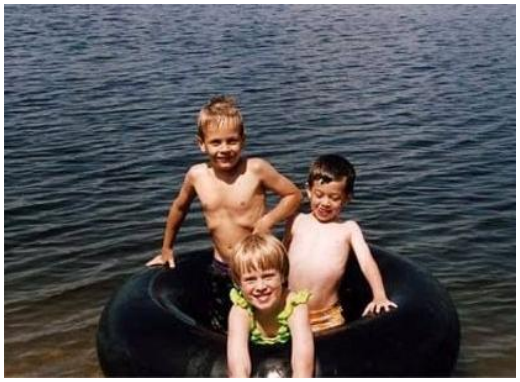
The Natural Step

City of Madison

Madison

What is Sustainability?

"Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their needs."



United Nations 1987 Brundtland Report - *Our Common Future*

A Sustainable City:

- Balances environment, economy and social good
- Recognizes a healthy environment underpins economic and social well-being

photo by: Archie Nicolette

Madison's Impacts on the Environment

The City's domain:

- 750 miles of streets
- 3.7 million sq ft of office and buildings
- 54 million kWh of electricity and 1.3 million therms of natural gas
- 60,000 tons of garbage and recycling
- 6,000 acres of parks
- 2.3 million gallons of fuel for buses and fleet

City government -- as both consumer and steward of our environment and its resources -- must incorporate the principles of sustainability to ensure the needs of tomorrow can be met.

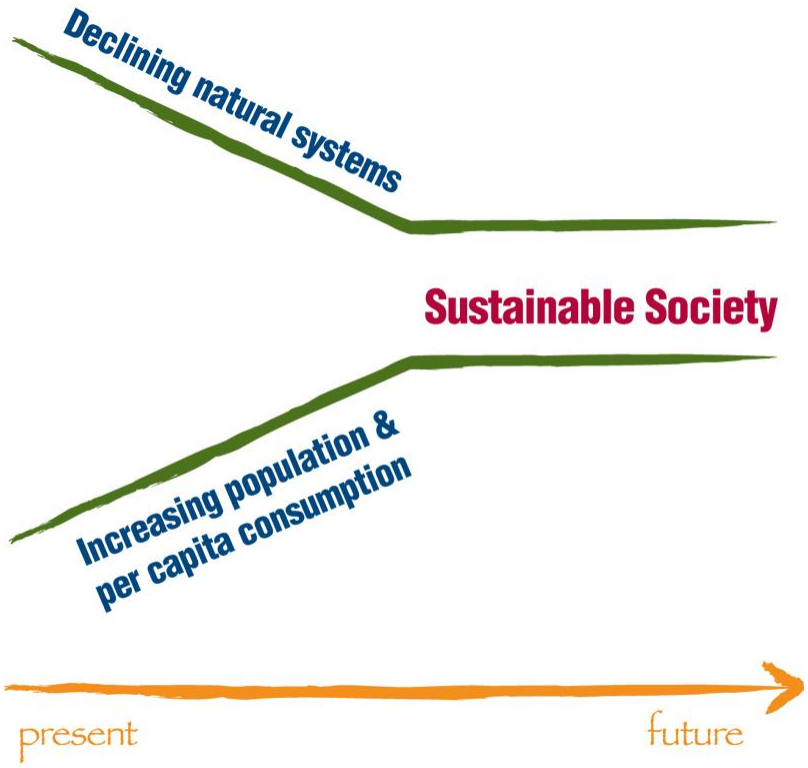
What is The Natural Step?

- Initially formulated in 1989 by Dr. Karl-Henrik Robèrt, The Natural Step (or TNS) identifies basic scientific principles that act as a framework to help us think about the environmental impact of City programs and projects.
- Provides a common language and systems thinking framework for analyzing the long-term impact of City facilities and operations, and will help us to make greater progress toward sustainability.
- Adopted by the City in 2005.
- Initial training for staff in 2006.

Key Elements of TNS

- Funnel metaphor
- Four System Conditions
- Strategic Planning Framework
- ABCD / Backcasting

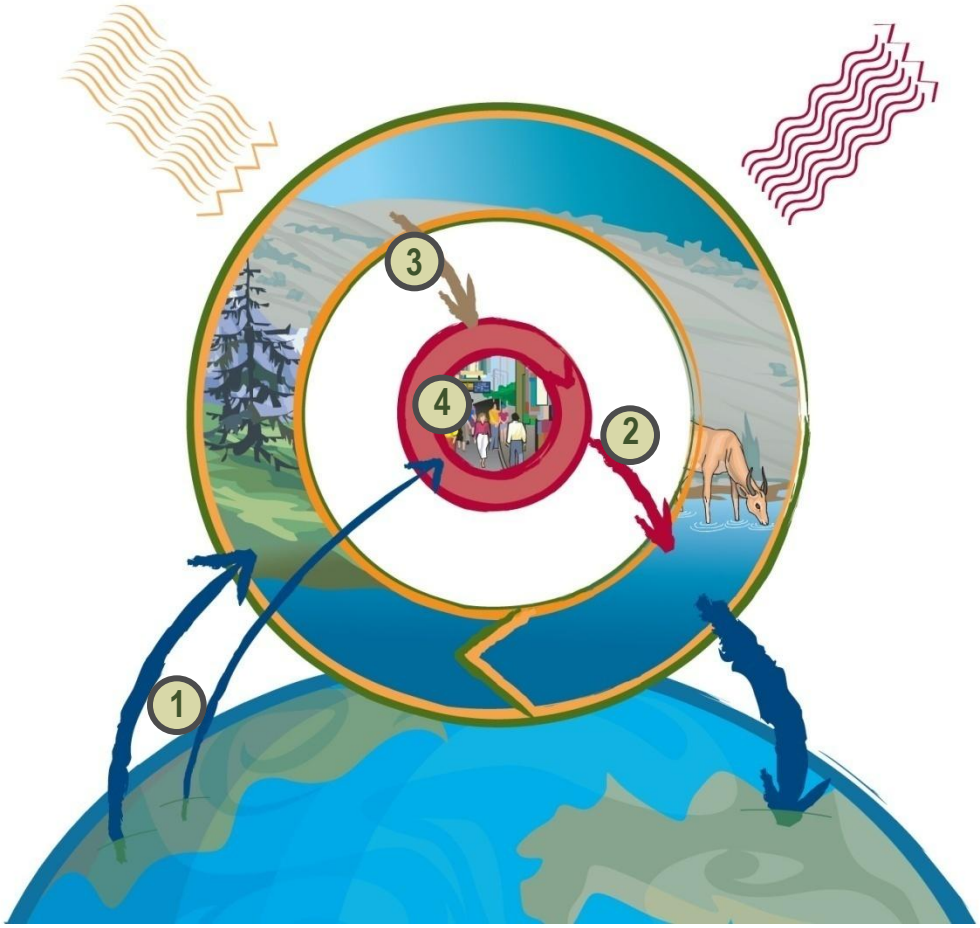
The Funnel as a Metaphor



- As time goes by, population growth and consumer habits increase the demand on natural resources and the environment.
- At the same time, the capacity of natural systems to accommodate that demand is shrinking.
- The convergence of these two realities will restrict our options.
- In a sustainable society, these two pressures are stabilized or even reversed.

TNS System Conditions for A Sustainable Society

In a sustainable society, nature is not subject to systematically increasing:



1. concentrations of substances extracted from the earth's crust
2. concentrations of substances produced by society
3. degradation by physical means

and, in that society…

4. people are not subject to conditions that systematically undermine their capacity to meet their needs or the needs of future generations.

Slide provided by TNS Canada

Sustainability – a systems perspective

Matter & energy do not disappear

- Matter and energy can only be transformed. (Newton's 1st Law of Thermodynamics- Conservation of Matter and Energy)
- The earth is a closed system with respect to matter.
- Energy enters the system as solar energy, leaves as heat radiation.

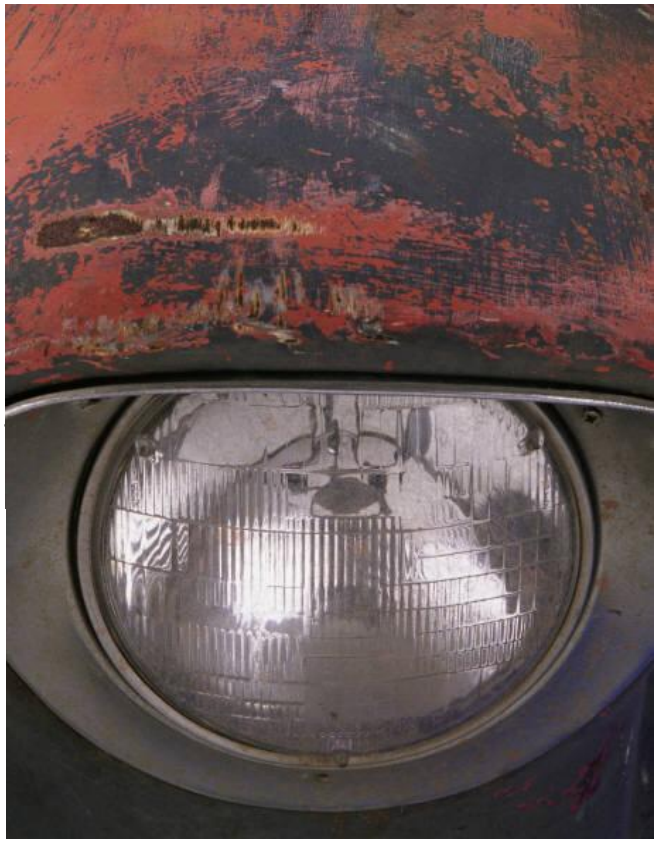
i.e. *nothing disappears*

- Earth has same mass as 4.5.billion years ago
- carbon in your body in dinosaur
- fuel in your car doesn't disappear

Sustainability – a systems perspective

Matter & energy tend to disperse

- All processes irreversibly disperse matter (and energy) into ever more chaotic states.
- Newton's 2nd Law of Thermodynamics (Law of Entropy)



i.e. *everything disperses*

- car to rust, carpet to dust, ink in water, etc

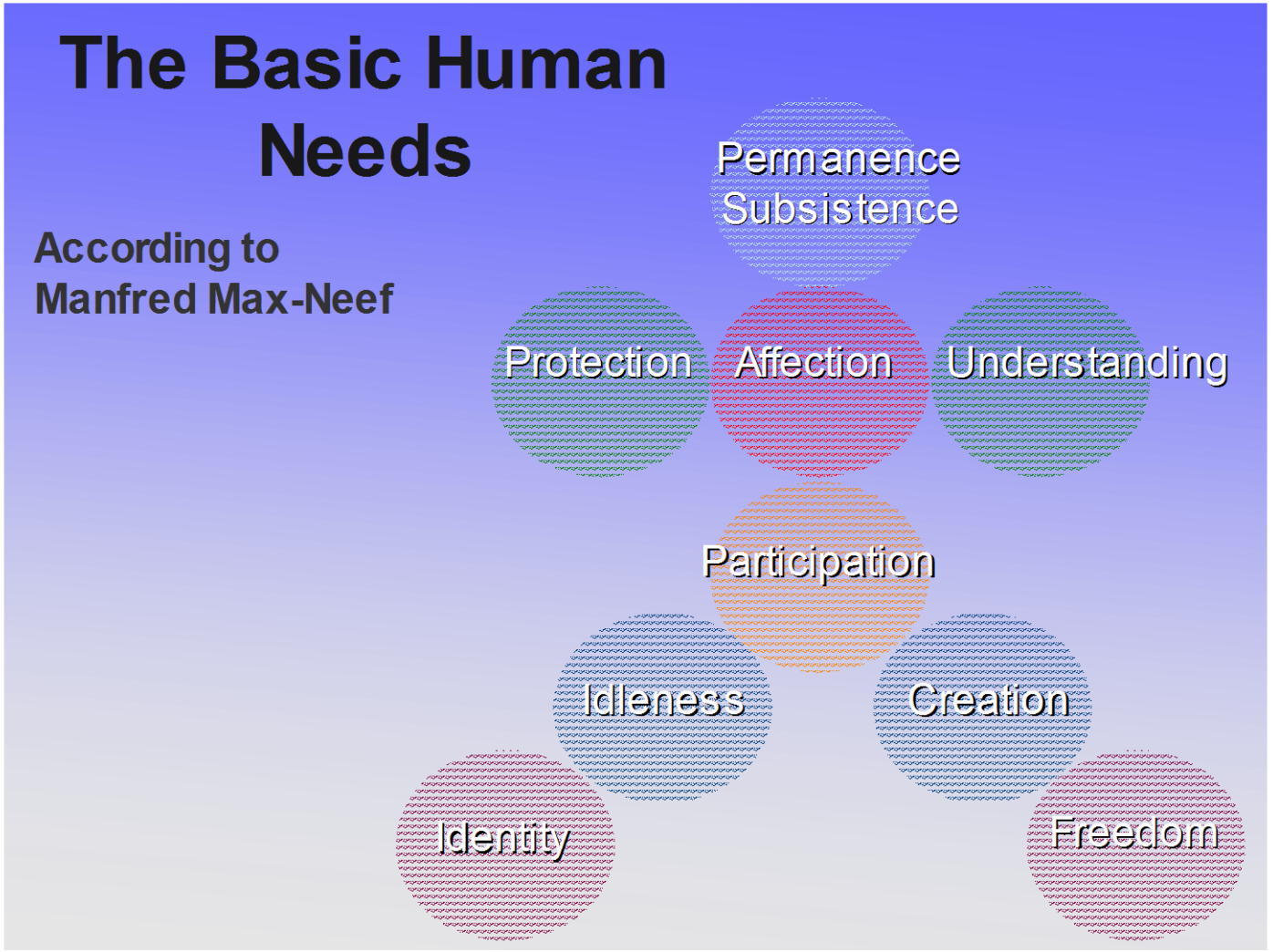
QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Ecosystem Services are the processes by which the environment produces resources

- Provisioning Resources
  - Foods (seafood/game)
- Regulating Resources
  - Nutrient dispersal
- Supporting Resources
  - Purifying air and water
- Cultural Resources
  - Spiritual, intellectual, recreational inspiration
- Preserving Resources
  - Biodiversity

- Ecosystems are threatened by many human activities- toxic runoff, non-native species, over-harvesting, erosion, sprawl, pollution
- Ecosystem Services have financial value
- Our future depends on wise eco-choices.

Sustainability – Human needs are Respected in a sustainable society



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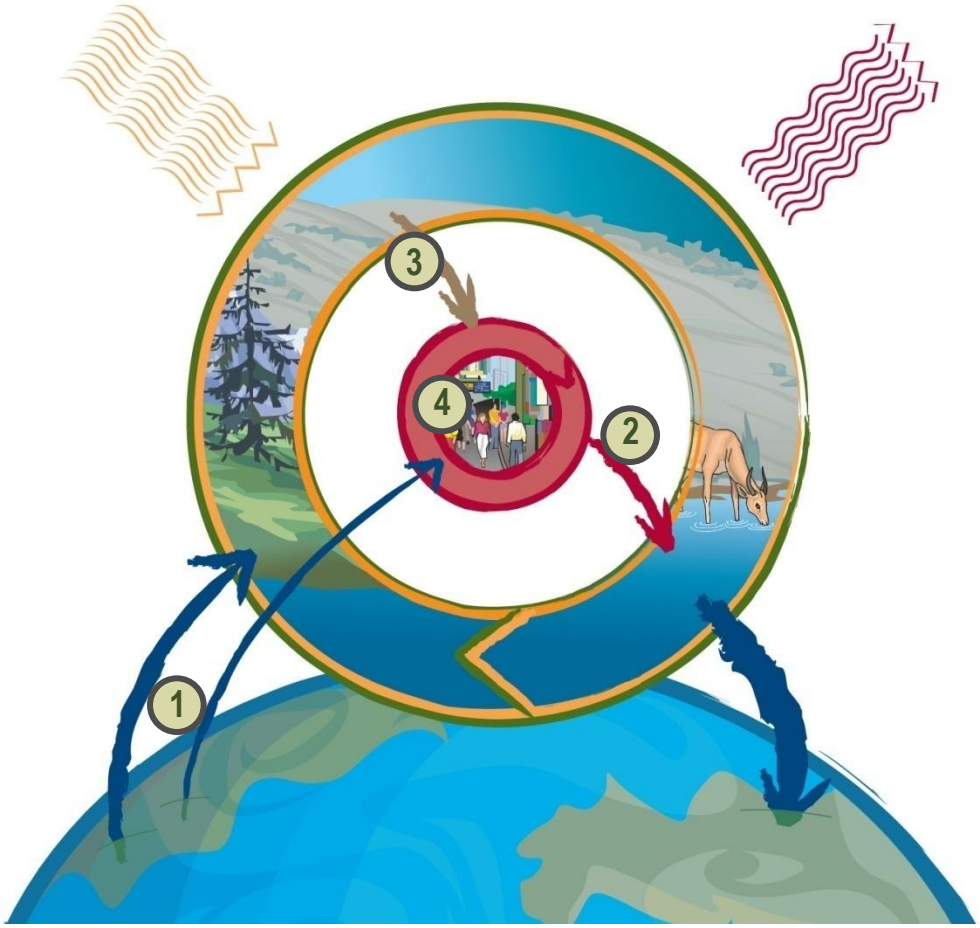

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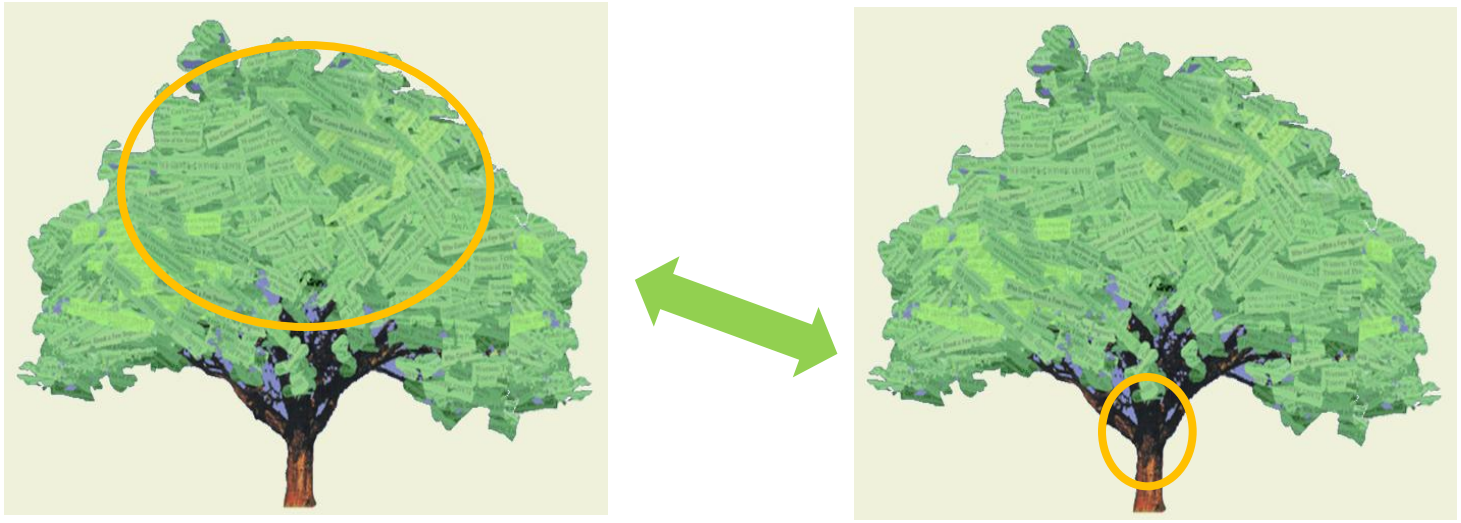
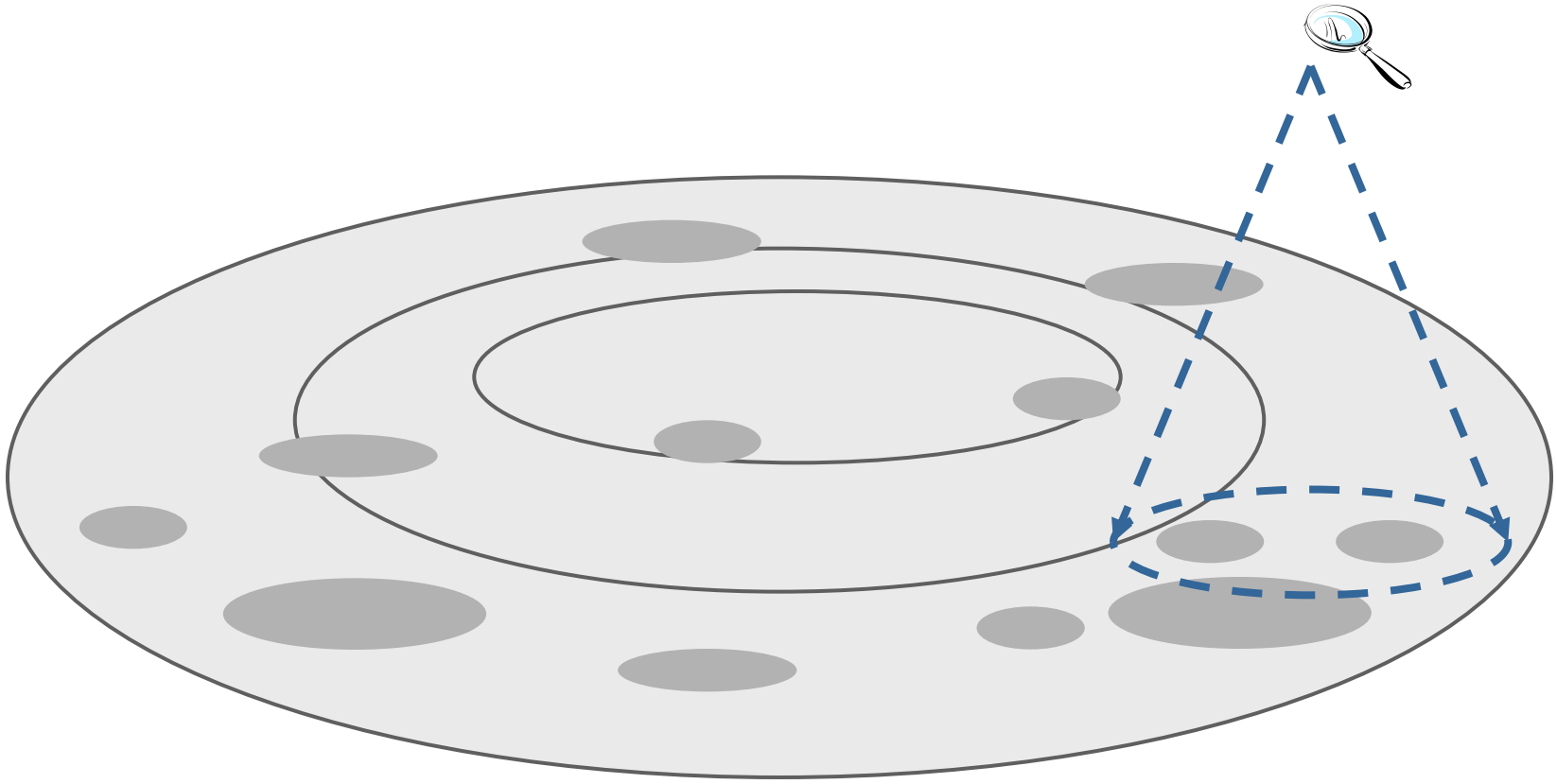
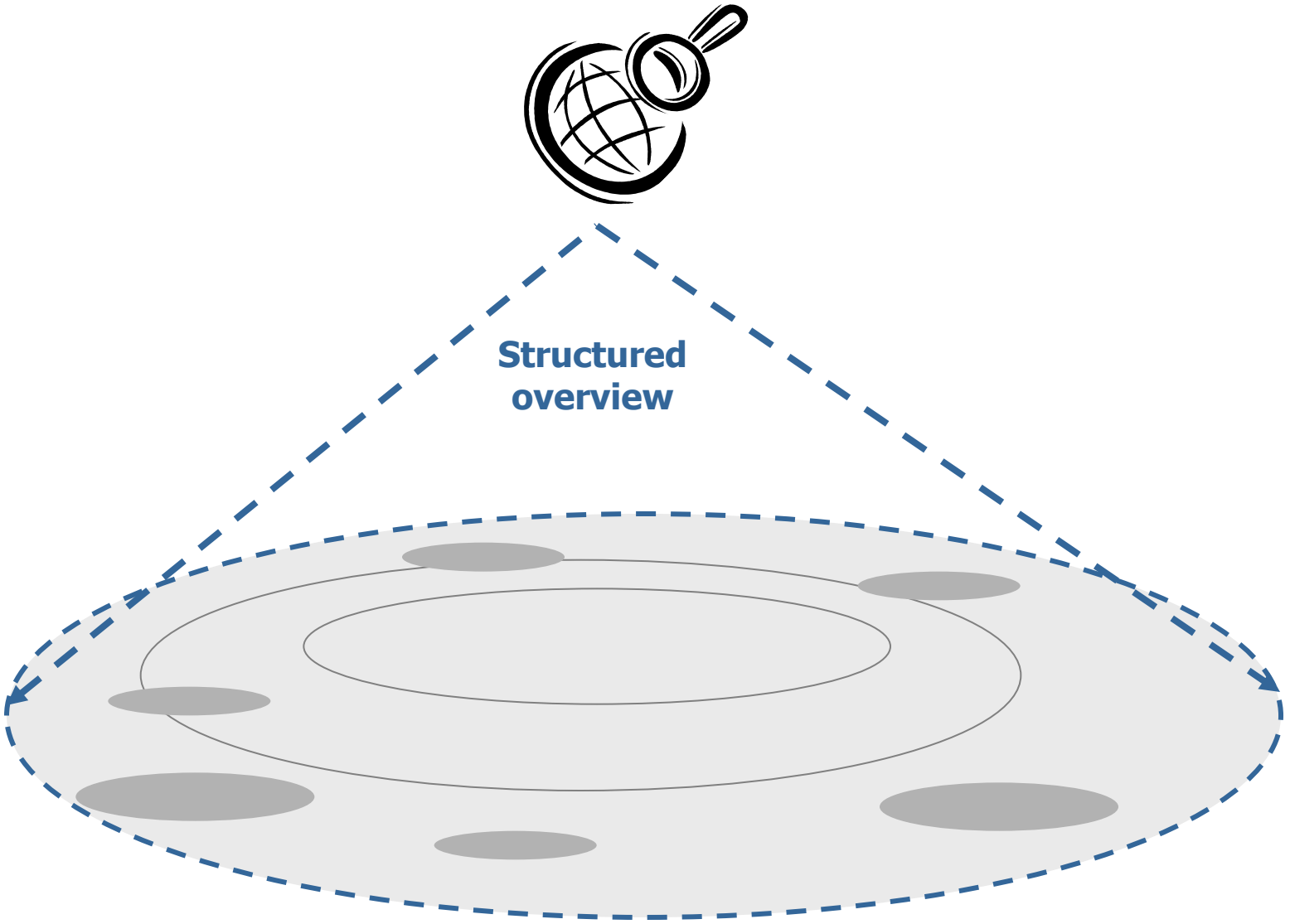
Unifying framework for Sustainable Development



Empirical Science

Theoretical science



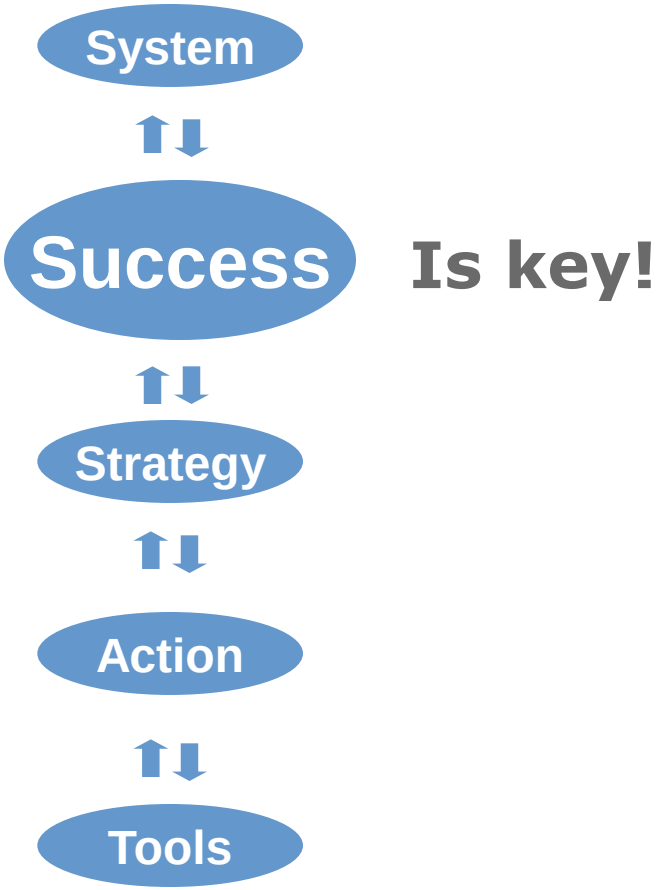

Structured
overview

Framework for planning in complex systems

Level 1, the Basic System
(Cannot, and need not, be engineered)

Thermodynamics, biogeochemical cycles, interdependencies, resilience and adaptiveness…

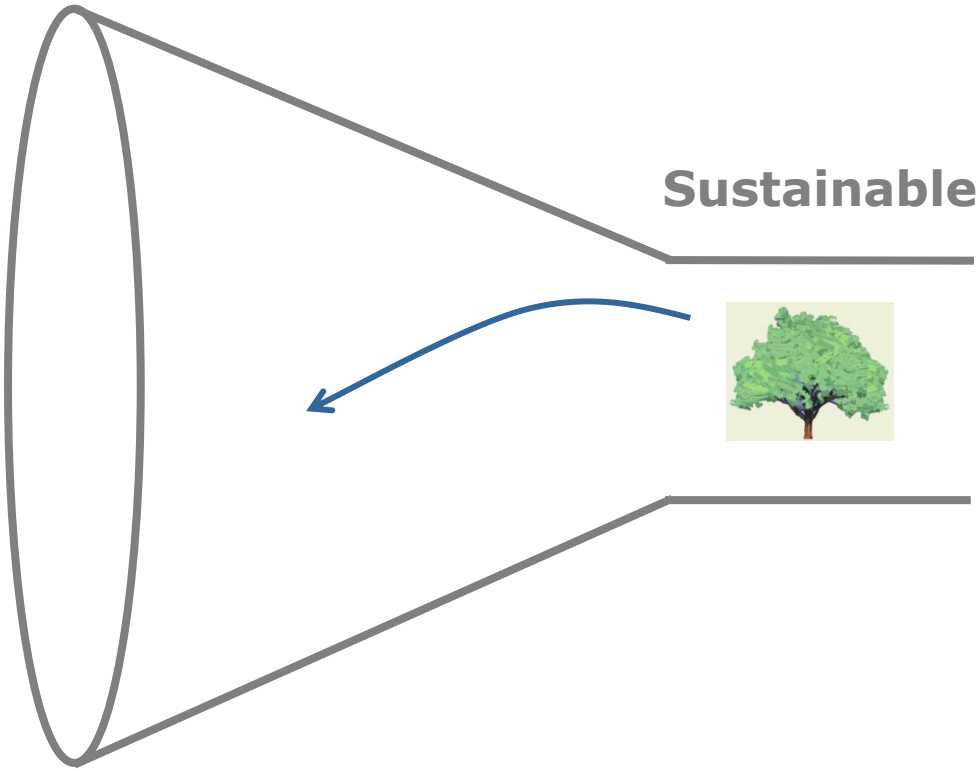
Framework for planning in complex systems



Is key!

Principles…

- Necessary
- Enough
- General
- Concrete
- Distinct



Sustainable Vision

Level 2, basic sustainability principles

In the Sustainable Society, Nature is not subject to systematically increasing...

1 …concentrations of substances from the Earth's crust.

2 …concentrations of substances produced by society.

3 …degradation by physical means.

and

4 … people are not subject to conditions that systematically undermine their capacity to meet their needs or the needs of future generations.

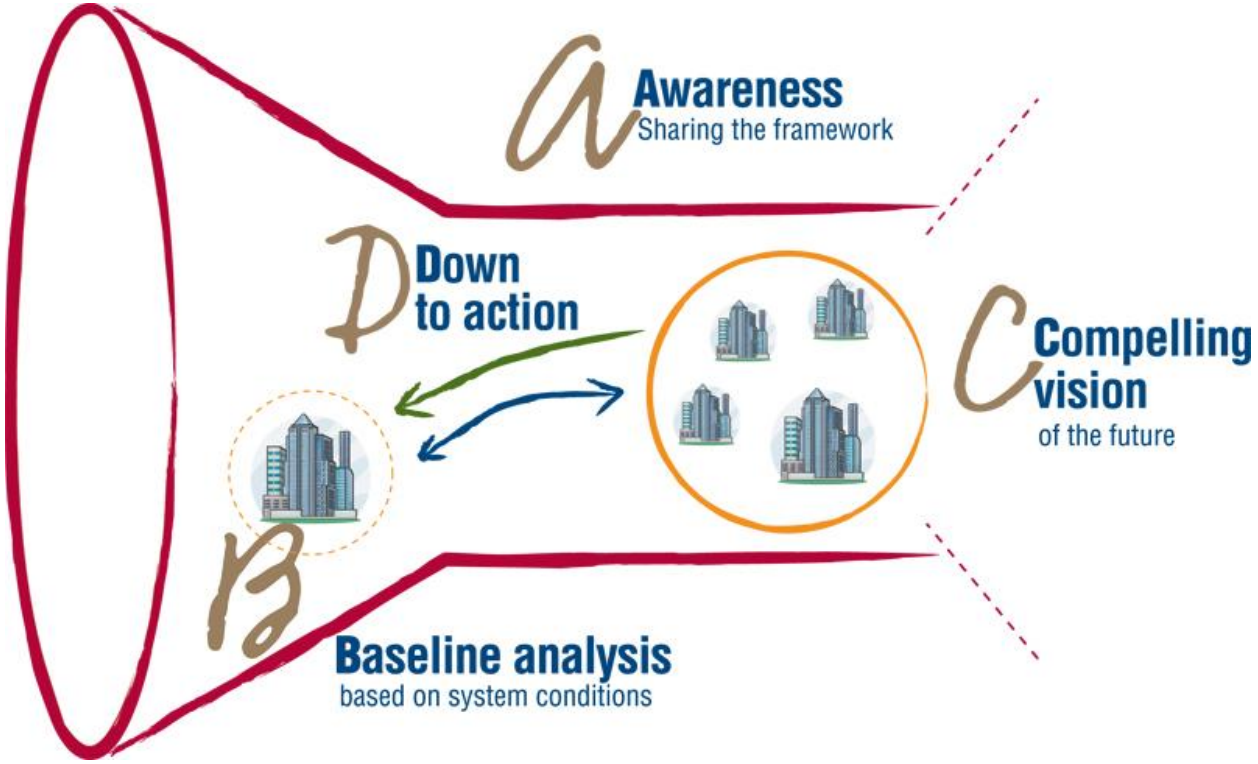
Framework for planning in complex systems

TNS Strategic Planning Framework

Right direction?

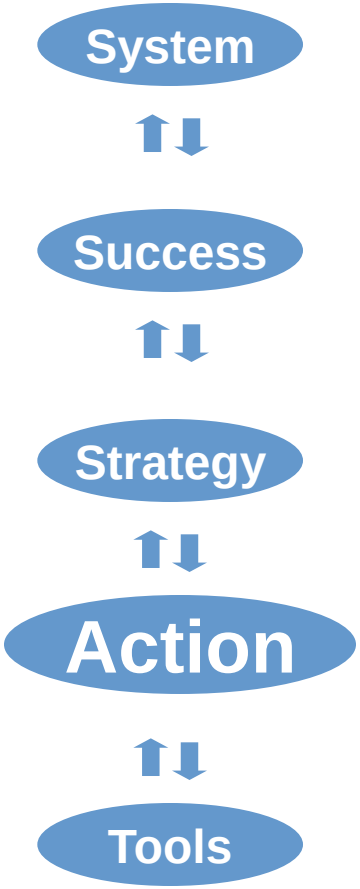
Flexible platform?

Return on investment?

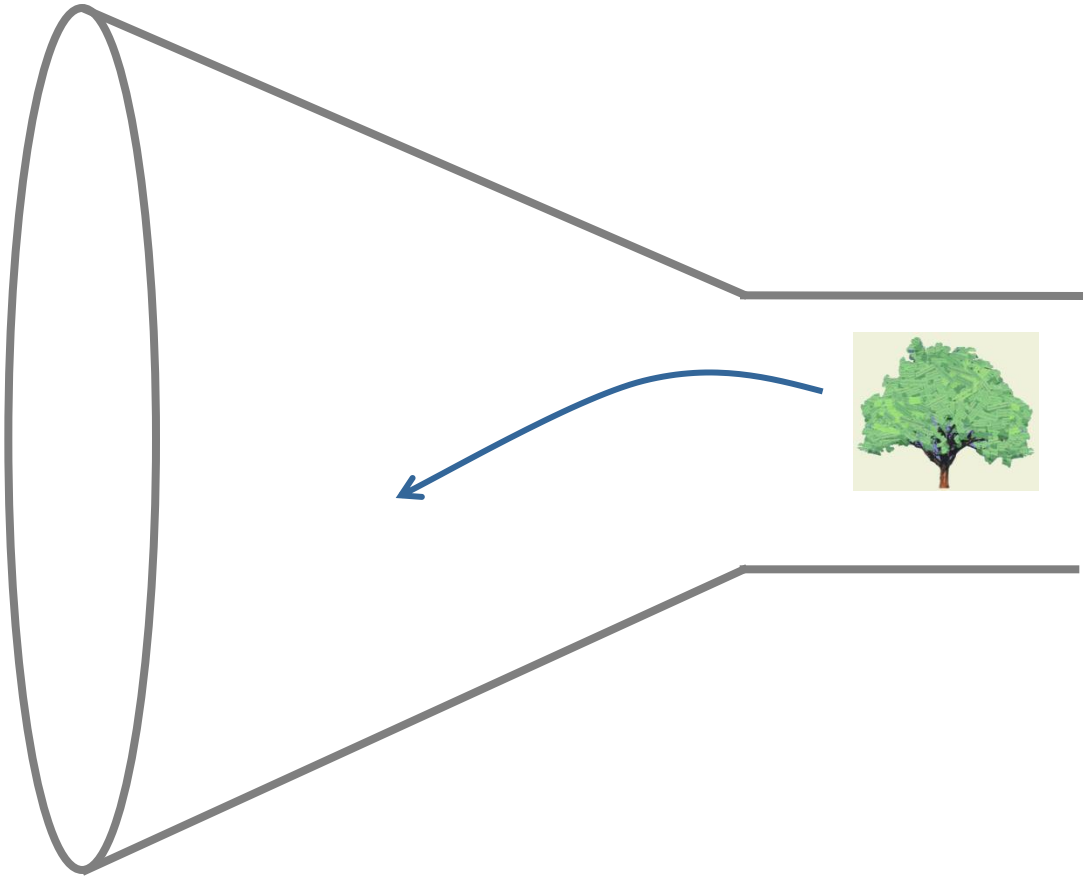


Slide provided by TNS Canada

Framework for planning in complex systems



Level 4, actions for government



Övertorneå
SEKO (70 local gov's)
Whistler
Calgary
FCM
Seattle WA
Portland OR
APA
EU Round Table
Chequamegon Bay WI
Madison WI
Portsmouth NH
Lawrence NJ
Pittsburgh/Vandergrift PA
Evanston IL
Duluth MN
Jefferson County WI
Corvallis OR
…

Top 10 List for 2007

1. Identifying Energy Wasters in City facilities.
2. Install solar and/or wind power at City facilities.
3. Green cleaning supplies and services.
4. Zoning code rewrite (RFQ and RFQ).
5. Bio-diesel pilot project for City Engineering vehicles.
6. Reduce fuel consumption and emissions of fleet vehicles and Metro buses.
7. Metro Garage door.
8. Metro bus wash and vacuum.
9. Commuting incentives for City employees.
10. Energy saving strategies and policies for public housing in the City.

Top 10 List for 2008

1. Solar Energy for Madison
2. Zero Waste Initiative
3. Olbrich Botanical Gardens Green Team
4. Paper Reduction Initiative: Planning Department
5. Green Purchasing Policies: Green Office Initiative
6. Green Purchasing Policies: Green Electronics Initiative
7. Green Fleet initiatives
8. Data Center Energy Reduction
9. Lower Impact Lawn Maintenance
10. Automated Work Order System for Forestry

Framework for planning in complex systems

Level 5, tools

Level 5, tools

Conclusions:

- **Many good tools and concepts**
- **Different strengths and gaps**
- **None can replace structured systems perspective**
- **A framework increases the value of concepts and tools**
- **Don’t wait for tools – get going!**
- **Select tools as needed**

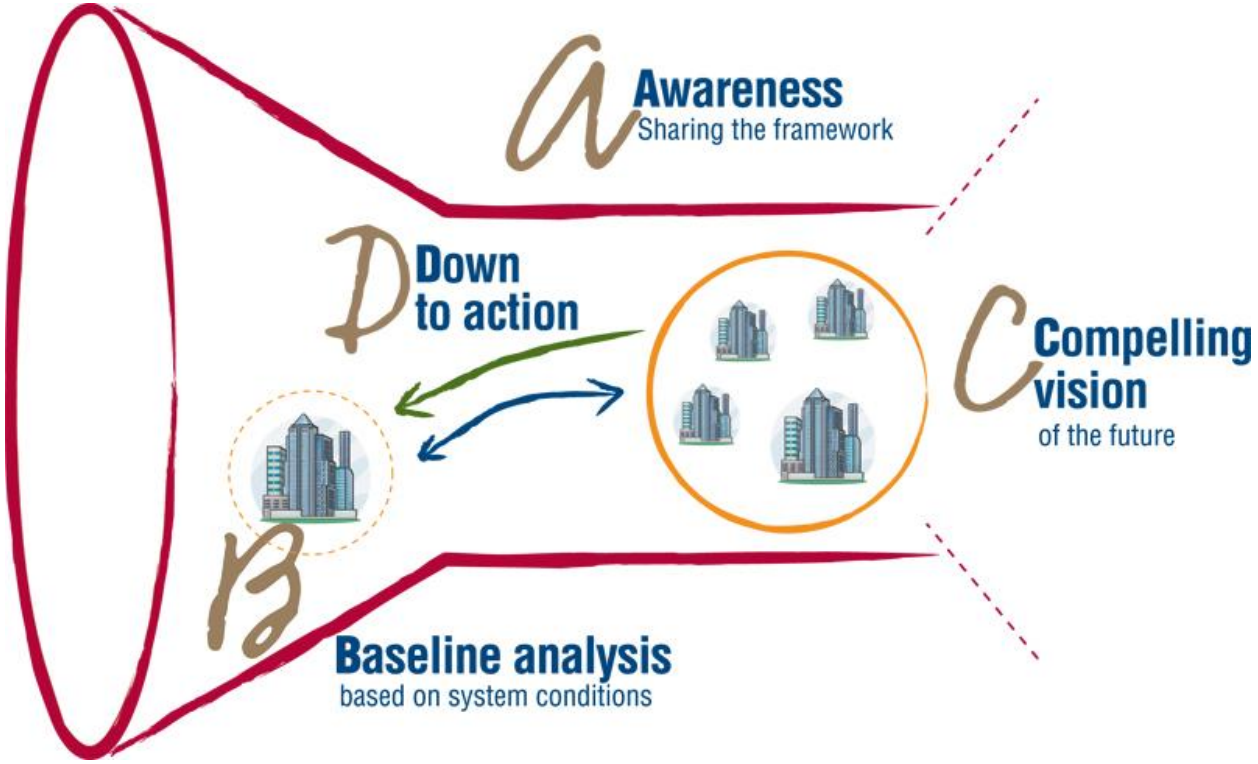
Robèrt, K.-H., Schmidt-Bleek, B., Aloisi de Larderel, J., Basile, G., Jansen, L., Kuehr, R., Price Thomas, P. Suzuki, M., Hawken, P., and Wackernagel, M. 2001. **Strategic sustainable development – selection, design and synergies off applied tools -.** The Journal of Cleaner Production, 10 (2002) 197-214.

TNS Strategic Planning Framework

Right direction?

Flexible platform?

Return on investment?



Slide provided by TNS Canada

“A” is for Awareness

The City has over 650 printers. Of these, 360 are local or desktop printers.

What is the full cost of all of these devices?

Per the four system conditions, how can we:

1. Reduce our use of electricity and coal?
2. Reduce our reliance on ink, toner chemicals and packing materials?
3. Reduce our consumption of paper and trees?
4. Satisfy our needs while moving us toward sustainability?

“B” is for Baseline Analysis

Administrative costs:

- IS must service multiple models
- Staff must order various types of cartridge and toner
- Optimal printer ratio is 1 for 7 employees; the City is at 1 for every 2.5
- Desktop printers are slow

Fiscal costs:

- Over $100,000 per year on toner and cartridges
- Desktop cost per page is triple a network printer
- Per page cost on a desktop printer is about 26¢
- We could get costs down to 7.4¢
- Paper itself is only 1/10 the total cost of printing, copying, etc.

“B” is for Baseline Analysis

Environmental costs:

- About 613 kWh/yr to run five desktop printers
- Our primary electrical energy source is coal
- This converts to half a ton of CO_2 per year
- Paperless society myth: e-mail increases printing by 40%
- 75% of all print output is waste

“C” is for Compelling Vision

We can do better and *need to* do better

- Environmental pressures
  - Greenhouse gases
  - Energy efficient appliances are good; fewer appliances is better
  - Landfilling is bad; recycling is good; nonconsumption is better
- Fiscal pressures

“D” is for Deployment

- What alternatives move us toward sustainability?
- Which alternatives provide a flexible platform?
- What are the alternatives’ return on investment?
  - Financial
  - Environmental
  - Social
- What policies are needed to ensure staff needs are met?

A Proposal: Replace desktop printers with MFDs

Multi-function devices (MFDs) offer centralized printing, copying and faxing. They are available in color.

- Less energy consumption
- Lower per page and annual costs
- Duplexing cuts paper consumption
- Lease costs covered by toner savings
- Longer life means less waste

What are your thoughts?

What exemptions should be made?

Another Proposal: Increase Recycled Content of Our Paper

By 2008, the City will commit to purchasing 80% of its paper from environmentally preferred processes, which includes 100% post-consumer recycled content

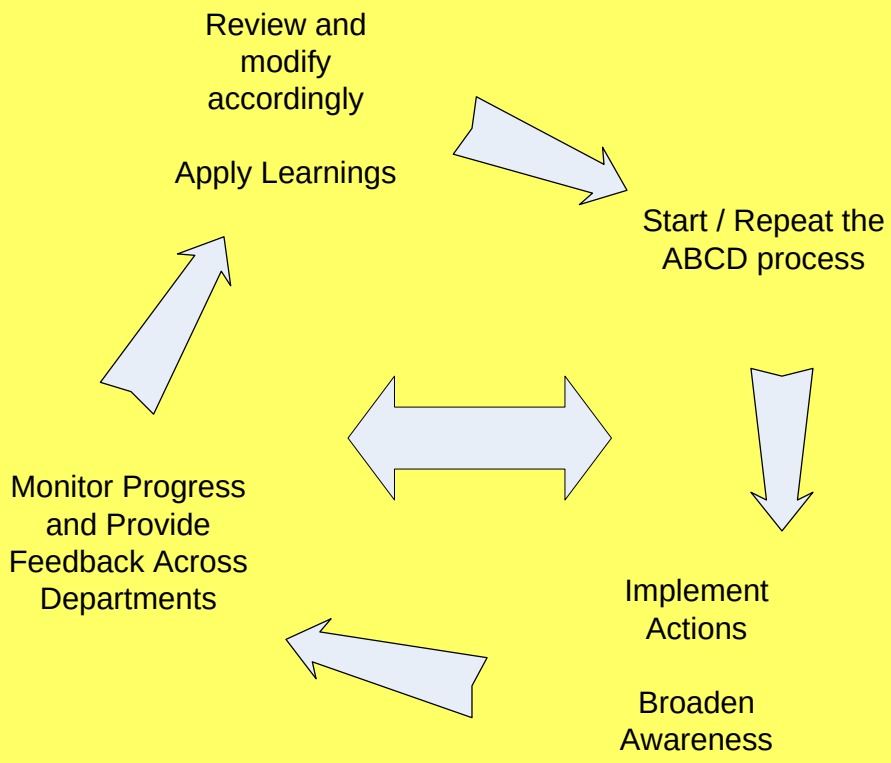
Recycled paper:

- Does not cost more
- Is not inferior or of inconsistent quality
- Performs well in copiers and printers

What are your thoughts?

What exemptions should be made?

ABCD is not Linear



To ensure we are moving toward sustainability, the City will take the following steps to improve on these system conditions:

1. Because resources like fossil fuels, metals and minerals are finite and damage our environment if allowed to accumulate, the City will reduce its consumption of materials extracted from the Earth's crust.
2. Because the accumulation of pesticides, fertilizers and other persistent chemicals are harmful to people and the environment, the City will reduce its dependence on these kinds of synthetic chemicals.

To ensure we are moving toward sustainability, the City will take the following steps:

3. Because ecosystems take a long time to recover from physical destruction (if they can at all), the City will mitigate its impact through wise land use policies, low-impact maintenance practices and environmentally friendly design.
4. Because our community will not be truly sustainable unless our residents are healthy, safe and prospering, the City will continue to pursue policies and actions that minimize the barriers that get in the way of residents ability to meet their basic needs.

Using many of the basic principles of TNS, the City will use a strategic planning framework to:

A) Work to increase awareness of sustainability among its staff and management. This will provide us with a common language and keep all of us thinking about the impact we have during the course of our daily tasks.

B) Take an inventory of current efforts that make progress toward sustainability and be frank about areas that need improvement. We will enhance our current efforts and identify additional improvements.

C) Formulate vision of what sustainability means for the City and identify long-term goals necessary to achieve that vision.

Using many of the basic principles of TNS, the City will:

D) Incorporate the awareness and terminology of sustainability into our budget decisions, program administration and project development. To achieve this, we will ask questions of relevant projects or policies like:

- Does this help move the City toward sustainability (even if incrementally)?
- Will elements of this project serve as a potential stepping stone toward other changes or initiatives?
- Will increased implementation costs yield savings in the long-run or provide a social or environmental return on investment?

Three Magic Questions

- Does your organization have a definition of Sustainability?
- What is, with reference to this definition, your gap to Sustainability?
- What are you doing, at the strategic level of the organization, to bridge that gap?

Some Additional Resources

- Mayor's website
  http://www.cityofmadison.com/mayor/Natural.html
- Karl van Lith 266-9037 kvanlith@cityofmadison.com
- Jeanne Hoffman 266-4091 jhoffman@cityofmadison.com