing the three bottom lines (integrated value)

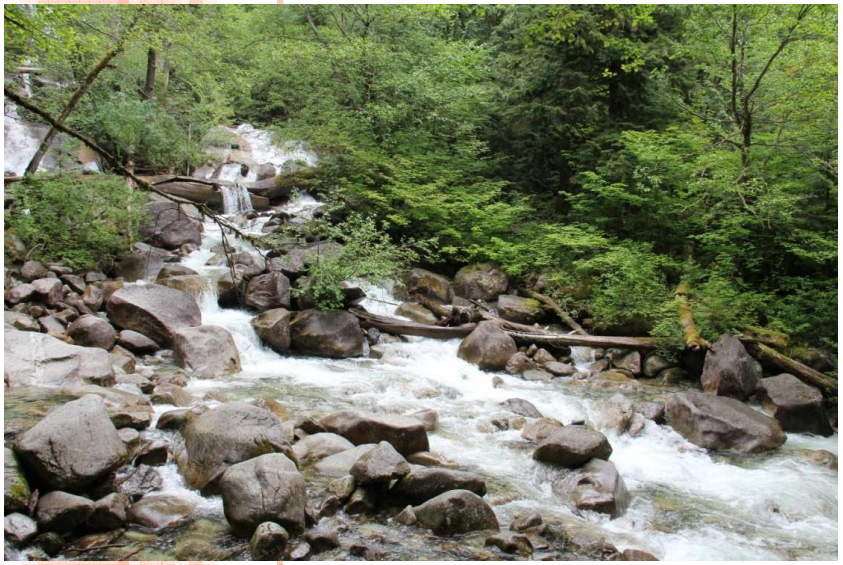
- **Lowest Financial cost**
- **Lowest Environmental impact**
- **Greatest Social benefit**

Creativity & Innovation

Team work

Persistence

VALUE BY DESIGN

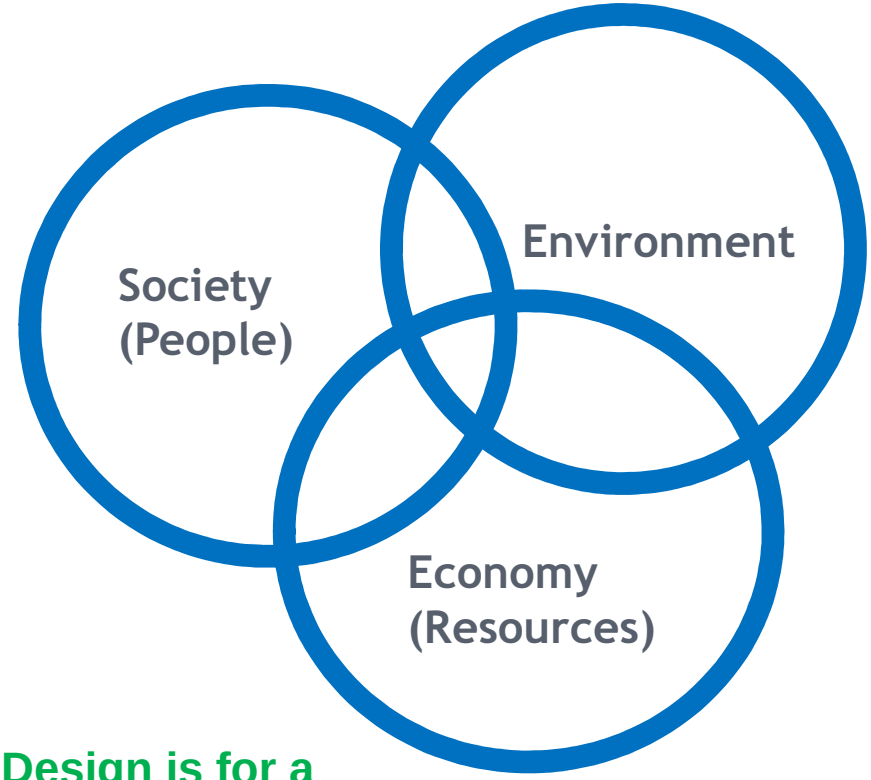


Sustainability & Three Bottom Lines

Corporations are accountable to people to take care of the environment, meet community needs and deliver excellent financial results.

Commitment to sustainability means balancing, tracking and measuring the Corporate performance along environmental, social and economic bottom lines

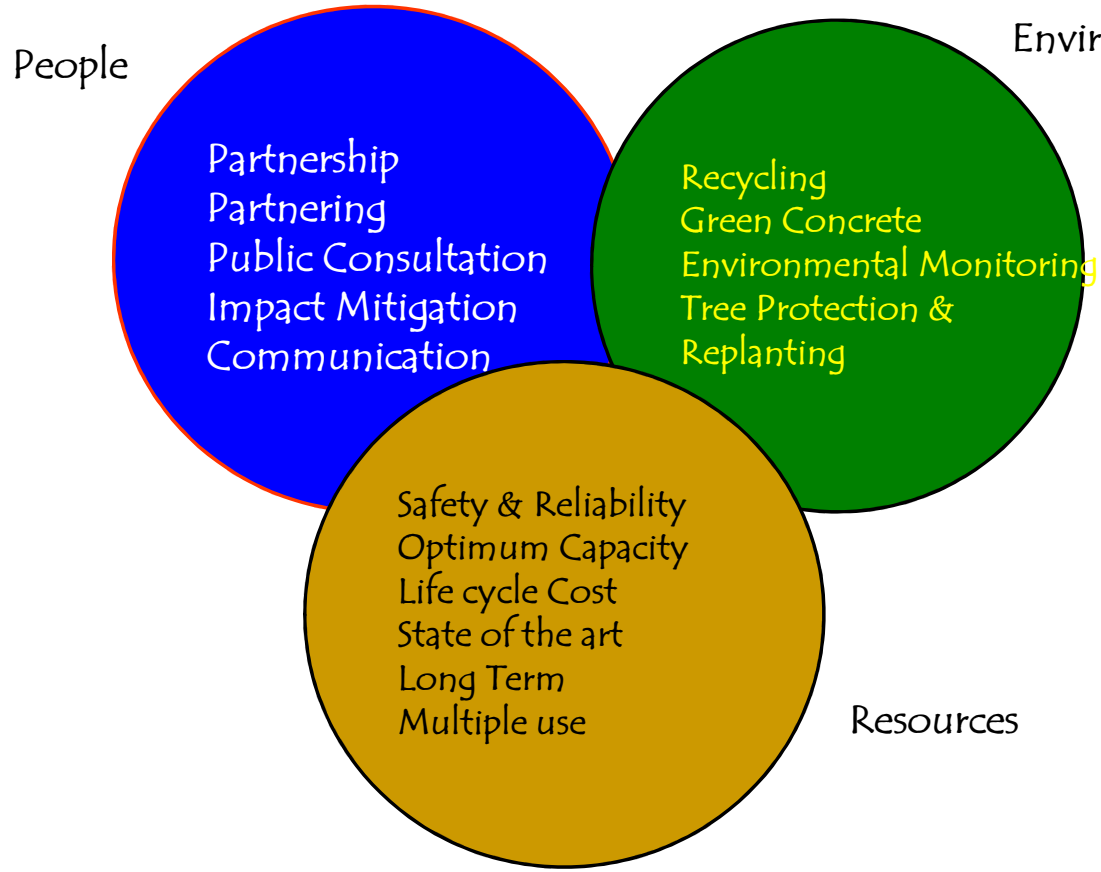
Sustainability - Balancing the Three Basic Aspects Triple bottom Line



Value by Design is for a Holistic development

Sustainability is about satisfying the needs of the present without compromising the ability of our future generations to meet their own needs

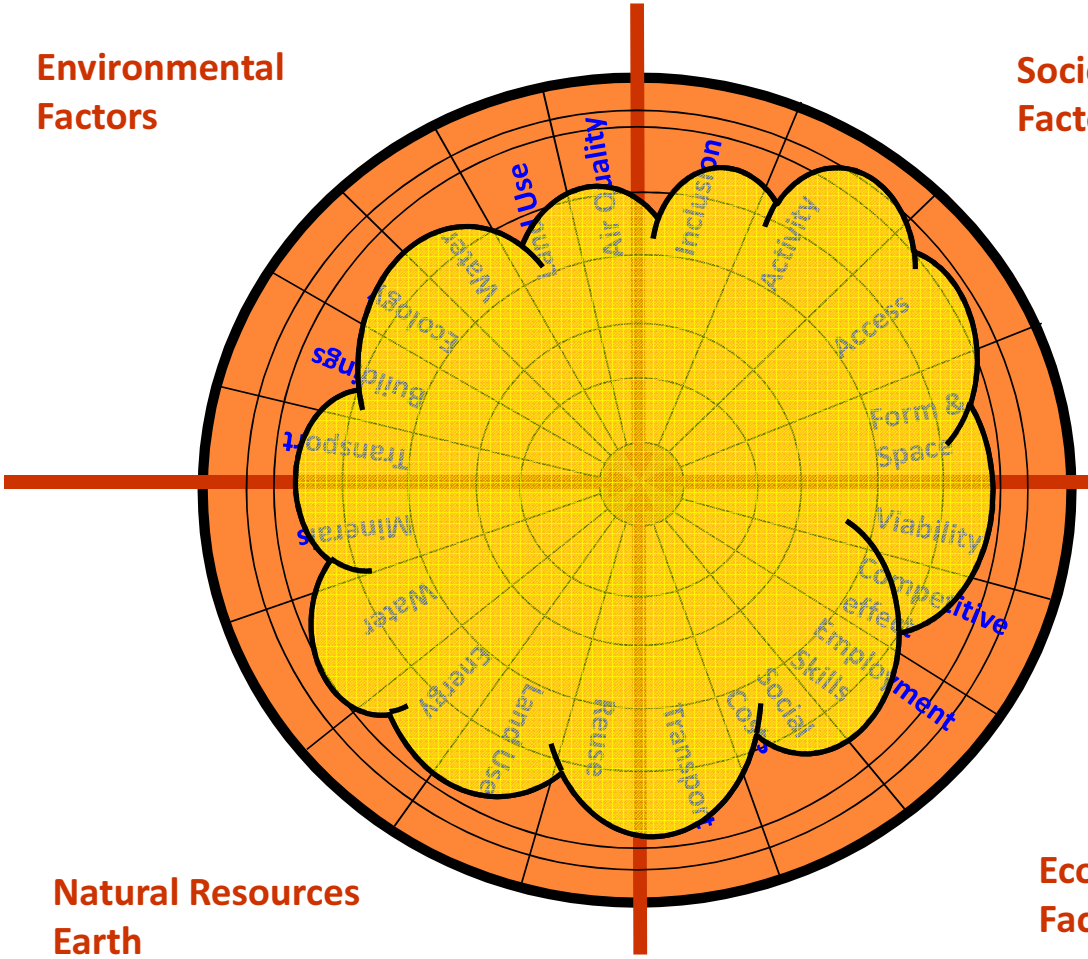
Sustainable development is about meeting the **growing needs** of natural resources, industrial products, energy, food, shelter and effective waste management while conserving and protecting environmental quality and natural resource base essential for future generations.



Value by Design is for a Holistic development achieved by:

Ensuring environmental integrity, social well-being and economic prosperity.

Sustainable Appraisal of a Project



Maximizing the Value in all 4 quadrants is Value by Design

SPeAR Riches, 2003

Construction produces 50% volume of garbage in the landfill !

Construction footprint !

The CO2 Numbers *(approximate)*

1 tonne clinker = 1 tonne CO2

8,000 Km

Forest sink
2,000 m2/a

Carbon footprint !

Sustainability Strategy applied to Construction Projects:

- **Minimize Environmental Impact**
- **Minimize Social Impact**
- **Optimize Resource Utilization & Life Cycle Cost**
- **Use State of the art technology**

EcoSmart™ Strategy:

To minimize GHG "signature" of concrete by optimizing replacement of Portland cement with SCM while improving or maintaining :

- **Cost**
- **Performance**
- **Constructability**
- **Project Delivery**

Value by Design

ENVIRONMENTAL IMPACT Of
Concrete Construction

- Annual global: 5 billion cubic yards.
- Next only to Water in consumption!

Twice as much concrete is used in construction around the world than the total of all other building materials, including wood, steel, plastic and aluminum.

Making one tonne of cement:

- requires 2 tonnes of raw material (limestone and shale)
- consumes 4 GJ of energy in electricity, process heat, and transport (the energy equivalent to 131 cubic metres of natural gas)
- produces 3 kg of NOX, causing ground-level smog
- produces 0.4 kg of PM10 - particulate harmful to the respiratory tract
- **produces 1 tonne of CO_2 emission**

SEYMOUR-CAPILANO CLEAR WELLS (METRO VANCOUVER)

HIGH VOLUME FLY ASH CONCRETE & ***GEOTHERMAL PIPING***

Geothermal heat recovery system

Sustainable Value Accomplishments: actual project example

On time, under budget
- didn't use contingency fund

Met people's needs
- alternate arrangements, facility to see construction
- partnership, partnering, business needs

Recycling of concrete - 10,000 cu.m
- on-site separation of steel ensuring recycling

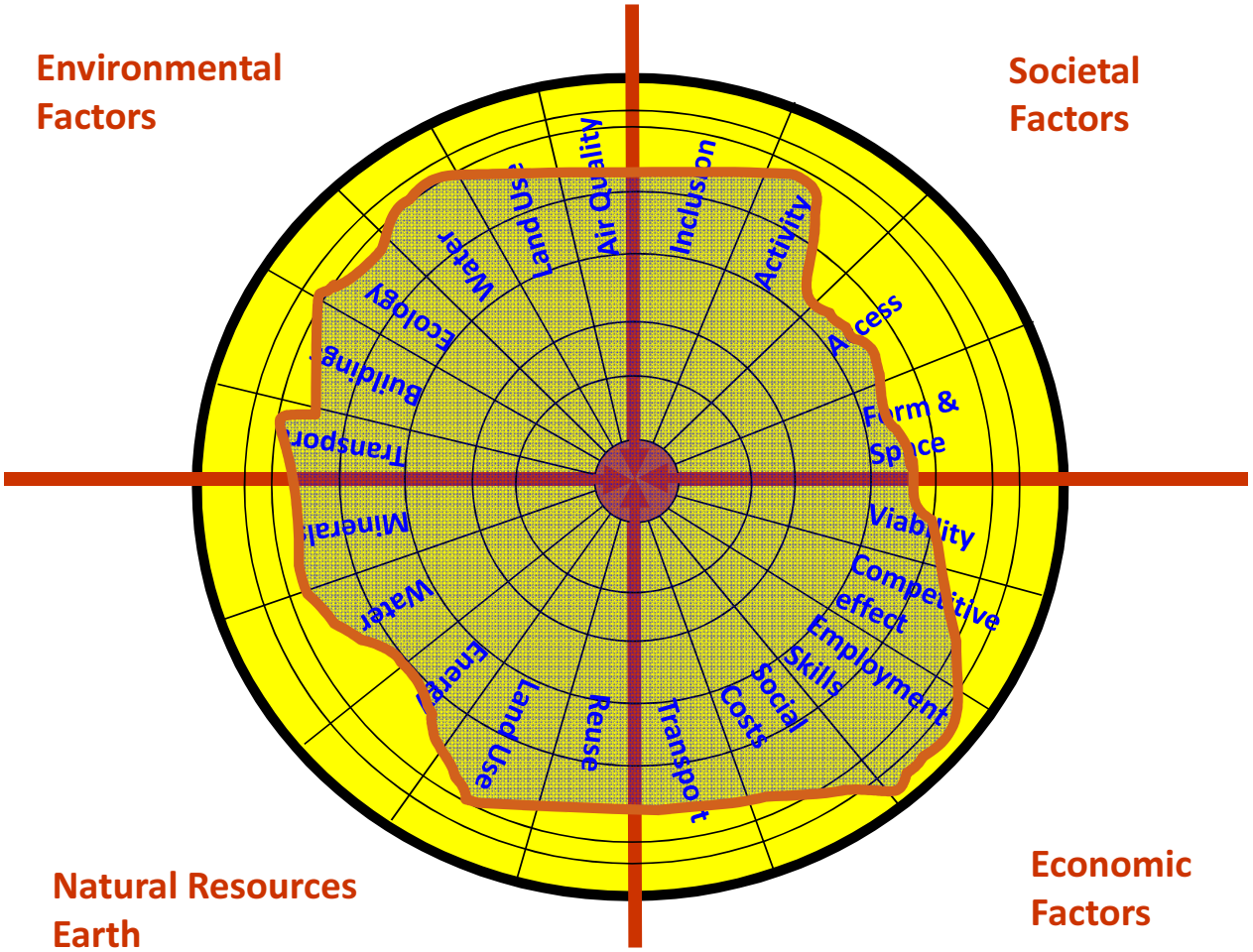
Environmentally excellent- exceeding standards
- no pollution, including sound, well managed run off, etc.
- plant & animals,

High quality concrete construction with EcoSmart Concrete
- 44% SCM on 28,000 cu.m. Reduction of CO_2 footprint (4200 tonnes)

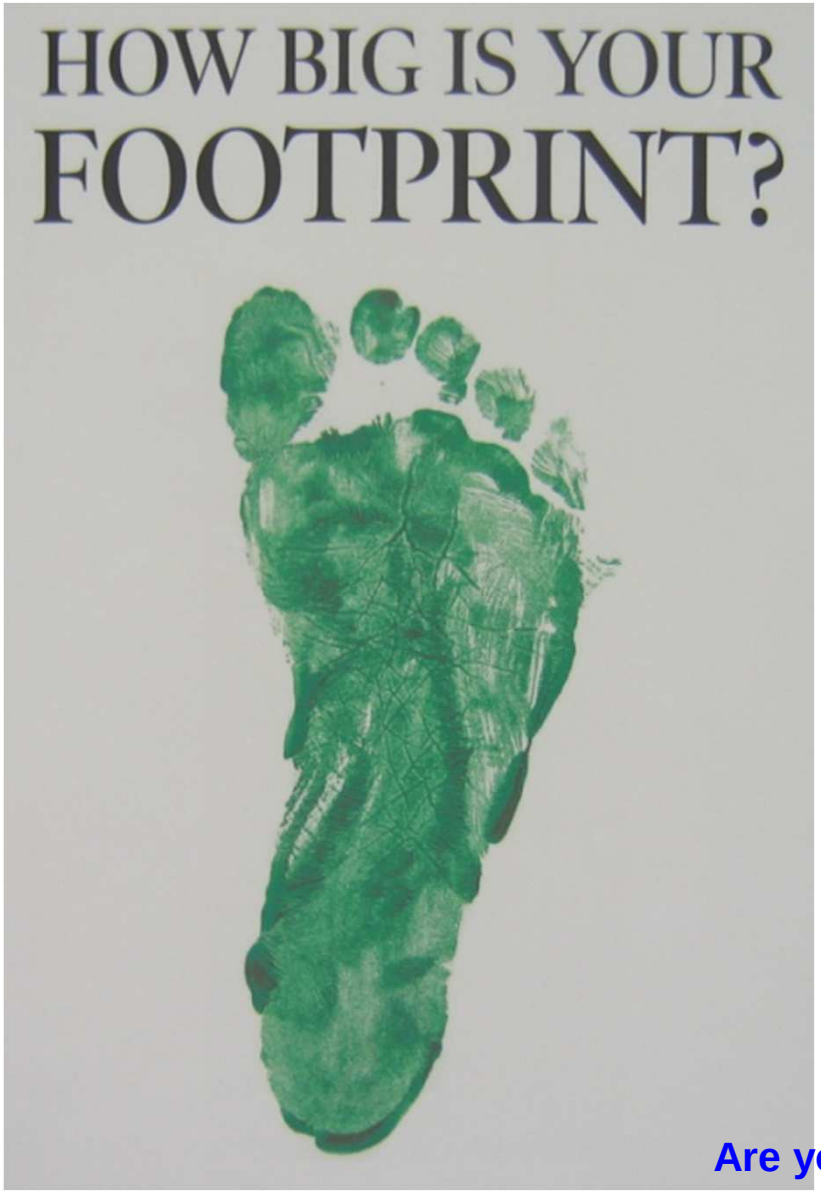
Transfer of knowledge to other projects
- Filtration plant used 55% fly ash replacement
- Invited talks, technical tours, case studies

Value by Design in Action

Sustainable Appraisal of a Project / Product



SPeAR Riches, 2003



Are you practicing Value by Design?

Why integrate the best of Value Engineering And Sustainability ideas?

- **Value Engineering has saved the private industry and governmental agencies many *$Billions* since its inception in 1947.**
- **The VE approach promotes the philosophy of *"Do the Right Thing Right the First Time."* (DTRT RTFT)**

- **Sustainability Concepts look at the holistic development which can be ideally combined in the VE style work plan.**
- **A shift in paradigm is required to include Sustainability aspects in the study.**
- **VbD looks at Financial, Social and Environmental costs *(i.e., Three bottom lines)***
- ***Integrated – Strategic - decision making for final selection of proposals***
- ***Good synergy when used with Value Methodology***

WHAT IS VALUE?

Value = Worth / Cost

V.E. Objective is to make W/C ~ =1.00 or better

'Low cost' need not give you high value
Higher satisfaction at lower cost improves value

$2500

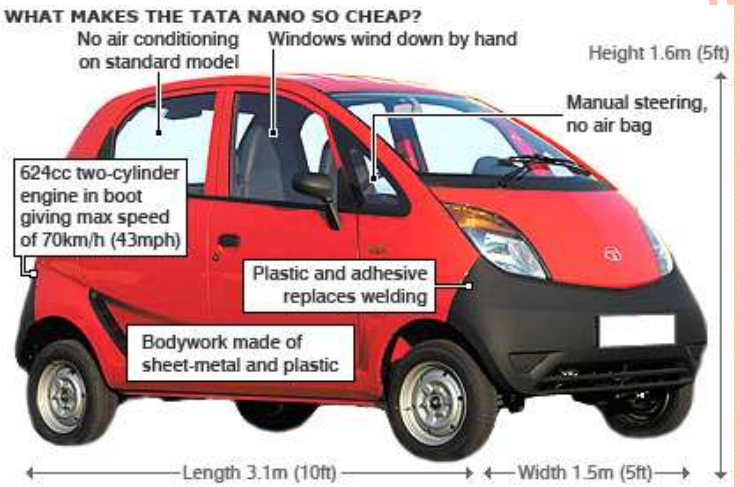
Tata Nano

$50000

Jaguar

Value enhanced

Both have optimized value
Both owned by the same company- TATA Motors, India



Understanding the Customer
True usage of Target Costing (~$2000)
No Gold plating or Strip Down
True Function–based product design
Operating cost (21 km/Ltr.)
Open Innovation in Design

TATA NANO

Jaguar & Land Rover ($50,000)
- also owned by TATA

Tata Airpod

Single seat . Compressed air fuel

Innovation, sustainability

WHAT IS VALUE?

$$\text{Value} = \frac{\text{Satisfaction of Needs}}{\text{Use of Resources}}$$

Satisfaction of Needs: What is necessary for a desired user

Use of Resources: Everything that is required to satisfy needs

Land usage
Natural Resources
Financial Resources
Human Resources (positive & Negative)

VbD Optimization aims at maximizing the Integrated Value

Best Value **is about improving the understanding of the business/project needs and delivering on it in a responsible manner.**

The Amphibious Bicycle – Innovation from India
Ideal for flood prone areas! (Discovery & BBC reports)

Creativity and Innovation requires an open mind!

Value by Design Objective:

Utilize a systematic approach, to identify the required functions and deliver the project at the lowest possible cost, keeping the design intent unchanged.

Expectations:

1. **Reduction on construction costs,**
2. **Reduced use of Natural Resources**
3. **Reduced use of Land**
4. **Improved operational performance, Safety**
5. **Reduced maintenance costs (loss time, shutdown, etc.)**
6. **Identification of risks and mitigation strategies (Safety by design?)**
7. **Lower life cycle costs (Financial, social & environmental)**
8. **Integrated enhancement of Value (triple bottom line)**

How is 'Value by Design' done?

Value Methodology uses a combination of **creative** and **analytical** techniques to identify alternative ways to achieve objectives.

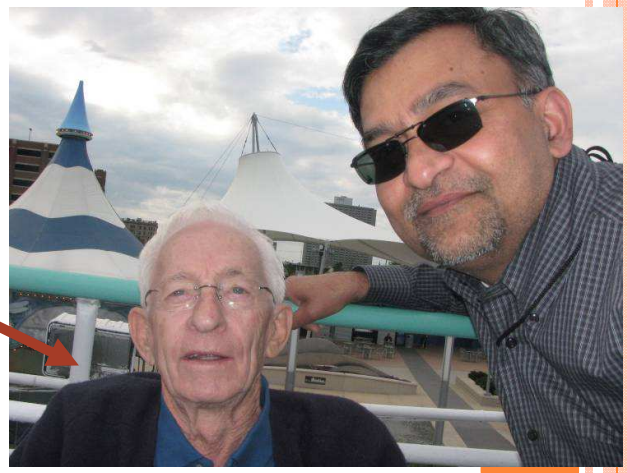
The use of **Function Analysis** differentiates Value Engineering from other problem solving approaches.

Function Analysis Systems Technique

F A S T

- Charles Bytheway

Father of 'FAST'



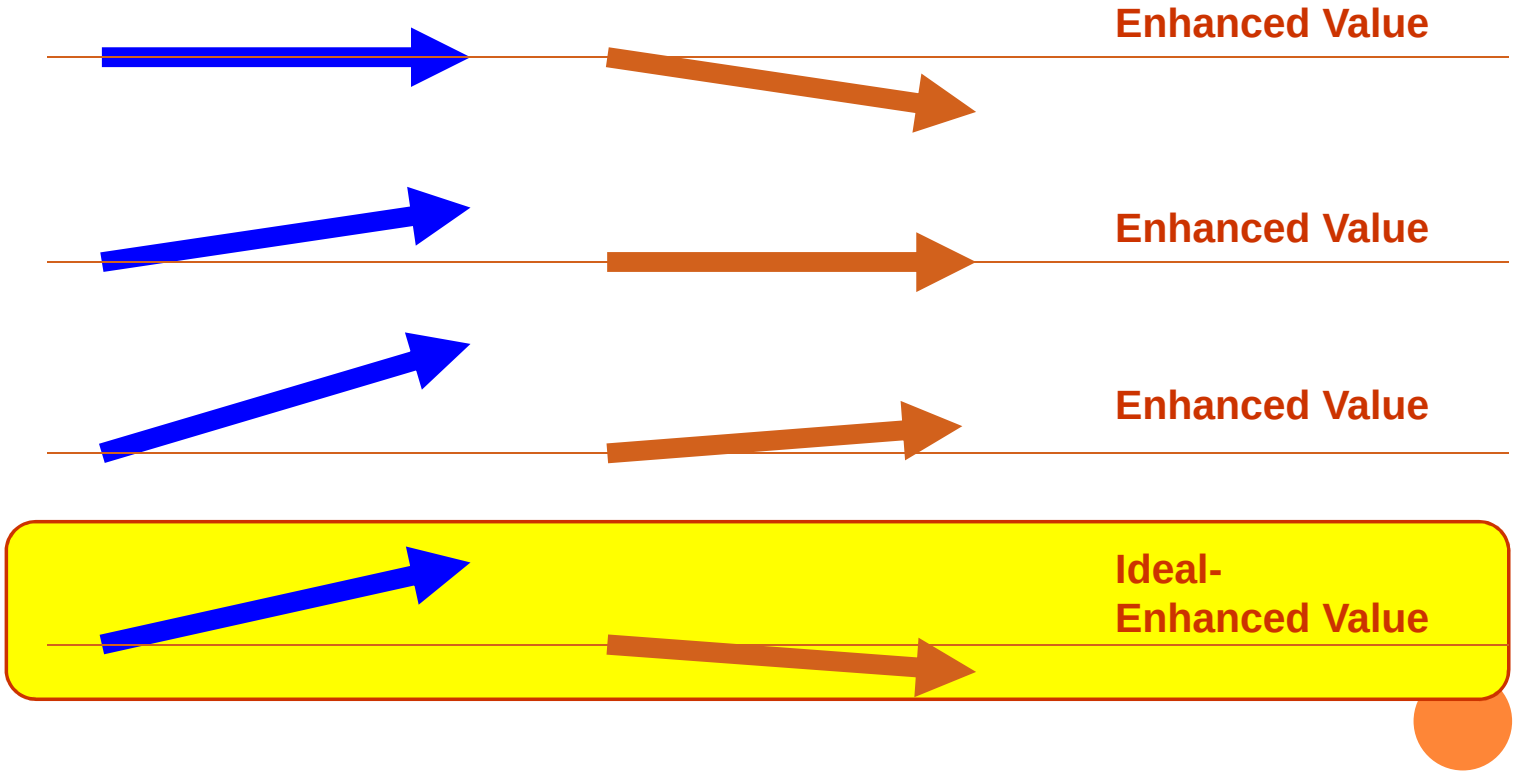
SAVE Conference, Detroit, 2009

How do we Improve Value of a function?

Function performance
Needed performance

Cost of function?
Financial
Environmental
Social

Resulting Value



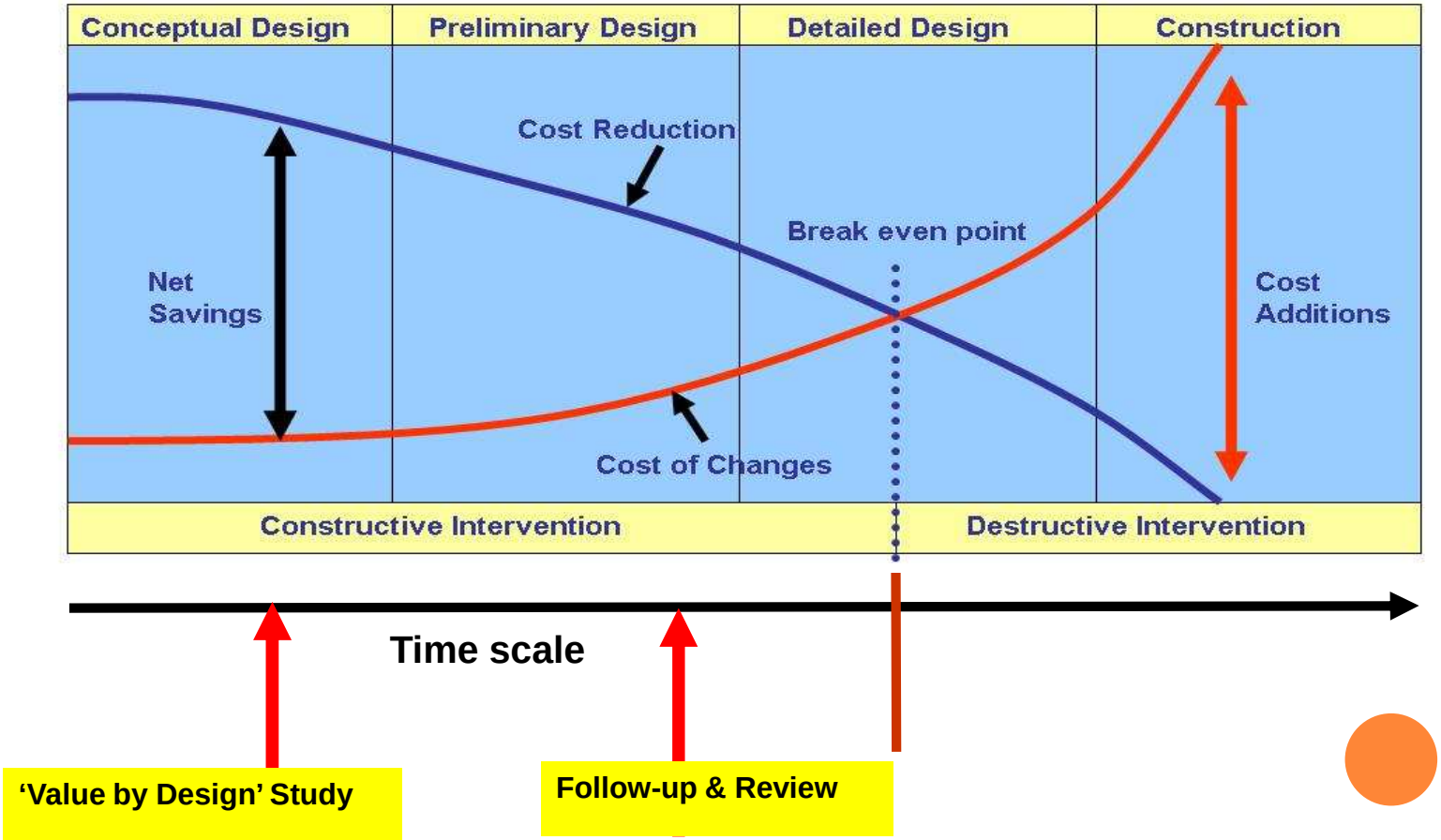
Value by Design is not

- **What a good Project Manager "does already".**
- **A task that can be fully outsourced to a consultant**
- **An effort to trade off essential functions to cut costs.**
- **Merely a review to eliminate "Gold Plating".**
- **A method for reducing costs through degrading performance and reliability.**
- **In any way intended as a reflection on the competence of the designer.**
- **An effort to cheapen the design.**
- **Only done at end of design or start of construction to return project to budget**
- **An effort to show off Environmental stewardship**
- **An effort to keep the paper work intact**

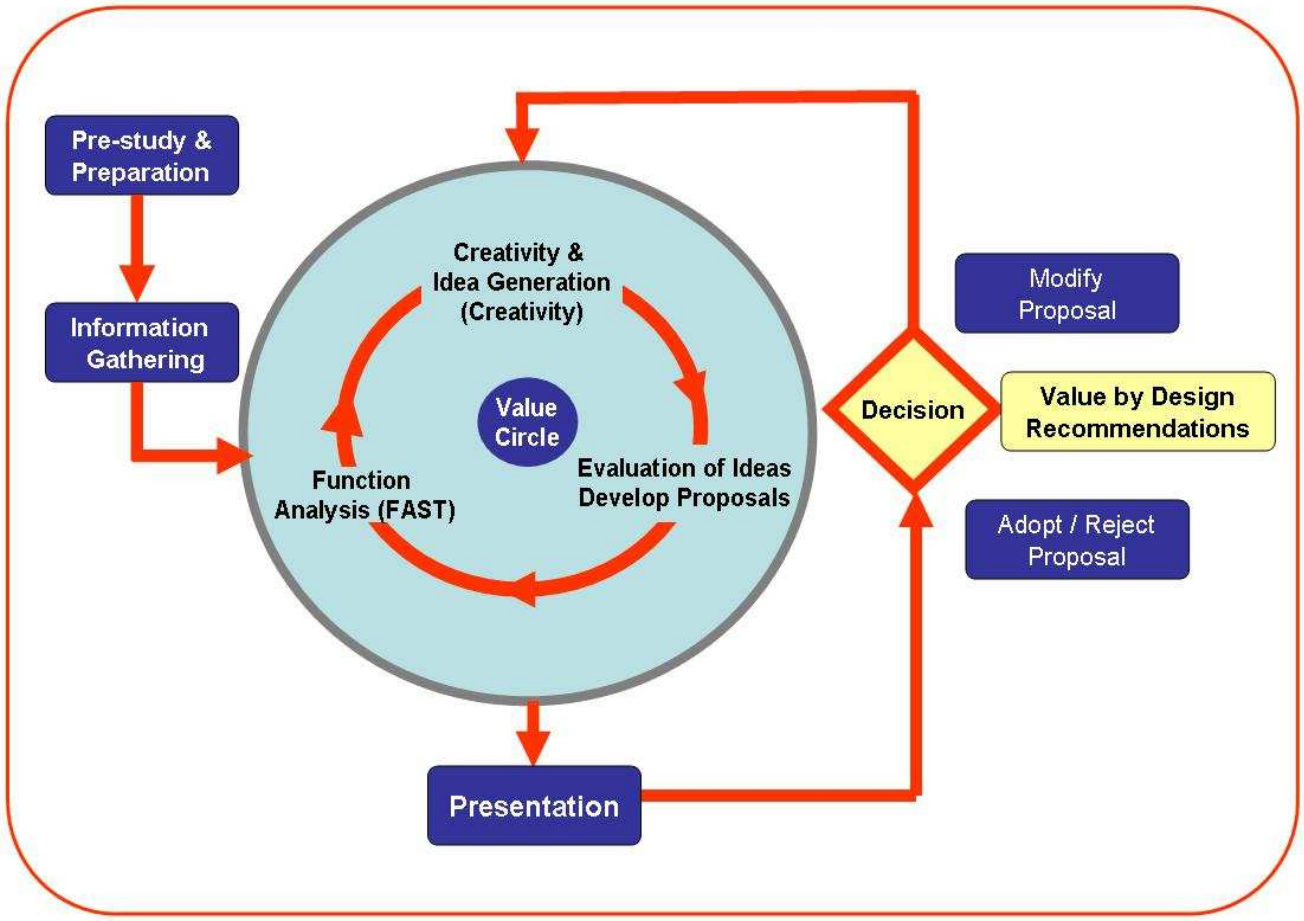
How is VbD different from conventional methods?

Conventional Approach	Value by Design Approach
Item oriented	Function oriented
Analytical, based on habits	Creative and Innovative not based on habits
Cost visibility by components (material, labor etc.)	Cost visibility by function (primary, secondary, etc.)
Individually oriented (cost engineer peer reviewer?)	Team oriented (brain storming/steering)
Financial Cost is the main (and only) concern	All 3 bottom lines are considered Financial Environmental Social
	Integrated Assessment model

IS THERE A GOOD TIME TO DO VBD?



Timing for Value by Design Study in Project life cycle



Value by Design – Schematic Process Model

Value by Design - Responsibility Matrix.

	Task	Project ponsor	Project Manager	Project Engineer	Task Manger	Engineering Managers	Principal Engineer
1	Value by Design Study (Overall)	I	A	R	R	I	I
2	Sourcing a Certified Value Specialist		I	A	R		
3	Sourcing workshop participants		C	A	R	C	I
4	Ensuring participation of RESC	I	A	R	R		
5	Conducting Value Workshop	I	C	A	R	I	I
6	Value by Design Report	I	C	A	R	I	I
7	Presenting Recommendations	I	C	A	R	I	C
8	Review & Sign-off on Recommendations	I	A	R	R	R	R
9	Follow-up Review & Reporting for Gates 3 & 4	I	A	R	R	C	C
10	Summary & Lessons learned	I	C	A	R	I	I

A - Accountable; R- Responsible; C: Consulted; I: Informed

Value based Sustainable Design

Corporate Sustainability Priorities and Goals

1. Specific priorities, e.g. community development, climate change, water conservation, etc.
2. Use of LEEDTM, SPiRiT, WSS Protocol, CHPS, Built Green, or other evaluation approaches.
3. Organization's sustainable design guidelines, e.g. use of integrated design, LCA/LCC, others.

Decision / Selection Criteria

Establish the decision criteria to be considered in evaluating and selecting design solutions: e.g.,

1. Corporate values.
2. Design principles.
3. Financial parameters/pro forma.
4. Life cycle cost analysis.
5. Environmental life cycle analysis.
6. Social Commitments

(Steven Page- Olympic Associates)

Critical Success Factors for VbD

Methodology / Standard SAVE process; use a CVS

Value job plan must be followed systematically

Attitude of Participants

Right attitude, appropriate stakeholders, awareness of process

Project Charter - Partnering

Create a project charter to clearly show the ‘vision’ subject to Corporate policies

Executive support

VbD workshops, sponsorship, implementation of results

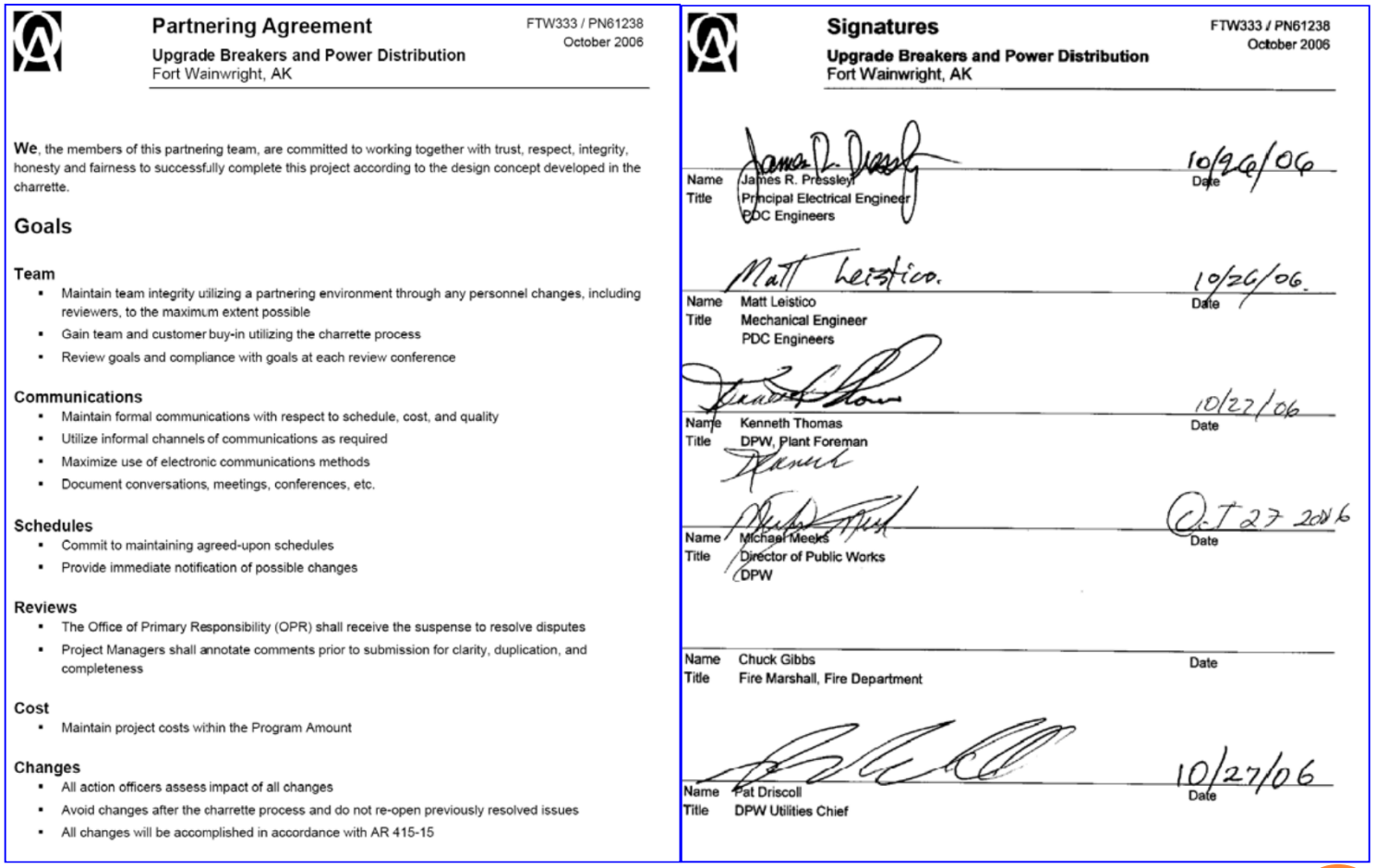
Management of Process

Clear objectives, timelines, review and feedback (who?, what?, when?)

Professional Workshop Facilitation

Probing with right questions, using appropriate tools, managing

the process, maintaining momentum of team, etc. etc.



Partnering Agreement

FTW333 / PN61238
October 2006

Upgrade Breakers and Power Distribution
Fort Wainwright, AK

We, the members of this partnering team, are committed to working together with trust, respect, integrity, honesty and fairness to successfully complete this project according to the design concept developed in the charrette.

Goals

Team
- Maintain team integrity utilizing a partnering environment through any personnel changes, including reviewers, to the maximum extent possible
- Gain team and customer buy-in utilizing the charrette process
- Review goals and compliance with goals at each review conference

Communications
- Maintain formal communications with respect to schedule, cost, and quality
- Utilize informal channels of communications as required
- Maximize use of electronic communications methods
- Document conversations, meetings, conferences, etc.

Schedules
- Commit to maintaining agreed-upon schedules
- Provide immediate notification of possible changes

Reviews
- The Office of Primary Responsibility (OPR) shall receive the suspense to resolve disputes
- Project Managers shall annotate comments prior to submission for clarity, duplication, and completeness

Cost
- Maintain project costs within the Program Amount

Changes
- All action officers assess impact of all changes
- Avoid changes after the charrette process and do not re-open previously resolved issues
- All changes will be accomplished in accordance with AR 415-15

Signatures

FTW333 / PN61238
October 2006

Upgrade Breakers and Power Distribution
Fort Wainwright, AK

Name James R. Pressley — Date 10/26/06
Title Principal Electrical Engineer
PDC Engineers

Name Matt Leistico — Date 10/26/06.
Title Mechanical Engineer
PDC Engineers

Name Kenneth Thomas — Date 10/27/06
Title DPW, Plant Foreman

Name Michael Meeks — Date 10-27-2006
Title Director of Public Works
DPW

Name Chuck Gibbs — Date
Title Fire Marshall, Fire Department

Name Pat Driscoll — Date 10/27/06
Title DPW Utilities Chief

Project Charter/Partnering Agreement

(Steven Page- Olympic Associates)

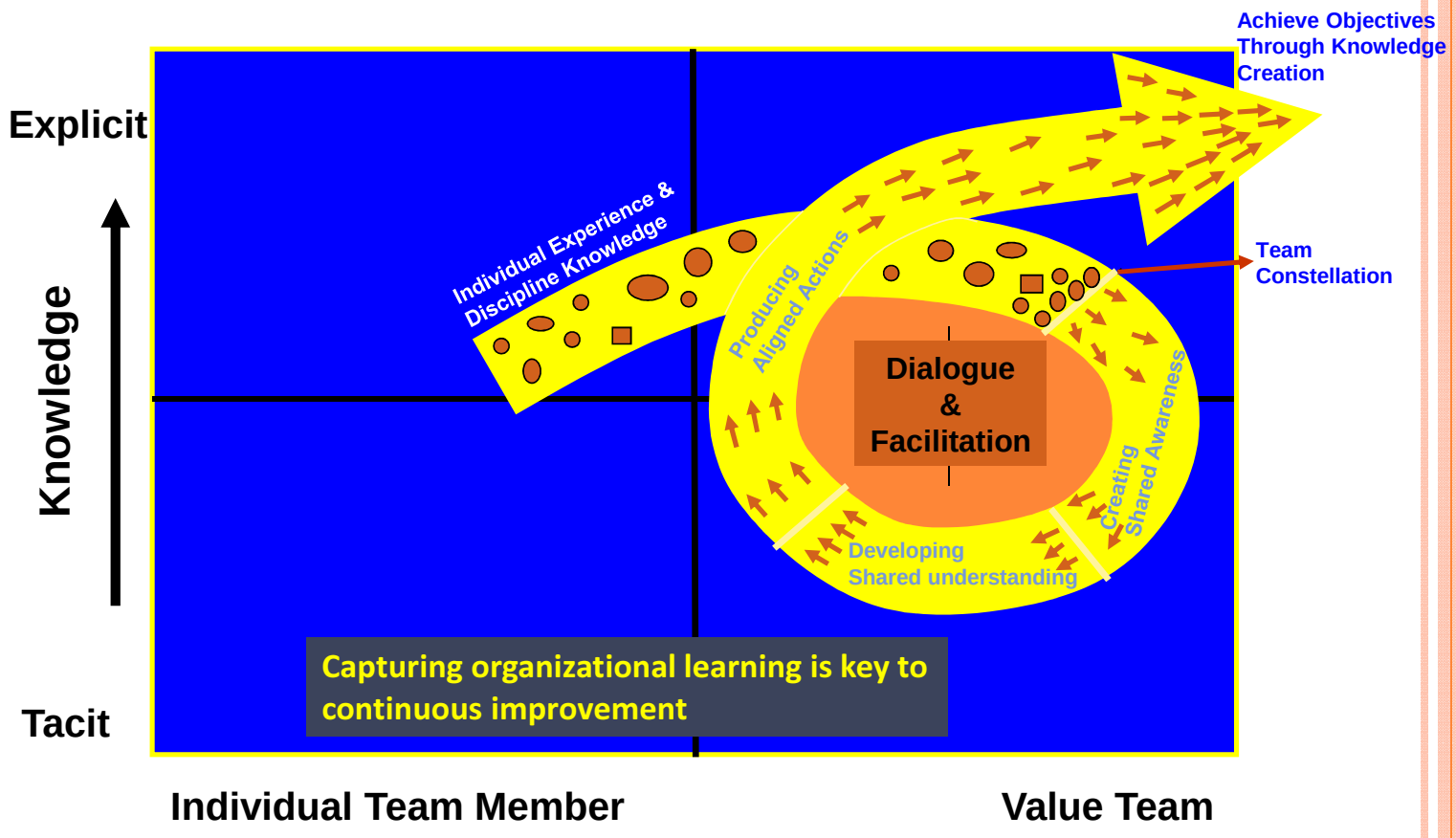
VbD Workshops

Multi-disciplined team approach

- Include all professionals
  (arch., struct., civil, mech., envi., and elec., etc.)
- Involve the Owner, Consultants and Construction Manager.
- Involve major stake holders
- Create a project charter (partnering?)
- Sustainability strategy and business guideline
- Strategic decision making guidelines
- Internal champion is a must
- Must be coordinated by a trained facilitator, CVS

Similar to VE Workshop,
but add specific Sustainability considerations/ resources

Value by Design – Knowledge Creation



Knowledge Creation Process in Value Team

VbD Phase	Agenda
Information Phase	•Conceptual presentation on Value Methodology •Conceptual presentation on Sustainability •Detailed Project Presentations •Defining Problem/Opportunities •Corporate guidelines / policies
Function Analysis	• Identifying Project Functions/FAST
Creativity	•Defining Targets •Creative Brainstorming / Brain steering
Evaluation	•Screening of Ideas to be Championed •Detailed Evaluation
Development	•Mid-Workshop Review Meeting with Owner/Agency •Technical Write-ups of VE Proposals
Presentation	• Team Presentation of VE Proposal

VbD Workshop Agenda

RECENT CASE STUDIES-

BC HYDRO

- **RUSKIN UPGRADE PROJECT – DAM & POWERHOUSE**
  - **Detailed case study of the Dam**

- **XXXXX PROJECT UPGRADING OF PENSTOCKS**
  - **Project is under development – Detailed case study**


Right Abutment
Concrete Dam
Radial gates & Roadway
Power plant

VBD* STUDY SUMMARY

- Value Ideas:
  - 176 'raw' Ideas Generated
  - 60 Ideas Shortlisted
  - 26 Ideas Developed in to VE Proposals

*** Originally done as a VE Study**

Summary of Proposals & Recommendations:

Rejected VE Proposals due to increased costs & not commensurate with benefits	2
VE Proposals considered for Design improvements (9 accepted)	12
Rejected VE Proposals after general considerations	7
Accepted VE Proposals for further consideration*	2
Accepted VE Proposals at the Preliminary Design*	3

Proposals with the highest impact

Design change Proposal adopted and are currently being constructed.

Install a plastic concrete cut off wall instead of jet grouting the right abutment slab

Financial

- **savings of $ 8.00 million – adopted**

Environmental benefits.

- **Less water pollution**
- **Fish flow maintenance**
- **Tree planting**
- **Taking care of species – animals and plants**

Social benefits –

- **First Nations sensitive areas avoided**
- **Sensitive areas enhanced with consultations**
- **Provided jobs to local native business owners**

Reduced use of land

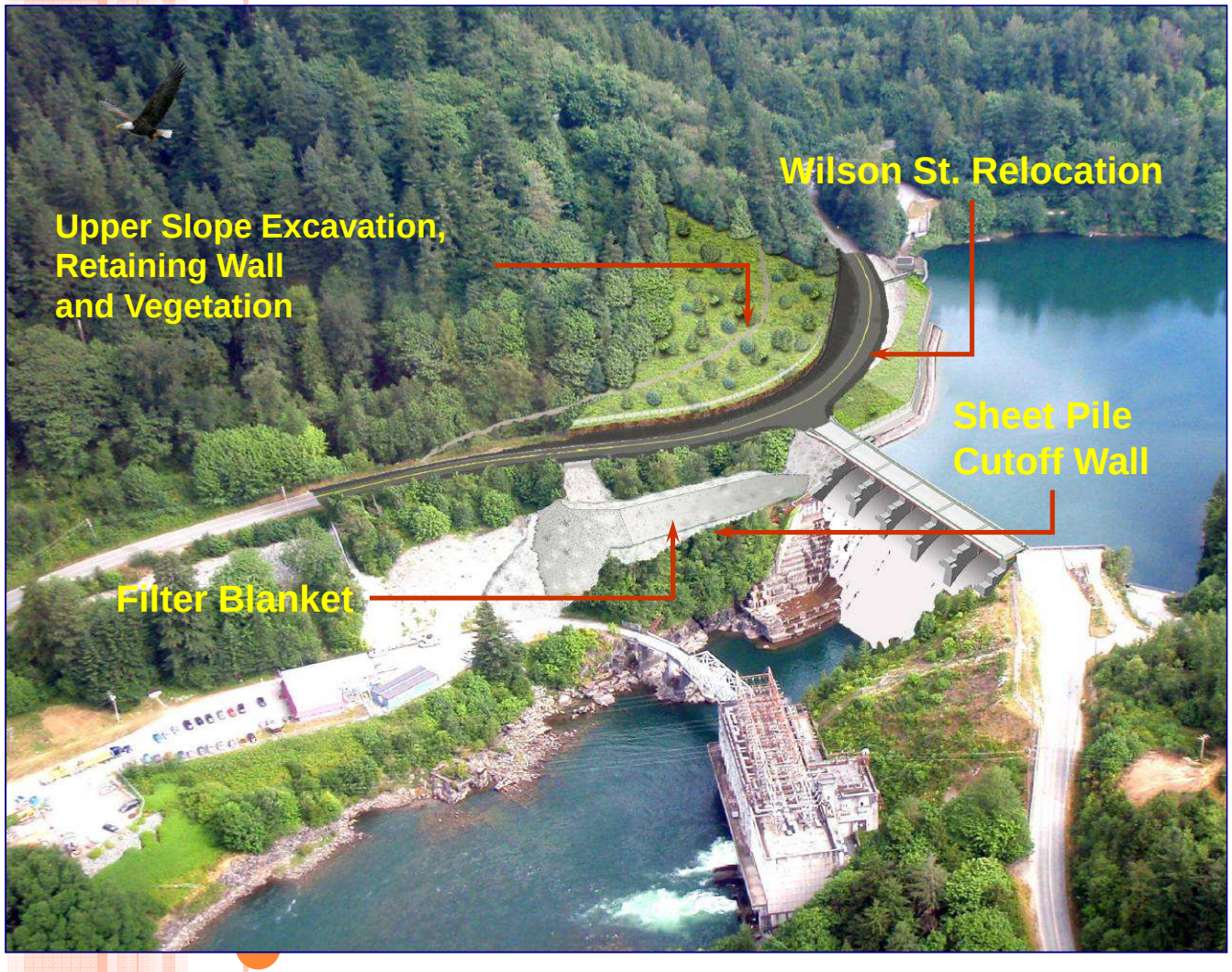
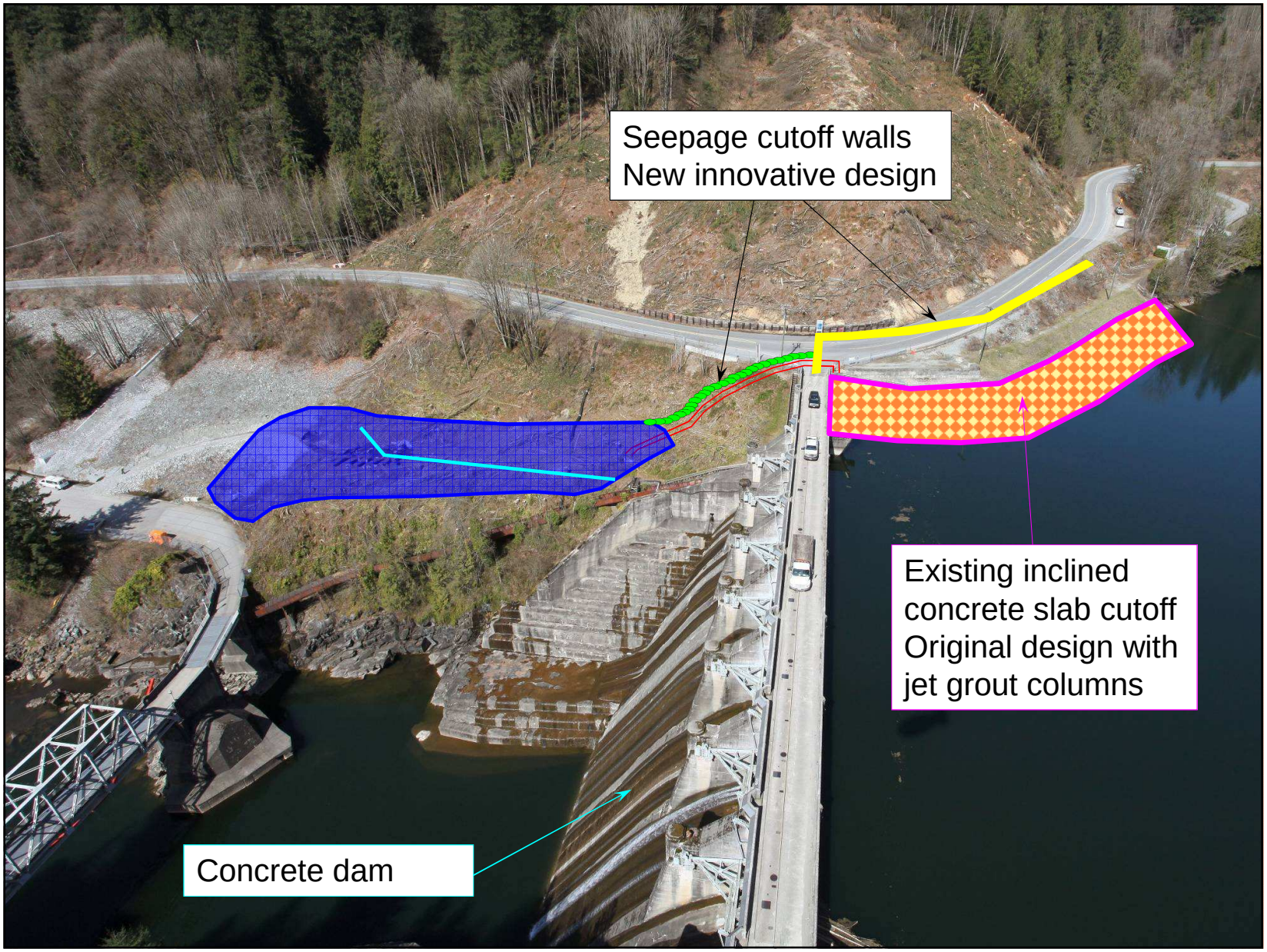


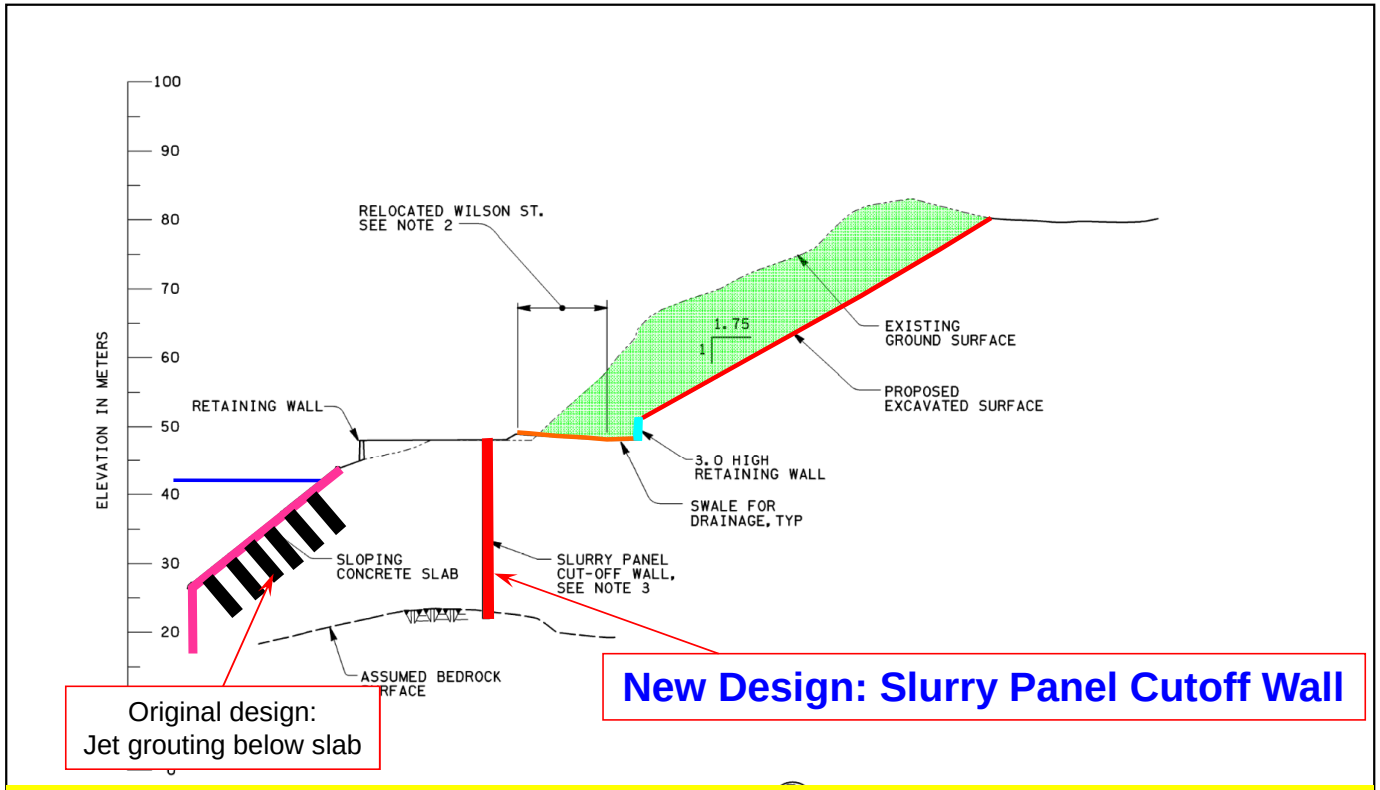
Photo Representation Of the Proposed work

Project Site

Upstream


Seepage cutoff walls
New innovative design
Existing inclined concrete slab cutoff
Original design with jet grout columns
Concrete dam

CUTOFF WALL AND EXCAVATION



A plastic concrete cut off wall instead of jet grouting

VE Proposal savings of $ 8.00 million – adopted

additional environmental benefits not quantified in $$.

Accomplishments - Ruskin Value Study.

1. VE proposals resulted in significant design decisions with impact on cost estimate. **Cost savings of a minimum of $8 million achieved with a potential for additional savings.** $150,000 was spent for the study.

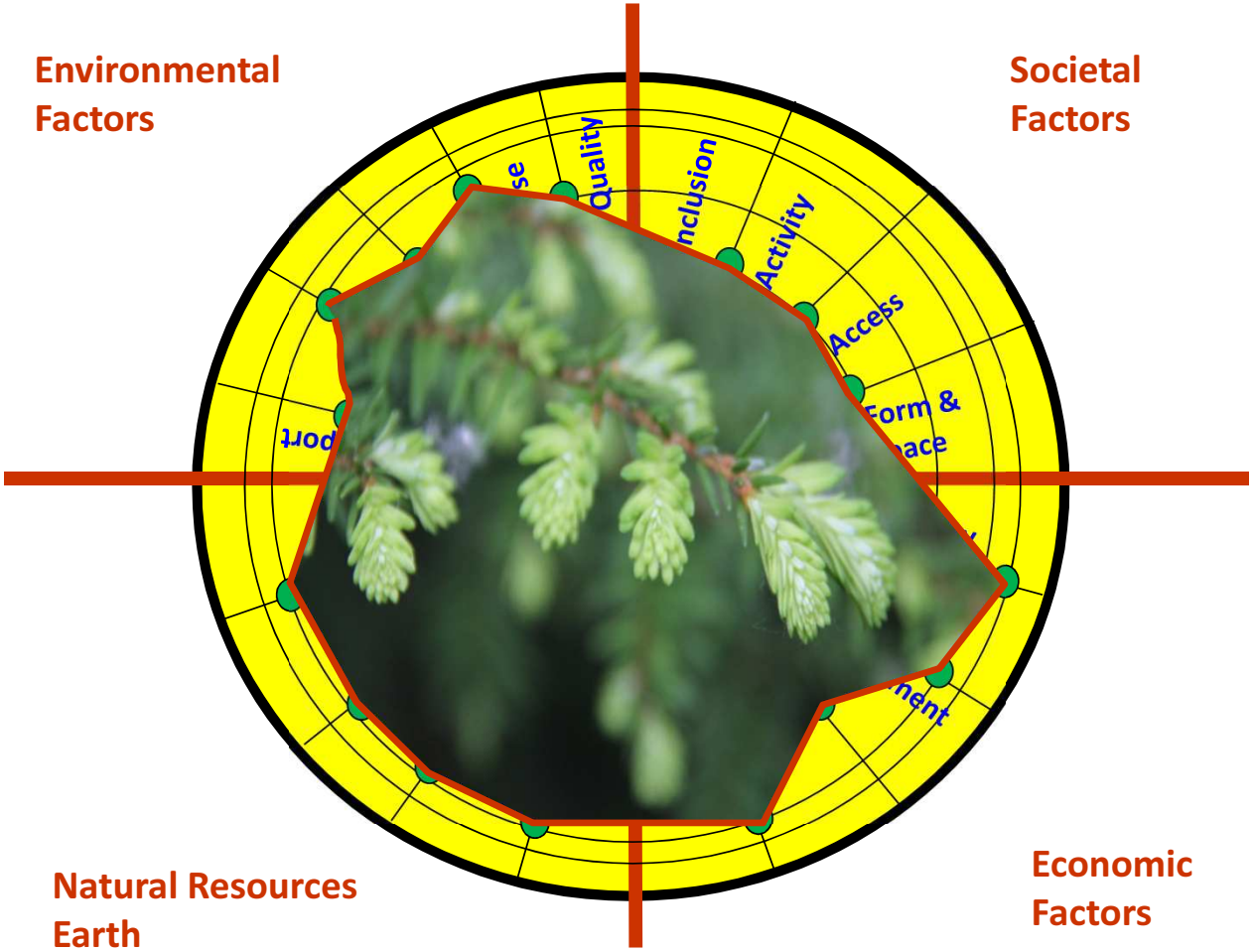
2. Several VE proposals adopted in design with no significant impact on cost, but **improved the quality of design.**

3. VE study resulted in **confirming that most of the design decisions thus far have been appropriate and thereby validating them**.

4. Established the **VE study as a tool for the management to ascertain that almost all possible design options have been studied** before making major design decisions.

5. Created **enhanced trust and reliance on the classic VE study** which will potentially be applied to all major projects in BC Hydro. This will hopefully result in a shift in culture of project delivery within the organization.

Sustainable Appraisal of the Ruskin Proposal*



** For demonstration only*

SPeAR Riches, 2003

Ruskin Dam VE Study

Winner of Outstanding Accomplishment

2009 SAVE Annual Conference – Detroit 29 June to 2 July 2009

BC Hydro
NCE- VE Consultants

RFP – Requirements of VbD Study

Review and evaluate the methods and approaches specified in the feasibility design documents developed to-date.

Study the effectiveness of the proposed design solutions, including scheduling and phasing

Develop and/or refine concepts or components to improve performance and/or reduce cost, while maintaining design standards and codes, safety and reliability.

Integrate ideas of Sustainability in the study
Social and environmental values to be considered along with life cycle financial impact

Integrate Safety by Design concepts in the study
Consider enhancement of Safety aspects for the project in the study

Case study-2. XXXXX PROJECT -

- UPGRADING OF PENSTOCKS
- Project is under development –

Value by Design

Strengths

- Optimization of Quality / Performance
- Overall Cost Optimization
- Appropriate, Sustainable Technology
- Sustainable (Reduce, Reuse and Recycle) Approach
- Enhanced Reliability & Safety
- Socially Responsible solutions
- Risk Mitigation (bad news upfront)

Limitations/Hurdles

- Value team should be involved right from the beginning
  - Company policy must be clear upfront
- Reliance on creativity and lateral thinking
  - Team work is a must
- Change in culture may be needed
  - Can result in many intangible changes
- Initial cost (time and effort) may be a deterrent
- Management may not see the importance

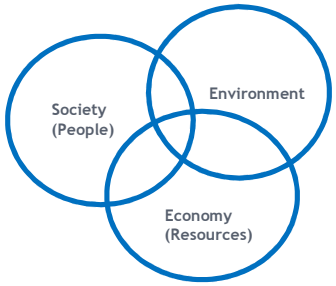
Value by Design & Sustainable development

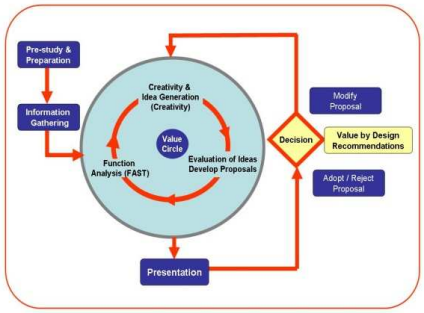
Potential Value Strategies include:

- **Partnership**
- **Partnering approach**
- **Input from public and stakeholders:**
- **Impact mitigation program for all affected parties**
- **Minimize public disruption**

- **Maximize Recycling**
- **Use of 'Green construction'**
- **Minimize green house gas emissions**
- **Environmental and noise monitoring during construction**
- **Tree protection and replanting /replacement program**

- **Optimized cost, minimize land use**
- **State of the art technology (long term planning)**
- **Integration of enhanced public safety, reliability**
- **The development to achieve triple bottom line balance .**





VALUE BY DESIGN !

- SYSTEMATIC APPROACH (VALUE METHODOLOGY)
- SUSTAINABILITY CONSIDERATIONS (NOT JUST $$)
- FULL USE OF CREATIVITY & TEAM WORK
- LIFE CYCLE – COST, MAINTENANCE, SUSTAINABILITY
  - Triple bottom line approach
- KNOWLEDGE TRANSFER AND ORGANIZATIONAL LEARNING
- GOOD SYNERGY WITH SAFETY BY DESIGN

In Summary….

Project - Infrastructure Renewal
Mission- Sustainable Development
Strategy- Value by Design
Partners - Public, Stakeholders
Project Team- Stewards
Result- A Sustainable Facility

Project Development Strategy
Value by Design


questions?