Information Mining for Sustainability

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Sustainability

- *"development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs"*
- Brundtland Commission 1987

Accounting for all costs

True cost accounting includes:

- The internal (currently counted) and external (environmental damage, diseases, death) costs
- These are reporting annually in Annual Report or in Sustainability Reports
- More than 10,000 are done each year, though few in the U.S.

The New Balance Sheet

Factory Inputs	Factory Outputs	Shipping/sales
▪ Raw materials	»Products	Water pollution
▪ Energy	»Waste water	Air pollution
▪ Water	»Air pollution	Body pollution
▪ Clean air	»Body loading	Animals/plants
	»Clothes/equip.	Solid wastes

Inventory

- Land area
- Structures/buildings/sidewalks- material types - leakage Zn, Cu etc.
- Parking lots and roads
- Fixtures
- Plant and equipment
- Vehicle fleet

Use/ Maintenance/Disposal

- Products
- Parts/supplies
- Energy
- Water
- Clean air

- »Air pollution
- »Water pollution
- »Waste water
- »Solid waste
- »Body loading
- »Animals/plants

Impacts

- Health issues - chronic and acute
- Ecosystem damage
- Loss of key species
- Biomangification
- Modification of releases to more toxic compounds
- Biodiversity loss

The Data Mining Challenge

- A small company in San Diego

Energy	Units	Source
Electricity	kwh	SDG&E bill
Natural gas	therms	SDG&E bill
Gasoline	gallons	fleet bills
Diesel	gallons	fleet bills
Solar	watts	solar controls

Now the hard part

Impacts per kwh -

- Depends on fuel mix supply SDG&E
- May depend on time of use SDG&E

Wanted - data miner to collect from SDG&E bills

Then calculating: CO_2, NO_x etc

Impact calculator - http://ecalc.tamu.edu

Harder

- Natural gas use SDG&E
- Efficiency of use Appliance manuf. or California Energy Commission
- Impacts - ? CO_2 NO_x etc.
- Ecosystem vulnerability near plant - SANDAG, FWS, CDFG, EPA, NGO
- Consultant estimation?

Harder yet

Gas and diesel - Use from billing

- Vehicle mix and use GPS/route data
- Impact per mile EPA, CalEPA
- Leakage-evaporation ?
- Losses in supply chain from ?
- War fighting costs ?

Jet fuel

- A major use in many firms
- Air travel is very energy intensive
- Pollutants are placed high in the atmosphere where they do more damage
- Energy use data - airline tickets/billing

DOE, EPA, others

Commuters

- Perhaps the largest impact will be employee commuting to work
- Surveys, parking lot counts

- How can we manage all this data?

The Goal

- Let the middleware do the hard work of mining information so a person doesn't have to
- Needed: accessible information from SDG&E, CEC, DOE, EPA, CalEPA, RWQCB, APCD, industry, scientists, medical system
- Audit and quality assurance process

What about a MNC

- For a MNC we would want to identify more detailed information across the firm and across the globe
- We would, for example, want to know the numbers of vehicles (gas, diesel, biodiesel, ethanol, LPG), fuel use, and the miles or km driven each year
- Airline and train miles

Integration

- This sustainability report software and middleware should link up with existing business software (SAP, Abacus, Microsoft, Quickbooks, etc.)
- It should be easy to use and easy to monitor quality

First things first

- Energy
- Water
- Materials

- But we much also look for ecotoxic and health risks from facilities, buildings, operations, supply chain and disposal

Global Reporting Initiative

- The GRI suggests what should be considered, costs and benefits:

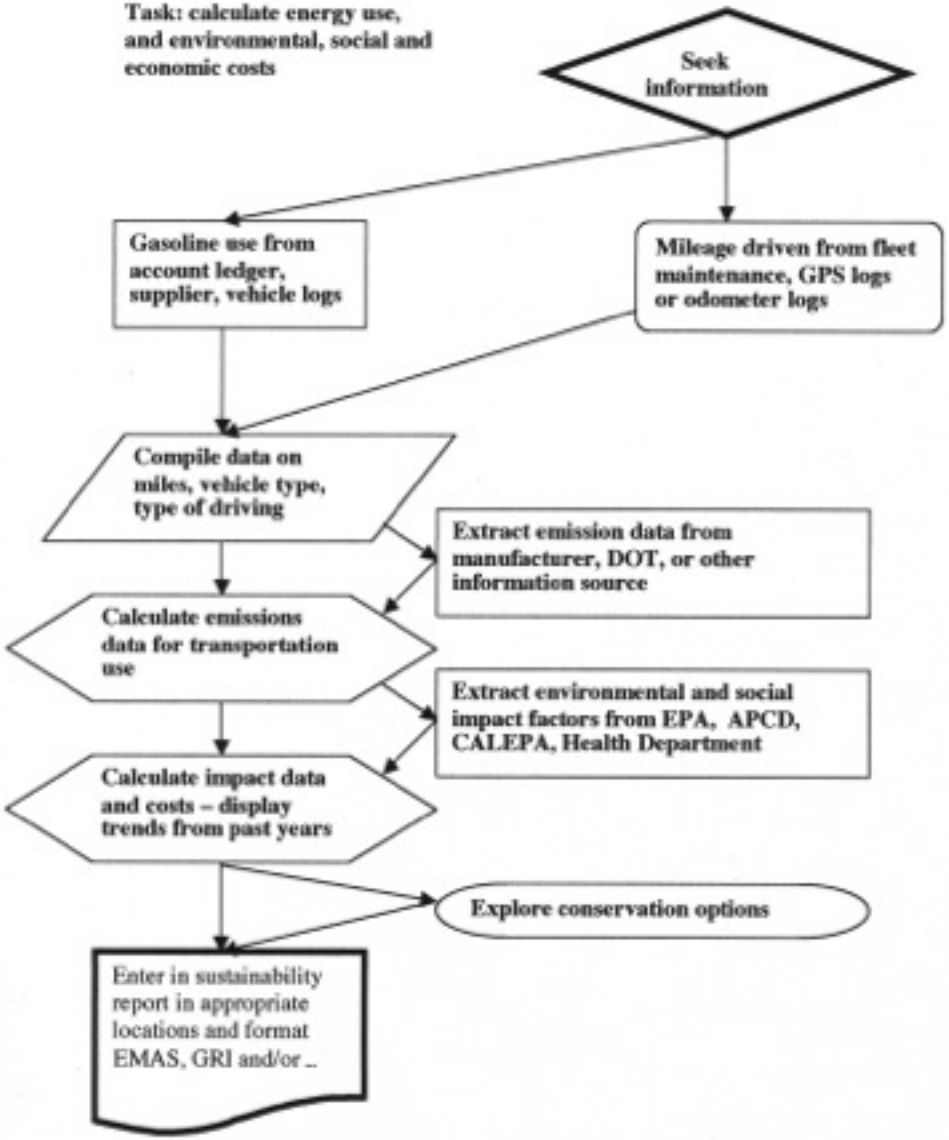
- Economic
- Environmental
- Social

The challenge

- How to do this efficiently and effectively
- How to add value to the company
- How to add value to stakeholders

- How to make it better, faster, cheaper, more sustainable and more fun!
- It might look something like this…

Transportation energy use – flowchart



Dangerous for people

- The first priority is risk to human health
- Anywhere in the supply, distribution, maintenance or disposal chain
- Chronic or acute
- Children and pregnant women are particularly vulnerable

Ecotoxicity

- Materials that are particularly disruptive of ecosystems also demand special scrutiny, these include; copper, zinc, cadmium, lead, many organic compounds and biocides, hormones, nitrogen and phosphorus

Zinc

- Facilities and equipment can be a persistent zinc emitter
- Primarily in water (esp. if acid fog or acid rain)
- Very toxic to some components of ecosystems

Zinc

- Zinc is eroded from galvanized roofing, pipe, truck frames and many other sources

Accounting for the future

- Data mining and management for sustainability reporting and environmental management is a growing field - but needs much more work. More has been done for buildings-- but still just a beginning

True cost will determine choices

- When all costs are included straw bale building will become much more common!

So will bicycles

- Amsterdam is investing $100 million for bicycle transportation
- Madison, Wisc. has done a pretty good job

Count the true cost

- Data mining can help refine cost and benefit estimates
- Sustainability software may help