Outline

- Framing Sustainable Development
  - Brundland definition
  - Consumption, Needs, Well-being
  - Suggested alternative that people and organizations can start to apply now

- Ways Life Cycle Methods might contribute
  - The essence of Life Cycle Assessment
  - Impacts of development in supply chains
  - Beneficience – *being* sustainable now
Sustainable Development

“Meeting the needs of the present without sacrificing the ability of future generations to meet their needs.”

-WCED (Brundtland Commission) 1987
Key themes in Brundtland definition

- **Human needs** at center
  - *Meeting them!*
  - Defining
    - Well-being
    - Health as a partial but powerful “barometer”
- How are needs met; how is the ability related to:
  * the state of the environment
  * abilities/patterns of consumption
  * other key factors
- **Not compromising ability of future generations**
Well-being, needs, commodities

Commodities (Income)

...anything else?

YOU BET!

Need Satisfaction

Max-Neef (92) insights about 4 existential categories and 5 types of satisfiers

Empirical needs: Biophysical Psychological

Well-being

Hedonic

Empirical Eudaimonic
Hedonic Well-being: Issues with Happiness

- Three components:
  - Life satisfaction
  - Presence of Positive mood aspects
  - Absence of Negative mood aspects

- Long-term reported life satisfaction:
  - More a personal characteristic than a result of situation/condition
  - People reluctant to report/entertain low life satisfaction

- Short-term mood versus long-term well-being
  - *Actions may provide temporary pleasure while compromising long-term satisfaction of basic needs*
happiness (1: not at all happy; 3.7 not very happy; 6.5: fairly happy; 9.3: very happy)
life satisfaction (1.2: extremely dissatisfied 4: as yet dissatisfied, 6.8: rather satisfied, 8.5 satisfied, 9.7 fully satisfied)

Per capita GDP Japan, From 1958 to 1991

Hofstetter and Madjar 2003
Two Frames of Well-being

• Hedonic well-being (“happiness”)
  – Subjective well-being
    • Aristippus, Hobbes, Bentham (utilitarian)
    • Diener 1984, Veenhoven, others
    • Hedonic Psychology: Kahneman et al., 1999

• Eudaimonic (thriving, being-well, actualizing)
  • Aristotle, Fromm, and many others
  • Deci, Ryan, Csikszentmihalyi, others
  • *Evolutionary psychology; observation of human thriving; happiness, vitality, mental and psychological health*
Need Satisfier classes and behavior

- **Synergic**: satisfy multiple needs at once (e.g., education)
- **Singular**: satisfy one need (e.g., insurance)
- **Inhibiting**: satisfy one, inhibit others (e.g., excess work)
- **Pseudo**: false sensation of satisfying, may impair (status symbols)
- **Violators and destructors**: false solution, may prevent actual solution while impairing other needs (govt. bureaucracy for security)
Max-Neef (1992): 9 Basic Needs

<table>
<thead>
<tr>
<th>Need</th>
<th>Having</th>
<th>Doing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsistence</td>
<td>Food, shelter, work</td>
<td>Eat, rest, procreate</td>
</tr>
<tr>
<td>Protection</td>
<td>Insurance/health/social security systems, savings, rights, etc.</td>
<td>Cooperate, prevent, plan, take care of, cure, help</td>
</tr>
<tr>
<td>Affection</td>
<td>Friendships, family, partnerships</td>
<td>Love, caress, share, take care of, cultivate, appreciate</td>
</tr>
<tr>
<td>Understanding</td>
<td>Literature, teachers, method, ed./communication policies</td>
<td>Investigate, study, educate, experiment, analyze, meditate</td>
</tr>
<tr>
<td>Participation</td>
<td>Rights, responsibilities, duties, privileges, work</td>
<td>Affiliate, cooperate, propose, share, dissent, agree, etc.</td>
</tr>
<tr>
<td>Leisure</td>
<td>Games, spectacles, clubs, parties, peace of mind</td>
<td>Play, daydream, brood, relax, practice</td>
</tr>
<tr>
<td>Creation</td>
<td>Abilities, skills, method, job</td>
<td>Work, invent, build, design, etc.</td>
</tr>
<tr>
<td>Identity</td>
<td>Symbols, language, religions, customs, values, norms, history</td>
<td>Commit, integrate, confront, decide, actualize, grow</td>
</tr>
<tr>
<td>Freedom</td>
<td>Equal rights</td>
<td>Dissent, choose, commit, risk, etc.</td>
</tr>
</tbody>
</table>
Meeting Needs

- Largely through actions, not things
- The ability of these actions to meet needs depends strongly on:
  - Quality of relationships
  - Time and attention
  - Abilities
- Many of these actions which are by definition intrinsically valuable, also generate benefits for others
Briefly about the more physical needs: Jerome Segal and Societal Efficiency

- Societal Efficiency: Need satisfaction per unit of income
- The inverse of the income required to meet one’s basic needs
- The modern USA is probably the most societally inefficient civilization the world has ever seen.
Food

• Middle class standard from Segal: “A person eats nutritiously, hosts with pride, eats diverse foods of good quality, celebrates holidays, eats produce out of season, purchases lunch in the workplace, and occasionally takes the family out for dinner.”

• Based on current spending: $1715 - $2212
Shelter

“Lives in a house or apartment with protection from the elements, with sufficient light and ventilation to sustain good health.

“Lives in sanitary and spacial conditions not generally viewed as disgraceful.

“Lives in a neighborhood where children can safely be outside alone.

“Lives where there is access to good public schools.”
Current Paradigm

• Products deliver function to user
  – These functions *may* meet basic needs to promote thriving of user, or not
• Product use generates negative impacts throughout LC
• Goal: Given the existence of the person, minimize his/her negative impacts on the world, by:
  – Finding greenest products; greening lifestyles
  – Making products greener
• At best, one person’s thriving is everyone else’s loss
• World would be better off without me
Reframing sustainable development

Thriving in ways that enhance the ability of others to thrive, present and future.
Thriving in ways that promote thriving

- Study, reduce the negative impacts of our consumption and actions
- Create enough positive benefits elsewhere in the world to more than off-set the negative impacts
- Enable innovations that reduce negative impacts
- Take actions, intrinsically valuable, which also generate benefits for others, including those which build/promote:
  - Quality of relationships
  - Time and attention
  - Abilities
Thriving in ways that promote thriving

- Study, reduce the negative impacts of our consumption and actions
... is dioxin-free, right?
“Show me the data.”

“How many grams, and how does that compare with our other impacts, like climate change?”

“And I've been wondering about all the jar-washing by our customers...”

“And what can we do about these issues ??”
Life Cycle Assessment

- Internationally Standardized (ISO 14040, 14044)
  - Think broadly: Life cycle, cradle-to-next-life
  - Think deeply: Impacts, endpoints
  - Think quantitatively: data
  - Think comparatively: what if we change xyz?
  - Think systematically: standards, transparency
LCA Defined: ISO 14040

Life Cycle Assessment Framework

Goal & Scope Definition

Inventory Analysis

Impact Assessment

Interpretation

Direct Applications:
- Product Development & Improvement
- Strategic planning
- Public policy making
- Marketing
- Other
Life Cycle Inventory Analysis

Releases to environment

Extracts from environment
Life Cycle Inventory Analysis
What is a Unit Process?

- ISO: “The level at which data are gathered”
### Inventory results (LCI)

<table>
<thead>
<tr>
<th>Substance</th>
<th>Compartment</th>
<th>Unit</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>Air</td>
<td>mg</td>
<td>27</td>
</tr>
<tr>
<td>Ammonia</td>
<td>Air</td>
<td>mg</td>
<td>778</td>
</tr>
<tr>
<td>Ammonium carbonate</td>
<td>Air</td>
<td>mg</td>
<td>241</td>
</tr>
<tr>
<td>Antimony</td>
<td>Air</td>
<td>µg</td>
<td>95.2</td>
</tr>
<tr>
<td>Antimony-124</td>
<td>Air</td>
<td>nBq</td>
<td>33</td>
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<tr>
<td>Antimony-125</td>
<td>Air</td>
<td>nBq</td>
<td>344</td>
</tr>
<tr>
<td>Argon-41</td>
<td>Air</td>
<td>Bq</td>
<td>7.34</td>
</tr>
<tr>
<td>Arsenic</td>
<td>Air</td>
<td>µg</td>
<td>37</td>
</tr>
<tr>
<td>Barium</td>
<td>Air</td>
<td>µg</td>
<td>100</td>
</tr>
<tr>
<td>Barium-140</td>
<td>Air</td>
<td>µBq</td>
<td>22.3</td>
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<tr>
<td>Benzaldehyde</td>
<td>Air</td>
<td>ng</td>
<td>17.5</td>
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<tr>
<td>Benzene</td>
<td>Air</td>
<td>mg</td>
<td>5.74</td>
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<tr>
<td>Benzene, ethyl-</td>
<td>Air</td>
<td>µg</td>
<td>149</td>
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<tr>
<td>Benzene, hexachloro-</td>
<td>Air</td>
<td>ng</td>
<td>56.2</td>
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<tr>
<td>Benzene, pentachloro-</td>
<td>Air</td>
<td>ng</td>
<td>80.9</td>
</tr>
<tr>
<td>Benzo(a)pyrene</td>
<td>Air</td>
<td>µg</td>
<td>23.7</td>
</tr>
<tr>
<td>Beryllium</td>
<td>Air</td>
<td>ng</td>
<td>227</td>
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<tr>
<td>Boron</td>
<td>Air</td>
<td>mg</td>
<td>9.67</td>
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<tr>
<td>Bromine</td>
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<td>µg</td>
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<td>Butadiene</td>
<td>Air</td>
<td>µg</td>
<td>23.4</td>
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<tr>
<td>Butane</td>
<td>Air</td>
<td>mg</td>
<td>10.7</td>
</tr>
<tr>
<td>Butene</td>
<td>Air</td>
<td>µg</td>
<td>146</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Air</td>
<td>µg</td>
<td>106</td>
</tr>
<tr>
<td>Calcium</td>
<td>Air</td>
<td>mg</td>
<td>1.36</td>
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<tr>
<td>Carbon-14</td>
<td>Air</td>
<td>Bq</td>
<td>28.6</td>
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<tr>
<td>Carbon dioxide, biogenic</td>
<td>Air</td>
<td>g</td>
<td>45.2</td>
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<tr>
<td>Carbon dioxide, fossil</td>
<td>Air</td>
<td>kg</td>
<td>2</td>
</tr>
<tr>
<td>Carbon disulfide</td>
<td>Air</td>
<td>mg</td>
<td>11.4</td>
</tr>
<tr>
<td>Carbon monoxide, biogenic</td>
<td>Air</td>
<td>mg</td>
<td>24.4</td>
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<tr>
<td>Carbon monoxide, fossil</td>
<td>Air</td>
<td>g</td>
<td>28.4</td>
</tr>
<tr>
<td>Sulfur</td>
<td>Air</td>
<td>µg</td>
<td>4.9</td>
</tr>
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</table>

### Impact Assessment results

<table>
<thead>
<tr>
<th>Impact category</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinogens</td>
<td>2.35E-5</td>
</tr>
<tr>
<td>Resp. organics</td>
<td>3.03E-6</td>
</tr>
<tr>
<td>Resp. inorganics</td>
<td>0.0011</td>
</tr>
<tr>
<td>Climate change</td>
<td>0.000432</td>
</tr>
<tr>
<td>Radiation</td>
<td>1.21E-6</td>
</tr>
<tr>
<td>Ozone layer</td>
<td>5.16E-9</td>
</tr>
<tr>
<td>Ecotoxicity</td>
<td>1.15E-5</td>
</tr>
<tr>
<td>Acidification/ Eutrophication</td>
<td>0.000123</td>
</tr>
<tr>
<td>Land use</td>
<td>1.85E-6</td>
</tr>
<tr>
<td>Minerals</td>
<td>1.3E-6</td>
</tr>
<tr>
<td>Fossil fuels</td>
<td>0.00624</td>
</tr>
</tbody>
</table>
Life Cycle Impact Assessment

- Origins
  - Global warming potentials (GWPs)
  - Ozone depletion potentials (ODPs)

  - Origin outside LCA
  - Reasonable international acceptance
  - Indicators, equivalency measures, not damage calculations
  - Permit summation within impact category
The greenhouse mechanism

Electromagnetic Radiation

CO₂, N₂O, CH₄, etc.

Infrared Radiation

Btu / year

years
Climate Change

- Emissions (e.g., CFCs, HFCs, CO₂)
  - Chemicals trap heat otherwise reflected back to atmosphere
    - Global warming potential (GWP)
      - Based on chemical’s radiative forcing and lifetime
        - Climate change affects temperature, precipitation, and sea level
          - Human health (e.g., malaria)
          - Agricultural effects
          - Forest effects
          - Water resource effects
          - Species damage
          - Coastal area damage

Endpoints
www.nrel.gov/lci

Life-Cycle Inventory Database Project

NREL, along with the Athena Sustainable Materials Institute, is leading an effort to develop a publicly available U.S. life-cycle inventory (LCI) database to track the environmental impact of commonly used materials, products, and processes. The project objective is to provide a central source for critically reviewed LCI data that is developed in accordance with a common research protocol, is consistent with international standards, and is maintained by a credible agency.

About the LCI Project
Project motivation and participants

Planning & Progress
Process review and recommended data development

Database
Life-cycle inventory data

Life-Cycle Inventory Database

This database provides life-cycle inventory data to support public, private, and non-profit sector efforts to develop product life-cycle assessments, support systems, and tools.

Support
Financial support is provided by the U.S. Department of Energy’s Office of Energy Efficiency and Renewable Energy, the GSA, the EPA, and the U.S. Navy. The private sector also provided funding.

A joint initiative of the ETH domain and Swiss Federal Offices

- Version 2: 3500+ processes
- Extensive environmental flow data
- Comprehensive technosphere data
The Global Burden of Disease

Approximate shares of global burden of disease (in DALYs) by risk factor category

- Childhood and maternal undernutrition: 28%
- Other diet-related risks and physical inactivity: 23%
- Addictive substances: 16%
- Environmental risks: 15%
- Occupational risks: 3%
- Sexual and reproductive health risks: 13%
- Other selected risks to health: 2%

Based on data from Annex Table 10, WHO 2002
Environmental Risk Factors

Global Burden of Disease, Environmental Risks, 2000

- Unsafe water, sanitation and hygiene: 45%
- Indoor smoke from solid fuels: 32%
- Lead exposure: 11%
- Climate change: 5%
- Urban air pollution: 7%

Based on data from Annex Table 12, WHO 2002
Can product policy do something about the other 97% of the global burden of disease?
Is product policy *already influencing* the other 97% of the global burden of disease? Beneficially? Burden-shifting?
A Fuller View of Life Cycles

- Consumption $\rightarrow$ economic activities $\rightarrow$
  - Pollution and resource consumption
  - Livelihoods, employment, income
  - Taxes $\rightarrow$ public investment

- Changes in livelihoods $\rightarrow$
  - Health, education, economic participation of families, descendants

- Changes in taxes $\rightarrow$ Investment in:
  - Infrastructure
  - Human development
  - Technology
Development influences health

- Long-term effect, observed in cross sectional and time series, within and between countries
- Effect confirmed controlling for influence of health on employability
Mean life expectancy and Per Capita GNP 1999 (PPP)

Chapter 12, Tables 1 and 2
Step 1: Life expectancy = \( f(\text{GDPPC}) \)

- **Data:** World Bank 2002: 126 countries
- **Model form:**
  - LE = life expectancy, in years
  - GDPPC = GDP per capita, 1999 $, adjusted for purchasing power parity

\[
LE = a - b \times \text{GNPPC}^{-c}
\]

<table>
<thead>
<tr>
<th></th>
<th>Male life expectancy</th>
<th>Female life expectancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>82</td>
<td>87</td>
</tr>
<tr>
<td>b</td>
<td>639</td>
<td>1176</td>
</tr>
<tr>
<td>c</td>
<td>0.44</td>
<td>0.52</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.78</td>
<td>0.81</td>
</tr>
</tbody>
</table>
Step 2: Life years saved = \( f(\Delta GDP) \)

\[ \Delta YL = Pop \ast \left[ LE(GDPPC_1) - LE(GDPPC_0) \right] \]

\[ \Delta YL = Pop \ast \left[ (a - b \ast GDPPC_1^{-c}) - (a - b \ast GDPPC_0^{-c}) \right] \]

\[ \Delta YL = b \ast Pop^{c+1} \left[ GDP_0^{-c} - \left( GDP_0 + \Delta GDP \right)^{-c} \right] \]

Specific to each LCA or product

Specific to each country or region
## Characterization Factors

<table>
<thead>
<tr>
<th></th>
<th>(per $1M GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean of M&amp;F</strong></td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>80</td>
</tr>
<tr>
<td>Norway</td>
<td>95</td>
</tr>
<tr>
<td>United States</td>
<td>95</td>
</tr>
<tr>
<td>Japan</td>
<td>102</td>
</tr>
<tr>
<td>Singapore</td>
<td>105</td>
</tr>
<tr>
<td>Austria</td>
<td>127</td>
</tr>
<tr>
<td>Belgium</td>
<td>133</td>
</tr>
<tr>
<td>Germany</td>
<td>134</td>
</tr>
<tr>
<td>Netherlands</td>
<td>137</td>
</tr>
<tr>
<td>Sweden</td>
<td>140</td>
</tr>
<tr>
<td><strong>Delta</strong></td>
<td></td>
</tr>
<tr>
<td>pers life yrs</td>
<td></td>
</tr>
<tr>
<td>Switzerland</td>
<td>80</td>
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<td>Norway</td>
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<td>United States</td>
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<td>Japan</td>
<td>102</td>
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<td>Singapore</td>
<td>105</td>
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<tr>
<td>Austria</td>
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<td>Belgium</td>
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<td>Netherlands</td>
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<tr>
<td>Sweden</td>
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<tr>
<td>Country</td>
<td>Mean of M&amp;F Delta (per $1M GDP)</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Switzerland</td>
<td>80</td>
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<tr>
<td>Norway</td>
<td>95</td>
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<td>United States</td>
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<td>Japan</td>
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<td>Singapore</td>
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<td>Austria</td>
<td>127</td>
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<td>Belgium</td>
<td>133</td>
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<tr>
<td>Germany</td>
<td>134</td>
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<tr>
<td>Netherlands</td>
<td>137</td>
</tr>
<tr>
<td>Sweden</td>
<td>140</td>
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<tr>
<td>Burkina Faso</td>
<td>66,575</td>
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<tr>
<td>Madagascar</td>
<td>69,033</td>
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<tr>
<td>Mozambique</td>
<td>73,607</td>
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<tr>
<td>Eritrea</td>
<td>75,387</td>
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<tr>
<td>Mali</td>
<td>75,486</td>
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<tr>
<td>Chad</td>
<td>83,681</td>
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<td>Angola</td>
<td>86,113</td>
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<tr>
<td>Tanzania</td>
<td>90,401</td>
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<tr>
<td>Niger</td>
<td>93,161</td>
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<tr>
<td>Malawi</td>
<td>103,863</td>
</tr>
<tr>
<td>Burundi</td>
<td>168,427</td>
</tr>
<tr>
<td>Sierra Leone</td>
<td>178,908</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>194,458</td>
</tr>
</tbody>
</table>
Practical Example:
1.6M Electricity in Netherlands

- Netherlands
- 153 different sectors
- Europe OECD
- 33 sectors
- Non-Europe OECD
- 33 sectors
- Rest of World
- 33 sectors
- Rest of World
- 33 sectors
- Rest of World
- 33 sectors
Global distribution of stimulated economic activity
Global distribution of health impacts of life cycle pollution

- Disability-adjusted life-years
  - NL
  - OECD
  - Rest of world

- Ozone layer
- Climate change
- Respiratory inorganics
- Respiratory organics
- Carcinogens
Global distribution of health impacts of development

- PM Health
- Socio-Econ Health

Disability-Adjusted Life-Years

Netherlands
OECD
Rest of World
Socio-Econ Health
PM Health
Global distribution of health impacts of development

- **Pollution health losses**
- **Socio-econ health gains**

**Legend:**
- NL
- OECD
- Rest of world

**DALYs**

- 10000
- 1000
- 100
- 10
- 1
- 0.1

**Y-axis:** DALYs

**X-axis:** NL, OECD, Rest of world
“Averages” from Macro-Modeling

- Health Impacts
- Pollution
- Socio-economic
“Averages” from Macro-Modeling

How measure + report case-specific impacts?

How achieve high benefits, not major damage?
Task Force Integration of social aspects into LCA

Objectives:
How to include social impacts in the methodology of Life Cycle Assessment (LCA)

Members:
Approximatively 40 members
Chair: Bernard Mazijn (Belgium)
Multidisciplinary Team: Businesses, academics, consultants coming mostly from Europe, but also from America, Asia and Africa.
Outline

- Framing Sustainable Development
  - Brundland definition
  - Consumption, Needs, Well-being
  - Suggested alternative that people and organizations can start to apply now

- How Life Cycle Methods can contribute
  - The essence of Life Cycle Assessment
  - Impacts of development in supply chains
  - Beneficience – *being* sustainable now
An Open Source, Publishing and Analysis Platform For Life Cycle Information about Products

- Producers: Tell your story, with data
- Improve your products, with supplier selection

- Buyers: Access green markets
- Drive transformation
Earthster Design Principles

- No cost
- Voluntary
- Open Source
- Use existing standards, work with existing systems
- Report once to serve many audiences
- Makes business sense for user
Example Co

Website: http://example.com
Email: info@example.com
Phone: +1 (800) EXA-MPLE

Contact:

Address:
3462 Westminster West Rd
Suite 1001
Putney, VT 05301

Available Products
- Homemade Bread
- Slightly Salted Organic Butter (80% Milk Fat)
- Mom's Mango Jam
- new product

Add Product
Name
Classification

Certifications
- Newearth Member: Yes
- ISO 14000 Certified: Yes
- FSC Certified: Yes

Want to show LCA data for your products?
It only takes a few simple steps to add information about your products' environmental impacts to your listing.
Free LCA, Confidential, w/ Benchmark

- Click to download a FREE LCA Calculator.
  - Runs on your computer.
  - Input last year’s data:
    - Amounts purchased
    - Amount released
    - Amount sold
- Click for a table of supply chain pollution
- Click to compare your product vs. sector average
Homemade Bread

Category: Bread, cake, and related products

Our Bread
At the Red Hen Baking Company, the ancient craft of making starters, or levains, guides us each day.

Keeping Our Bread
We bake and deliver seven days a week, insuring that every loaf you buy was baked only hours earlier.

In an effort to preserve the crust, we package all of our breads only in paper bags.

Because our process of natural leavening encourages beneficial acids which act as a natural preservative, our bread will keep for up to two days in its bag.

Our breads also freeze well. After thawing, placing your loaf in a 350 degree oven for 15-20 minutes will revive some of the crispiness of the crust.

All of our breads are naturally leavened and made from flour derived from certified organic grains. Each loaf is then formed by hand and baked in a 500 degree hearth oven.

This process results in an interesting, intentional irregularity to the interior hole structure, as well as the dark, crisp crust for which our breads are known – essential to the flavor and style of our loaves.

LCA Data
Cradle to Gate: Air Emissions (kg)

<table>
<thead>
<tr>
<th>Name</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>2168.133 kg</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>42.575 kg</td>
</tr>
<tr>
<td>Methane</td>
<td>18.622 kg</td>
</tr>
<tr>
<td>Particulates, &lt; 10 um</td>
<td>21.106 kg</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>6.81 kg</td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>4.146 kg</td>
</tr>
<tr>
<td>VOC, volatile organic compounds</td>
<td>1.745 kg</td>
</tr>
<tr>
<td>Ammonia</td>
<td>1.929 kg</td>
</tr>
</tbody>
</table>

Cradle to Gate: Water Pollution (kg)

<table>
<thead>
<tr>
<th>Name</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus</td>
<td>7.502 kg</td>
</tr>
<tr>
<td>Nitrate compounds</td>
<td>0.184 kg</td>
</tr>
<tr>
<td>Ammonia</td>
<td>0.013 kg</td>
</tr>
<tr>
<td>Manganese compounds</td>
<td>0.002 kg</td>
</tr>
<tr>
<td>Methanol</td>
<td>0.001 kg</td>
</tr>
<tr>
<td>Sodium nitrite</td>
<td>0 kg</td>
</tr>
<tr>
<td>t-Butyl methyl ether</td>
<td>0 kg</td>
</tr>
</tbody>
</table>
Link to **Supplier Data.**

- Click to find out if some of your suppliers have published better-than-average LCIs, or made major gains (reductions in emissions / impact).
- Click to take credit – use their LCI data in place of generic, and recalculate your LCI.
- Call other suppliers.
- Call your customers.

**Supply-chain-specific LCA**

Without requiring suppliers to give data, and without divulging supplier identities.
The Earthster Consortium

- Opportunity to influence the technical and market development of the Earthster system
- Credit and publicity for being a funder and member of the consortium, including display of your organization's logo in the Earthster website
- Opportunity to help shape the governance and systems for validation of data
Making the world better off with us

- Reduce our negative impacts as far as possible
- Increase our positive impacts to be at least greater than our negative impacts

Beneficient = Beneficial + efficient
A market for innovation & transformation

- Use systems such as Earthster to
  - Quantify last year's footprint, impacts
  - Quantify potential benefits of changes

- Use the web to
  - Offer the changes for sale
You start the year with this much burden. You reduce it to this level, through efficiencies. You sponsor this much transformation elsewhere, offsetting your remaining burden.
Stimulate Supply & Demand for Innovations

- Use life cycle tools and other methods to
  - Quantify last year's footprint, impacts
  - Quantify potential benefits of changes

- Use the web to
  - Offer the changes for sale
The “MINT” in today's offset context

- **Everyone** gets into the act
  - Households
  - Organizations
  - All companies
- No exclusion of “non-additional” (cost-effective)
- Your supply chain making you greener... benefits you!
- You sell innovative green things? Market them!
- Cap & trade = we only do as good as the cap, and innovation finds the least-cost solution
- Beneficient market for transformation = we go as far as the mutually reinforcing combination of creativity and demand/desire can take us.
Taking the leap

- Saying: We can't do this alone.
- Saying: I don't know how to get there.
- Putting yourself at the mercy of humanity's (nature's) creativity
- Getting there. Together.
Thriving in ways that promote thriving

- Study, reduce the negative impacts of our consumption and actions
- Create enough positive benefits elsewhere in the world to more than off-set the negative impacts
- Enable innovations that reduce negative impacts
- Take actions, intrinsically valuable, which also generate benefits for others, including those which build/promote:
  - Quality of relationships
  - Time and attention
  - Abilities