

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

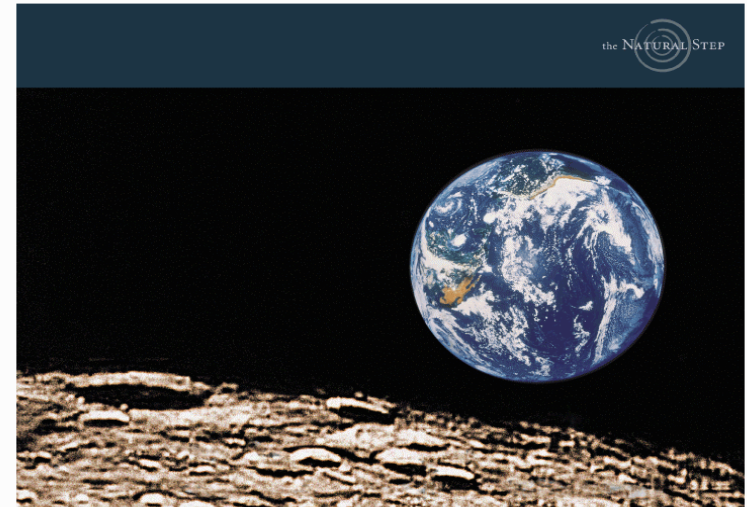


City government -- as both consumer and steward of our environment and its resources -- must incorporate the principles of sustainability to ensure the needs of tomorrow can be met.

The City Adopts The Natural Step

Historically, Madison had multiple individual environmental initiatives

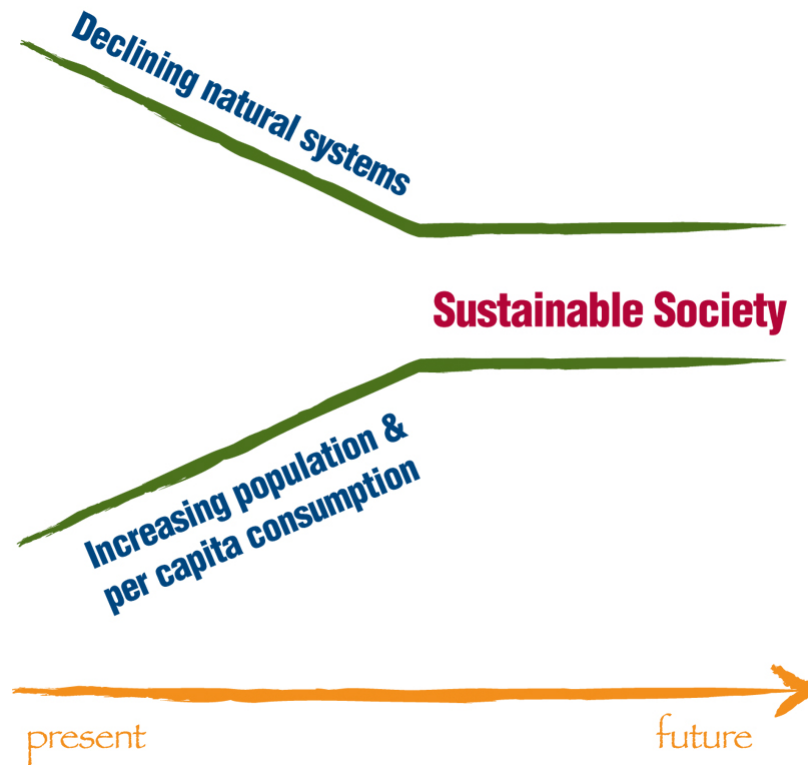
- City adopts *Building a Green Capital City Blueprint* in 2004
 - Integrates sustainability in a systematic way into decision making, policies, operations and capital improvements in all departments
- The Natural Step (TNS) is adopted by Common Council resolution in December 2005 as City's guiding sustainability framework
- TNS trainings are conducted for 25 City managers, supervisors and staff across departments in 2006
- TNS is applied to numerous projects by trainees and other staff



What is The Natural Step?

- Based on fundamental scientific principles, The Natural Step is a framework that helps us think about the environmental, economic and social impacts of City programs, projects and facilities.
- The Natural Step lays out the conditions and requirements that will help the City make greater progress toward sustainability.
- The Natural Step helps us to plan strategically for the most sustainable outcomes.

The Funnel as a Metaphor



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

Implications for Communities

“Restricted options” can mean:

- Increased operational costs (energy, waste disposal, water treatment, infrastructure maintenance, etc)
- Increased demand for social services
- Regulations & compliance challenges
- Public health issues
- Loss of cultural uniqueness

declining

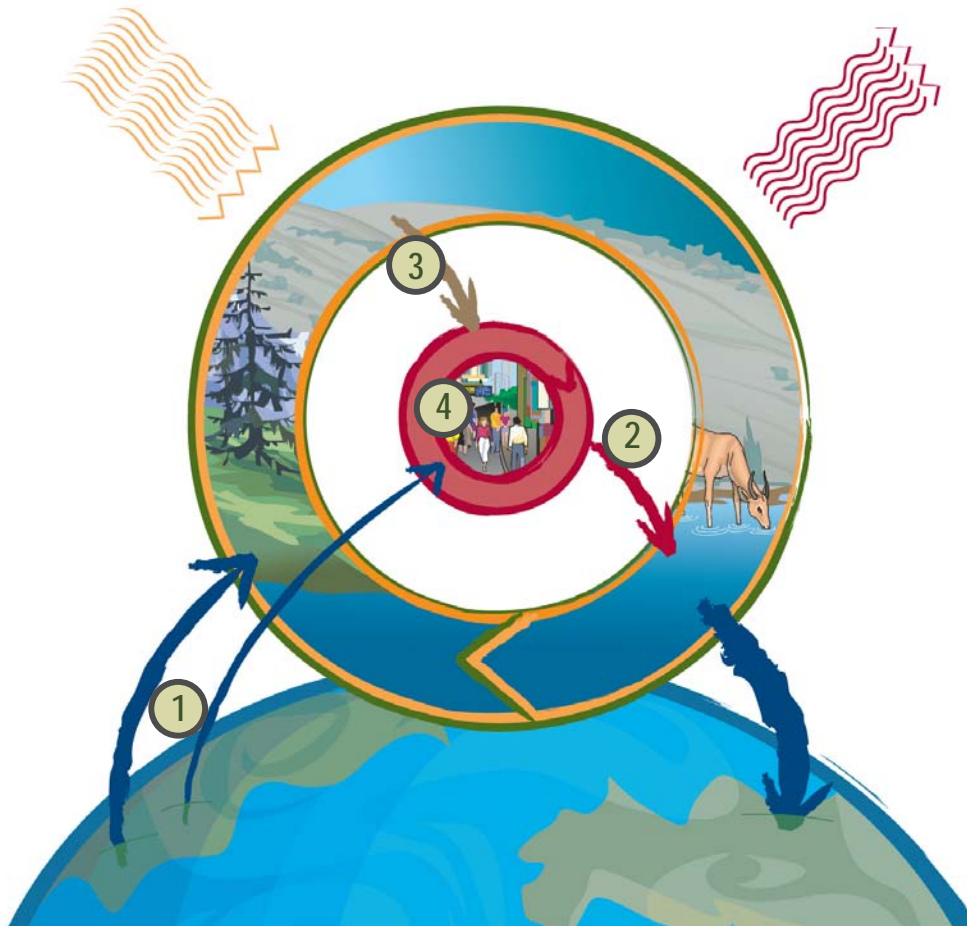
*Resources
*Ecosystem

increasing

*Population
*Demand for resources
*Waste products

System Conditions

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.

System Condition 1



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

... concentrations of substances extracted from the Earth's crust;

Inefficient Use → Efficient Use

Dissipative Use → Tight Technical Cycles

Scarce metals → Abundant metals

Fossil Fuels → Renewables

System Condition 2

Halogenated compounds

Chlorodifluoromethane
 chlorotrifluoromethane
 dichlorodifluoromethane
 chloromethane
 chloroethane
 trichlorofluoromethane
 dichloroethylene
 Freon 113
 methylene chloride
 chloroform
 trichloroethane
 carbon tetrachloride
 trichloroethylene
 chloropentane
 dibromochloromethane
 tetrachloroethylene
 dichloropropene
 chlorobenzene
 chlorohexane
 iodopentane
 3-methyl-1-iodobutane
 chloroethylbenzene
 dibromodichloromethane
 dichlorobenzene
 chlorodecane
 trichlorobenzene

Aldehydes

acetaldehyde
 methyl propanal
 n-butanal
 methyl butanal
 crotonaldehyde
 n-pentanal
 n-hexanal
 furaldehyde
 n-heptanal
 benzaldehyde
 n-octanal
 phenyl acetaldehyde
 n-nonanal
 methyl furaldehyde
 n-decanal
 n-undecanal
 n-dodecanal

Cyclic

cyclopentane
 methyl cyclopentane
 cyclohexane
 ethyl methyl cyclohexane
 C10H14 isomers
 C10H16 isomers (other)
 limonene
 methyl
 decalin
 à-pinene
 camphene
 camphor

Aromatic

benzene
 toluene
 ethylbenzene
 xylene
 phenyl acetylene
 styrene
 benzaldehyde
 C3-alkylbenzene isomers
 C4-alkylbenzene isomers
 methyl styrene
 dimethyl styrene
 C5-alkylbenzene isomers
 naphthalene
 C6-alkylbenzene isomers

Ketones

acetone
 methyl ethyl ketone
 methyl propyl ketone
 methyl vinyl ketone
 ethyl vinyl ketone
 2-pentanone
 methyl pentanone
 methyl hydrofuranone
 2-methyl-3-hydroxybutanone
 4-heptanone
 3-heptanone
 2-heptanone
 methyl heptanone
 furyl methyl ketone
 octanone
 acetophenone
 2-nonanone
 2-decanone
 alkylated lactone
 phthalide

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

...concentrations of substances produced by society;

Inefficient use

Persistent and Unnatural

Dissipative use

Epoxides

Efficient use

Abundant and breakdown easily

Tight Technical Cycles

Alkanes Alkenes Alkynes

C3H8	C3H6	C5H8
C4H10	C4H8	C6H10
C5H12	C5H10	C7H12
C6H14	C6H12	C8H14
C7H16	C7H14	C9H16
C8H18	C8H16	C10H18
C9H20	C9H18	C12H22
C10H22	C10H20	
C11H24	C11H22	
C12H26	C12H24	
C13H28	C13H26	
C14H30	isoprene	
C15H32		

Furans

furan
 tetrahydrofuran
 methyl furan
 ethyl furan
 dimethyl furan
 2-vinylfuran
 furfuraldehyde
 2-n-butylfuran
 2-pentylfuran
 methyl furfuraldehyde
 furfuryl alcohol
 benzofuran

Other Oxygenated Isomers

C4H6O
 C4H8O
 C6H8O
 C6H10O
 C6H12O
 C6H14O
 C7H12O
 C7H14O
 C7H16O
 C6H6O2
 C8H14O2
 C8H16O2
 C7H10O2
 C9H18O
 C8H6O2
 C10H16O
 C10H18O
 C10H20O
 C10H22O
 C9H8O2
 C11H20O
 C10H10O2

Alcohols

methanol
 isopropanol
 2-methyl-2-propanol
 n-propanol
 n-butanol
 n-pentanol
 n-hexanol
 à-furfuryl alcohol
 ethyl-heptanol
 phenol
 n-butylamine
 n-terpineol

Acids

acetic acid
 decanoic acid

Sulfur compounds

sulfur dioxide
 carbon disulfide
 dimethyl sulfide
 carbonyl sulfide

Nitrogen compounds

nitromethane
 C5H6N2
 C5H8N2
 C4H4N2O
 methyl acetamide
 benzonitrile
 methyl cinnoline

Esters

vinyl propionate
 ethyl acetate
 ethyl-n-caproate
 isoamyl formate
 methyl decanoate
 ethyl decanoate

Ethers

dimethyl ether
 diethyl ether

System Condition 3



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

... degradation by physical means;

Inefficient use of
resources and land



Efficient use
of resources and land

Resources from poorly
managed ecosystems



Resources from well-managed
ecosystems use

System Condition 4



In a sustainable society, people are not subject to:

conditions that systematically undermine their capacity to meet their needs.

Unsafe working and living environments



Safe working and living environments

Economic barriers



Sufficient resources for livelihood

Political Oppression



Political Freedom

To ensure we are moving toward sustainability, the City will adhere to the system conditions and take the following steps:

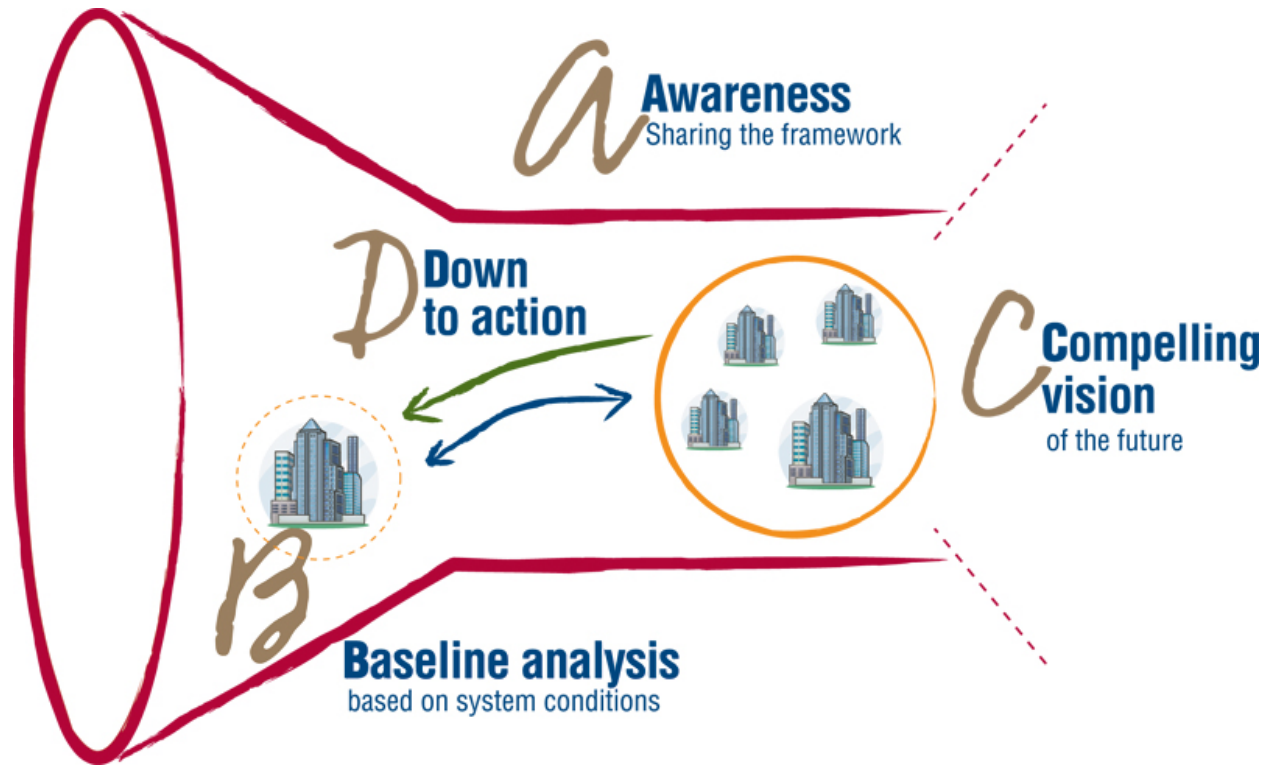
1. Because resources like fossil fuels, metals and minerals are finite and damage our environment if allowed to accumulate, the City will reduce its consumption of materials extracted from the Earth's crust.
2. Because the accumulation of pesticides, fertilizers and other persistent chemicals are harmful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

To ensure we are moving toward sustainability, the City will adhere to the system conditions and 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.

Strategic Planning Framework

Right direction?
Flexible platform?
Return on investment?



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 a vision of what sustainability means for the City and its programs and identify long-term goals necessary to achieve that vision.

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

- 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 sustainable changes or initiatives?
 - Will increased implementation costs yield savings in the long-run or provide a social or environmental return on investment?

Current Top 10 List of TNS Projects

1. Inventory of City buildings and their use of electricity and natural gas. Formulation of uniform lighting specifications and energy and ventilation standards for all City facilities.
2. Solar power and/or wind power at City facilities
3. Green cleaning supplies and services
4. Rewrite the City's zoning code with an eye on sustainability
5. Bio-diesel pilot project for City Engineering vehicles
6. Reduce fuel consumption and emissions of the City fleet and Metro buses
7. Garage door at Metro to reduce heating costs and improve indoor air quality
8. Replacement of bus wash and vacuum systems at Metro
9. Commuting incentive programs for City employees to reduce SOV
10. Develop energy saving approaches and policies for public housing in the City

Contact Information

For additional information, a list of current TNS projects, and to provide feedback and recommendations, please contact:

- Andrew Statz, Mayor's Office

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- Karl van Lith, Organization and Development Training

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- Sustainable Design & Energy Committee

http://webapp.cityofmadison.com/sustainable_design/index.cfm

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