Life-cycle Value Assessment

A P2 TOOL

Canadian Pollution Prevention Roundtable

Wednesday June 11, 2003

Applying LCVA in a Company

STRATEGIC PLANNING

MANAGING = DECISION-MAKING

OPERATIONS

PERSONAL

Eco-efficiency

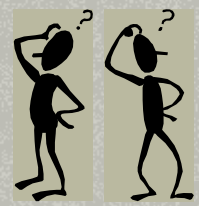
$$\text{Eco-efficiency} = \frac{\textit{Useful product or service}}{\textit{Undesirable wastes}}$$

getting the most of what we want for the minimal amount of impact.

Life-Cycle / Systems Thinking

Taking a systems approach to looking up and downstream ...

Raw Material Acquisition	Material Manufacture	Product Purchase	Use and Service	Retirement Disposal



With the objective to...

- ✓ Eliminate air, water, land pollutants,
- ✓ Minimize raw material use,
- ✓ Maximize social benefit,
- ✓ Optimize economic benefit.

Why Life-Cycle Value Assessment?

***Better** information for **better** decisions:*

- multi-disciplinary systems analysis
- improved financial and business grounding for decision-making (total cost analysis).
- cradle-to-cradle understanding of environment, economic, health and safety impacts and risks.
- reduced environmental “burden-shifting” and mis-directed environmental action.
- project design improvement = increased “eco-efficiency” and design for sustainability.

What does LCVA do?

1. Public and Government Approvals

2. Design Improvement

3. Approval for Expenditure

Early warning of key obvious and hidden issues.

Encourages continuous improvement.

Documents and supports the decision.

Life-Cycle Value Assessment

Engineering

Operations

Human Resources

Communications

Environmental

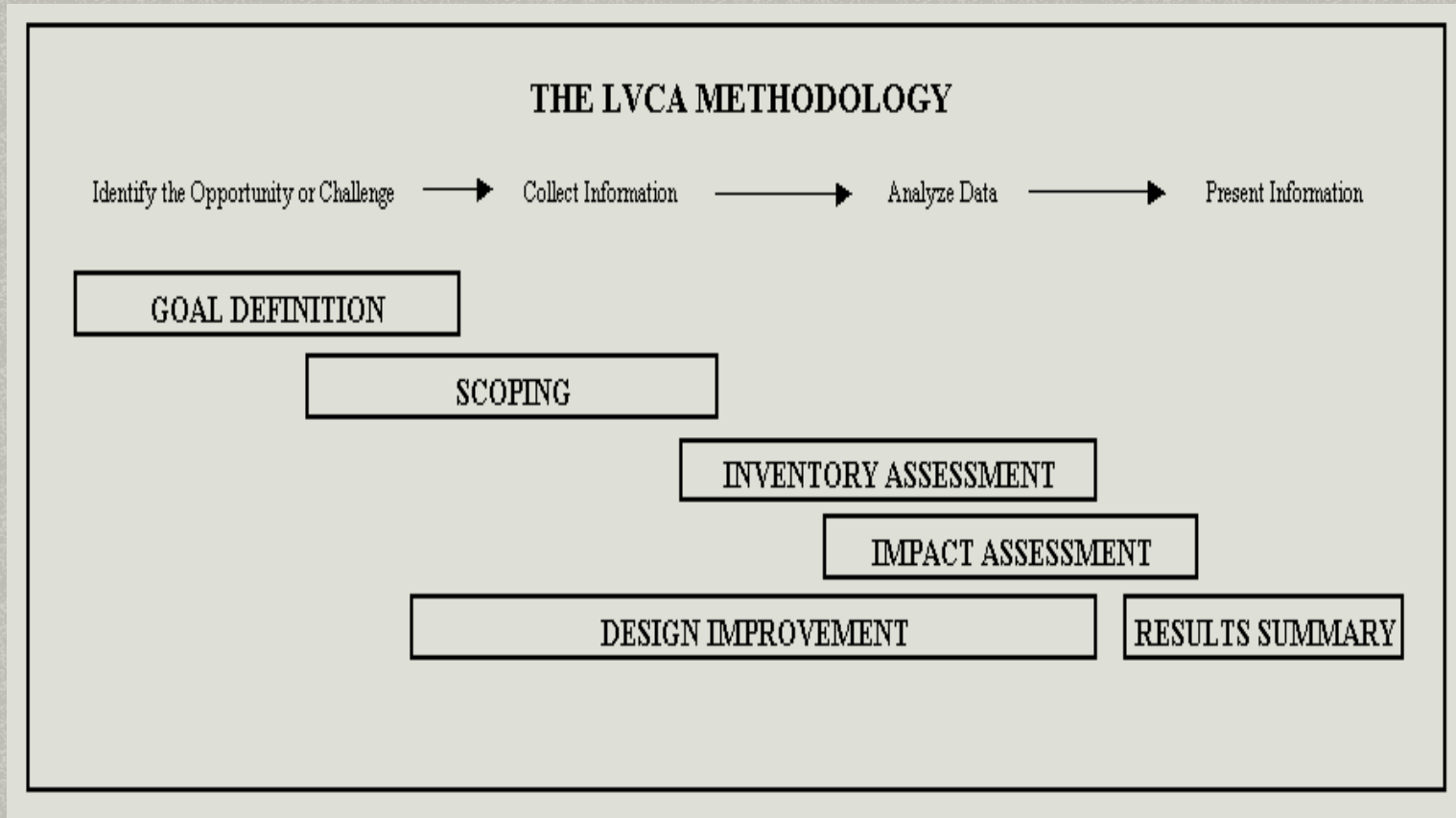
Finance

Safety

What does it take to complete an LCVA?

- Early identification of the opportunity
- A facilitator to bring the appropriate people together at the appropriate times
- Common understanding of the approach
- Project team commitment
- Open minds
- Support tools available

LCVA Methodology



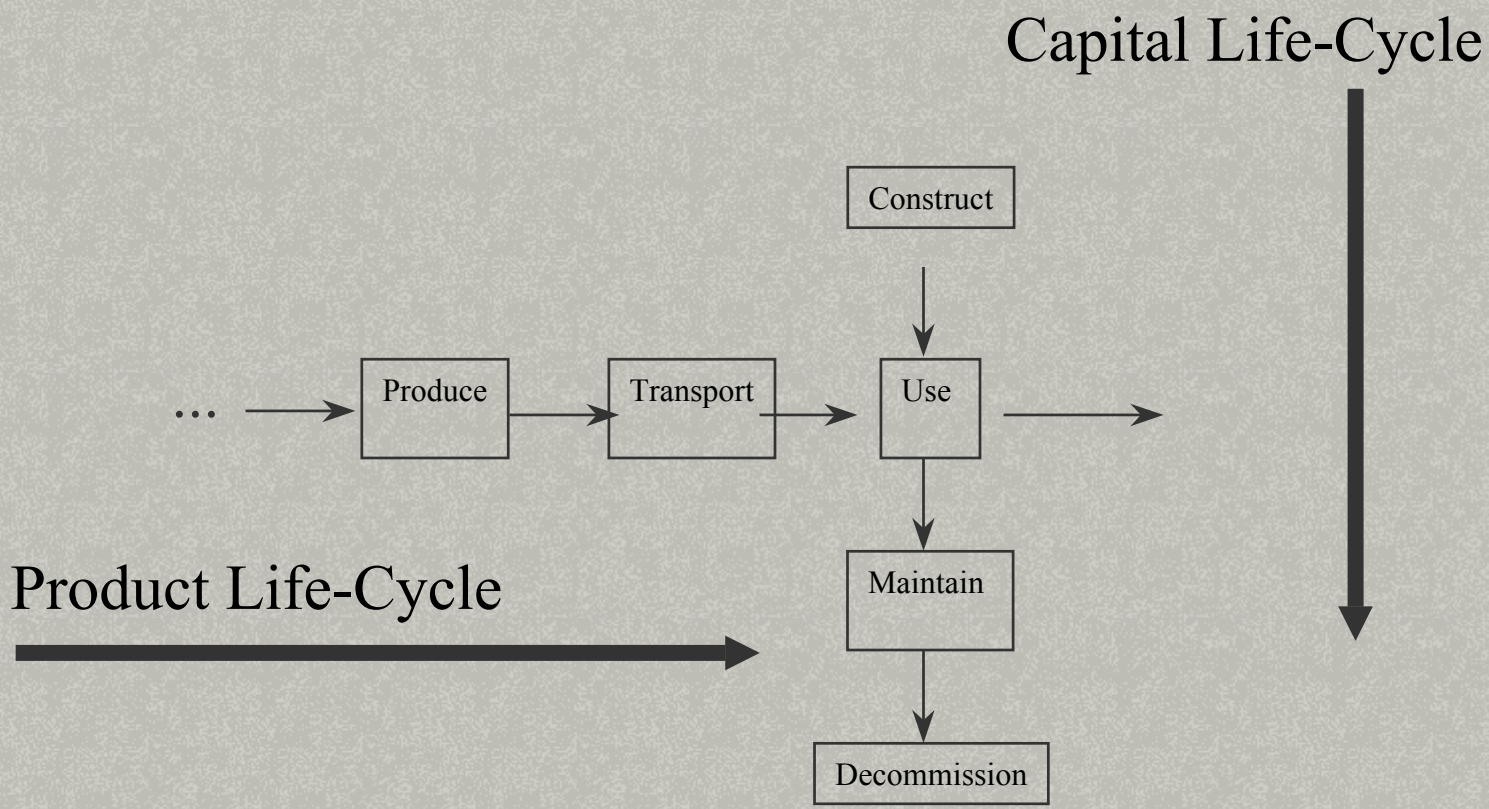
LCVA Outcomes by Step

1. Goal Definition	Clearly stated objectives outlining options to be evaluated, resources required, and audiences considered.
2. Scoping	Life-cycle process maps; Qualitative issues scan; Key stressor categories identified.
3. Inventory Assessment	Data collection and compilation; uncertainty analysis.
4. Impact Analysis	Results compared to specific context (background loadings, corporate targets).
5. Design Improvements	Push for eco-efficiency.

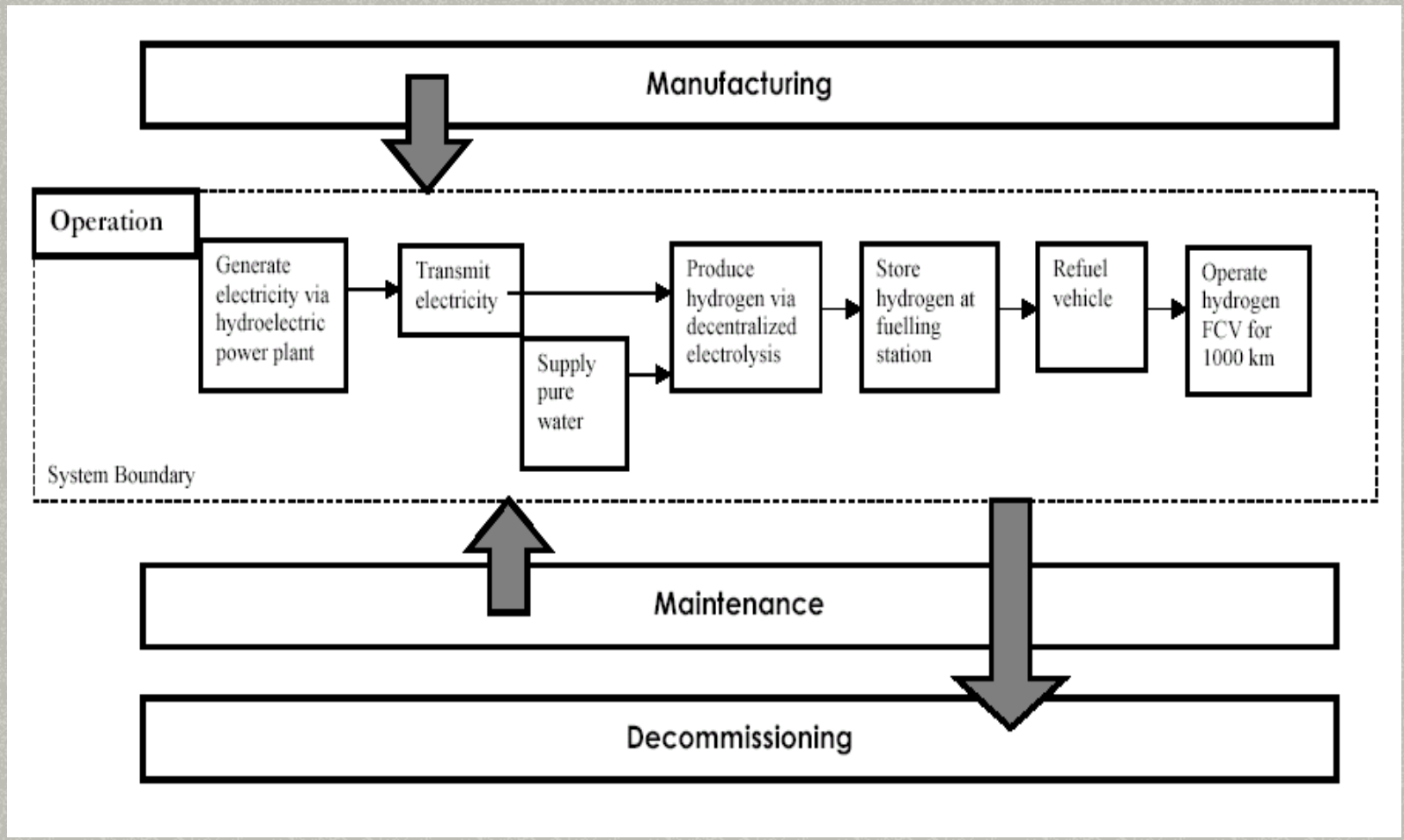
Levels of Application

- 80% of the benefit from 20% of the work!
- The scope, and level of detail and rigor must reflect the potential environmental and economic risk or opportunity being assessed
- A range of levels / approaches to be used:
  - complete LCVA for a major project
  - partial LCVA on select environmental stressors and select stages
  - basic life-cycle thinking as a way of evaluating options.

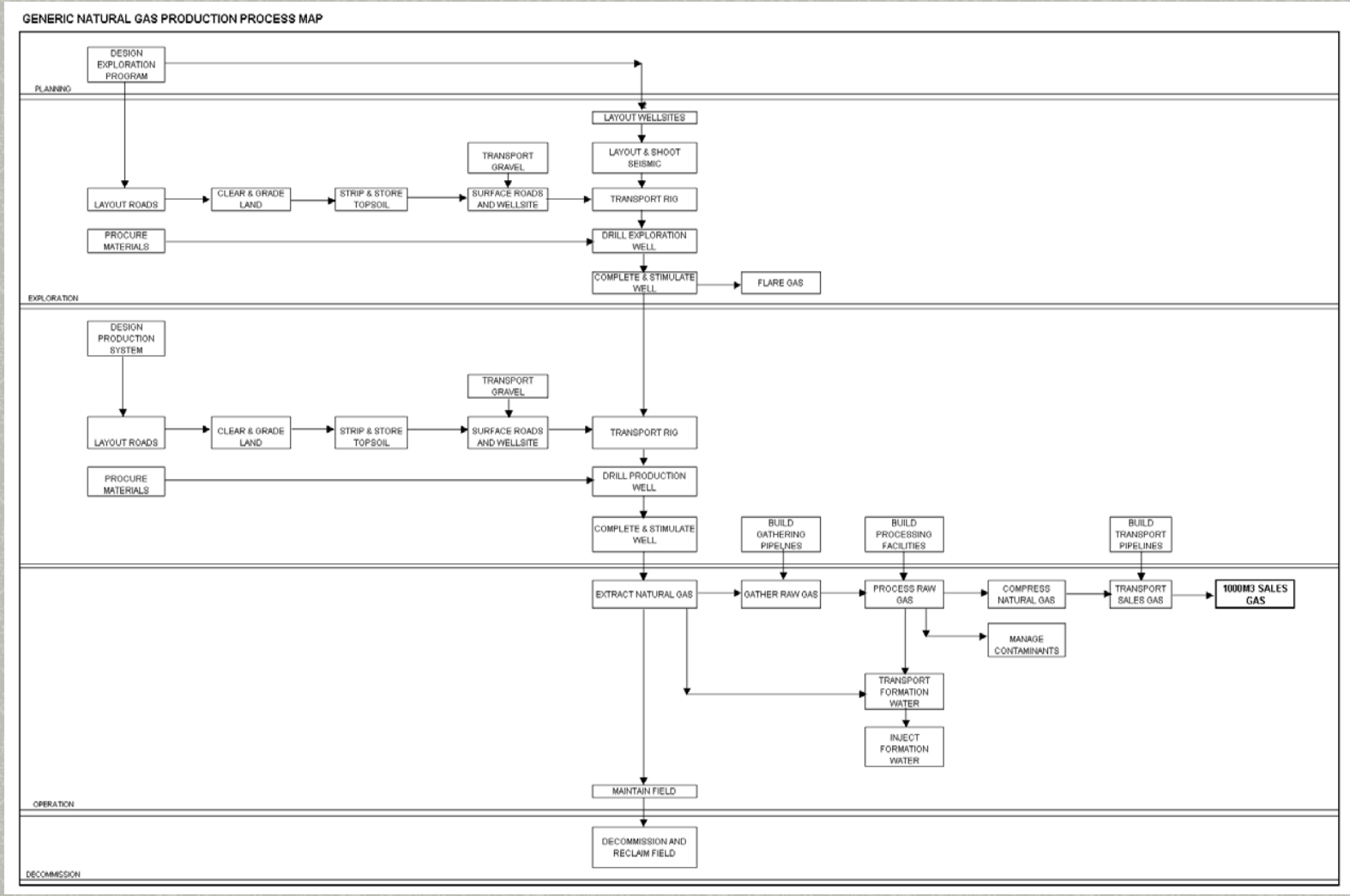
Building The Activity Map



Building The Activity Map



Activity Map: Natural Gas Production



Activity Scoping - Qualitative

PEMBINA INSTITUTE LCVA UNIT PROCESS SCOPING WORKSHEET

Upstream Process(es)

Primary:

Secondary Services, Operations, Materials:

UNIT PROCESS

#

Name:

Primary Output Unit:

(units)

Activities/Sub-Processes:

umptions:

erations:

Catastrophic Failure Considerations:

Potential Data Sources:

Downstream Process(es) or Product(s)

Primary:

Co-Products:

INPUTS

Economic Resources	*L/M/H*	*Notes/Questions*
Capital Expenditures		
Operating Costs		
Finance Implications		

Energy Resources	*L/M/H*	*Notes/Questions*
Electricity		
Nat. Gas		
Diesel		
Gasoline		
Propane		

Water Resources	*L/M/H*	*Notes/Questions*
Cooling		
Process		
Steam		

Land Resources	*L/M/H*	*Notes/Questions*
Footprint - Permanent		
Footprint - Temporary		

Human Resources	*L/M/H*	*Notes/Questions*

Community Contribution	*L/M/H*	*Notes/Questions*
Consultation		
Involvement		
Infrastructure		
Political Support		
Goods and Services		

OUTPUTS

Economic Impacts	*L/M/H*	*Notes/Questions*

Air Quality Impacts	*L/M/H*	*Notes/Questions*
Greenhouse Gas emissions		
Acid Rain Precursor emissions		
Smog and particulates		
Ozone Depletion		

Water Quality Impacts	*L/M/H*	*Notes/Questions*
Toxic Effluent		
Biological Oxygen Demand		
eat		

s	*L/M/H*	*Notes/Questions*
ste Disposal		
Wildlife/Wilderness/Habitat		
Cultural Property		
Recreational / Agricultural		

Health & Safety		
Career Progression		
Employment Equity		

Local Community Impacts	*L/M/H*	*Notes/Questions*
Health, Safety & Security		
Long Term Stability		
Community Investment		
Social Equity / Cultural		
Noise / Aesthetics		
Education / Capacity Building		

Economic Aspects

Material / Energy Flows

Environmental Aspects

Design Opportunities

Community Aspects

Workplace / Employees

Inventory Analysis - Qualitative

- Air emissions
  - Greenhouse gases (CO_2, CH_4, N_2O, CFC)
  - Acid deposition precursors (SO_X,NO_X, ammonia)
  - Ground level ozone (smog) precursors (NO_X, volatile organic chemicals)
  - Hazardous air pollutants (CO, NO_2, SO_2)
  - Particulate matter
  - Heavy Metals
- Land use
- Water use and impacts
- Resource use
- Community and consumer safety
- Internal and external costs and benefits

Inventory Analysis - Quantitative

Stressor Category	Contributing Factors	Unit of Measurement
1. Greenhouse Gases	CO_2, CH_4, N_2O	kg CO_2 Equivalents.
2. Acid Forming Emissions	SO_2, NO_x	kg SO_2 Equivalents.
3. Ground Level Ozone	VOCs, NO_x	kg VOC + NO_x.
4. Caribou Habitat	Loss of habitat area, increased access, noise.	Ha of caribou habitat impacted.
5. Old Growth Forest	Removal of old growth forest.	Ha of old growth forest cleared.
6. Rare Habitat	Clearing of areas with significant vegetation.	Ha of rare habitat impacted.
7. Fish Habitat	Disturbance of rivers during construction and operation.	Ha of fish habitat impacted and Number c stream crossings.

Design Improvement = P2

5.1 Identify key impact stages

5.2 Engage at Drawing Board:

- 5.2.1 innovations
- 5.2.2 new options
- 5.2.3 impact reduction/mitigation
- 5.2.4 design improvement checklist

5.3 Analyze potential Design Improvement

Improvement Assessment