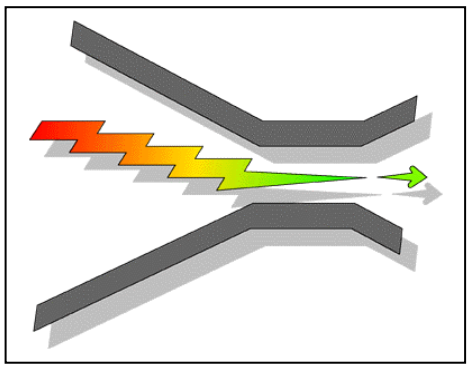


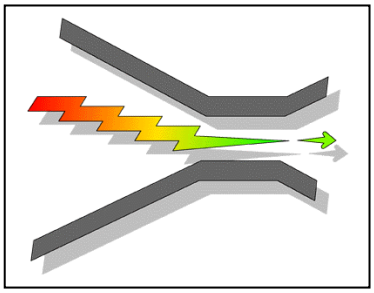
# Overview of Pathways to Sustainability:

## A Strategic Planning Model for Achieving Environmental Sustainability

WASHINGTON STATE DEPARTMENT OF ECOLOGY

**Tools for Green Planning**

*Publication No. 02-01-007*
*(Second Edition: Revised May, 2003)*



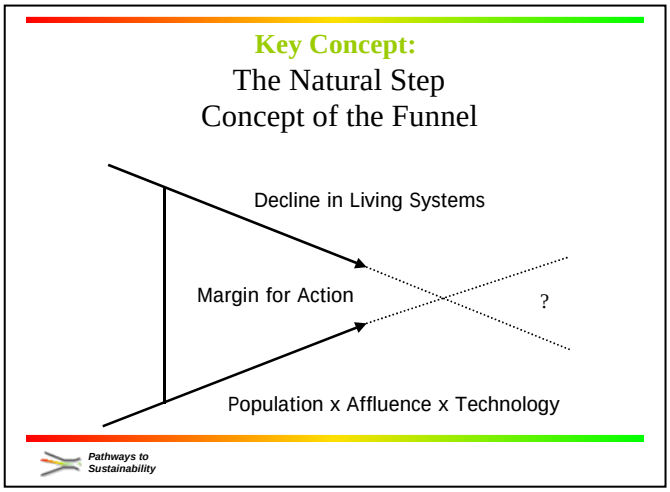
# *Overview of Pathways to Sustainability:*

## *A Strategic Planning Model for Achieving Environmental Sustainability*

# An Illustrated Introduction to the Pathways to Sustainability Project

## Key Concepts:

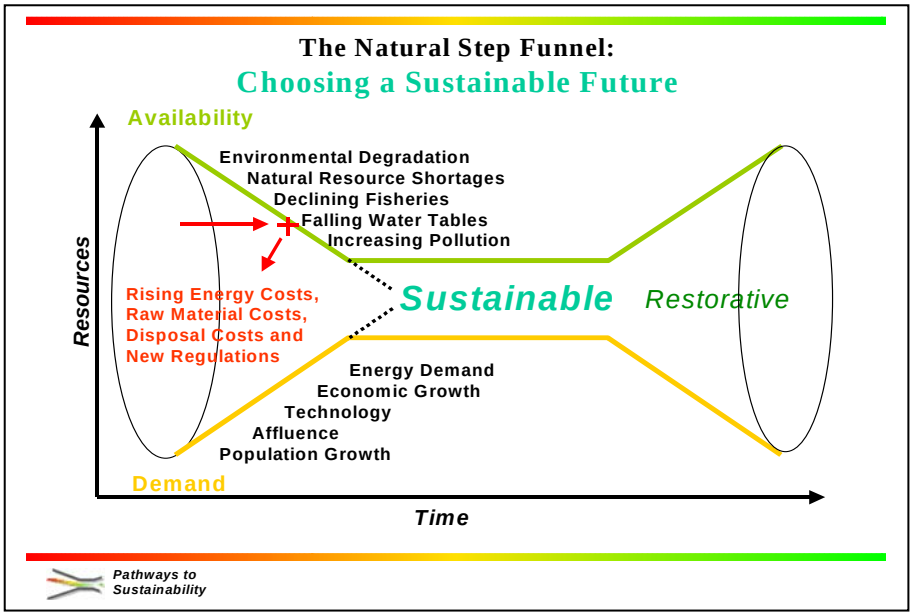
While innovative, this project is built upon the work of others in the emerging field of sustainability. In this section, we briefly review some of the project's conceptual foundations.




The first key concept comes from the breakthrough green planning work done in Sweden, called "The Natural Step." What is called "the funnel" shows why we all need to act soon to reduce our environmental impacts to sustainable levels. The funnel concept illustrates a demand curve that rises over time, representing the increasing global demand for goods, services, and energy. This demand is driven by the combined increases in population, affluence and powerful technology.

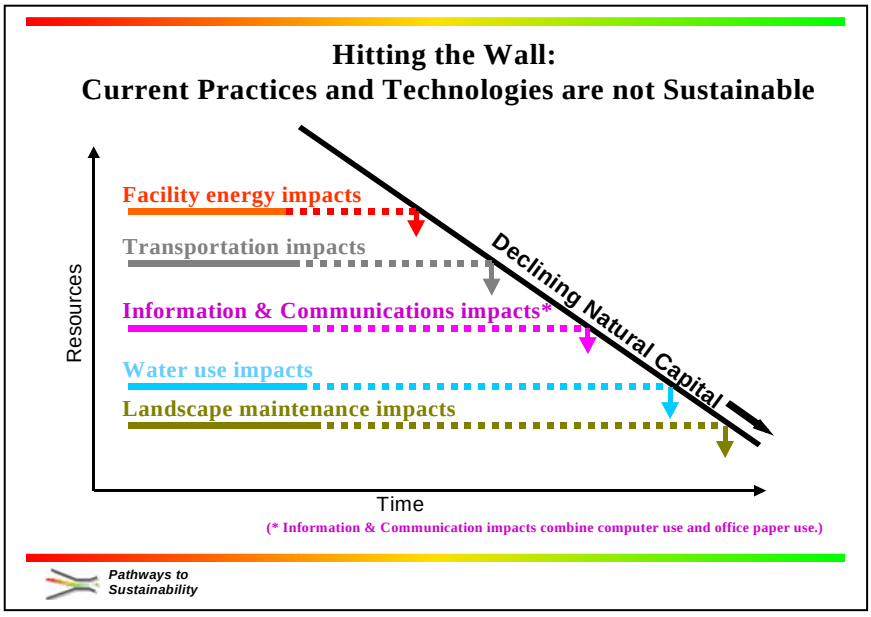
The consequence of rising demand and consumption has been a corresponding decrease in natural resources, and in the vitality of living systems. What level of natural resource use can be sustained for future generations will depend on three main factors: population growth, over which we have little control; on our technology, over which we have great control, and on the efficiency with which we use natural resources and energy. As Janine Benyus puts it, our success depends on how well our technology can work with natural systems[i].

As Paul Hawken *et al* describe in *Natural Capitalism: Creating the New Industrial Revolution,*[ii] the future contribution natural systems can make to human enterprise

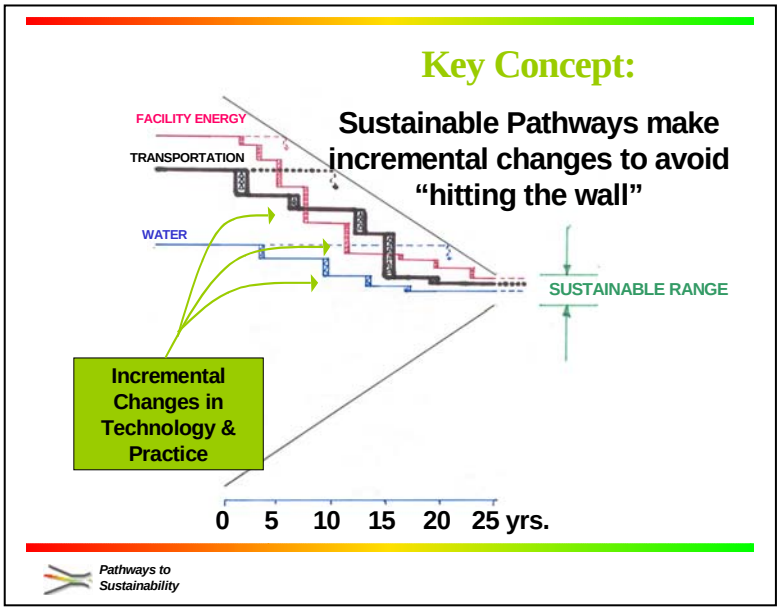



depends on how cleanly and efficiently we use those natural resources. Our challenge is to flatten out our demand curve and the corresponding decline in natural systems. This is a global challenge. But it is also an enterprise-specific challenge.

**"Hitting the wall":** Each enterprise -- whether business, public agency, or household -- currently has a level of product, resource and service use which more or less reflects mainstream consumption patterns. Typically, the levels of resource use required by today's technology and practice are not sustainable. Sooner or later, they will "hit the wall," jeopardizing the future of the enterprise. This wall takes the form of rising energy, raw material and disposal costs and, inevitably, legally imposed limits and conditions on the use of scarce resources.



**Finding pathways that avoid "hitting the wall":** Current consumption patterns can be changed. Over time, an enterprise can make changes in its practices and technologies. The idea is to make these changes toward sustainability before major disruptions are experienced. Advance planning and gradual implementation will help make the undertaking more successful, both for the enterprise and the larger society. Some changes will require that emerging technologies come into large-scale production. Long-range planning can be used to help exert a "pull" on the market for these alternative technologies.




## Context and Approach:

The context and approach for any organization's assessment and transformation of its environmental impacts will vary, and so the approach it takes may require some adjustments from this model. The Pathways to Sustainability model was not developed in the abstract, but used the headquarters facility of the Washington State Department of Ecology as its pilot. To help the reader gauge the scope of this effort, or compare it to another, Ecology's headquarters facility provides office space for about 1,100 people. While many details of the Department of Ecology may be unique, the features most relevant to shaping the Pathways approach should be familiar to most readers:

- Our financial resources are very limited; and
- We have a fairly lean set of management information and reporting systems. Most of these are tied to financial management and reporting.

Ecology's approach to developing the Pathways to Sustainability Project emphasized practical considerations. The following tenets guided the consultants' research and development work, to set the stage for successful implementation:

- **Build on existing systems:** We wanted to monitor our environmental impacts -- our throughputs – using existing tracking and reporting systems as much as possible, to keep new reporting system costs and staff impacts low. Concentrating on information and management systems that actually receive high use -- like financial systems, and vehicle

management systems -- can channel any reporting system investments into improving core management information systems, and avoid unproductive investments in ancillary systems for occasional use.

- **Reveal priorities for action:** Existing impacts have to be analyzed from a sustainability perspective, to help concentrate limited resources for investments in change where there is the greatest concern.

- **Build an open green planning model:** A planning framework had to be devised that could be applied (and demonstrated) by Ecology, and could easily and quickly be extended to other Washington State agencies as requested. The approach used also had to be broad enough that it could be adapted for use by other agencies, businesses and households.

- **Support the goal of becoming sustainable in 25 years:** This planning framework had to support the goal of achieving sustainability in 25 years. This time frame is appropriate to the scale of change that needs to be made, and it facilitates setting aggressive goals for sustainability.

- **Support implementation budgeting with payback estimation:** Implementation of many new technologies -- for saving energy and reducing other impacts -- will have an up-front cost that will be offset by reduced energy costs in the future. We wanted an approach that would help us make our case for future savings, where we could expect to see them. (We recognize some changes will not have a direct financial payback.)

## Overview of the Pathways Model:

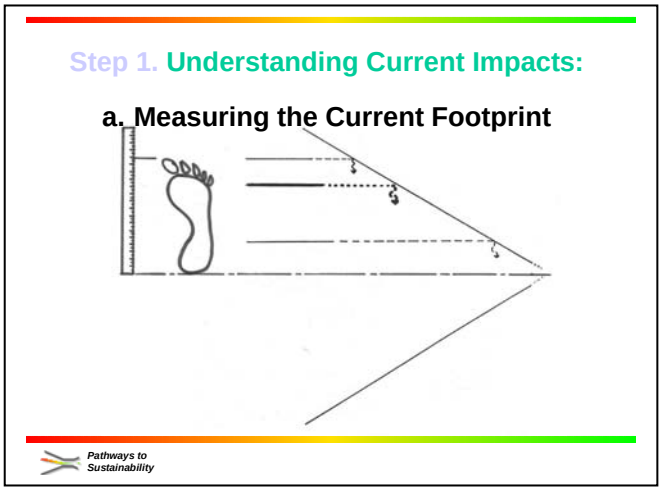
There are five basic steps to adopting Pathways to Sustainability.

1. **Understand Current Impacts**
   - Quantify
   - Analyze using sustainability lens
2. **Set 25-year Goals**
   - By Resource
   - By Functional Area
3. **Identify Strategies and Assumptions**
   - Technology
   - Key Events
4. **Lay Out 5-year Sub-Goals (Steps in the Pathway)**
   - Last Step
   - Rest of Pathway
5. **Implementation**
   - Leadership
   - Planning responsibility
   - Tools (e.g. Payback Analysis)
   - Training and Support

We will look at each one of these steps in more detail, using Ecology's work as an example.

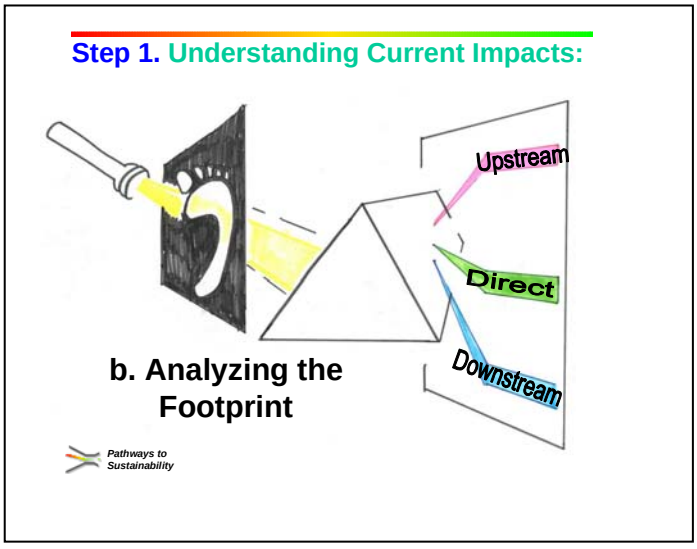
1. **Understand Current Impacts:** Understanding current impacts has two parts: **quantifying** energy, materials, and resources used; and **analyzing** the results from a sustainability perspective to see which are of most concern.

   - **Quantify: Measure the current footprint**. Existing management reports can be (and were) used as the basis for quantifying current impacts.




For impacts with seasonal fluctuations, a full year's data were required, but either calendar year or fiscal year data are acceptable. Where existing reports lumped together two or more things that should be analyzed separately, percentage breakouts of the annual totals were estimated based on a representative sample. In the future, these data requirements can be met by making minor changes in existing information systems, during routine future updates.

   - **Analyze the footprint: analyze the impact data from a sustainability perspective.** The Pathways model uses computer-based models from environmental economics to quantify relative impacts from a sustainability perspective. What is distinctive about these models (and establishes the sustainability perspective) is their inclusion of impacts that are "upstream," direct, and "downstream."




These econometric models help identify and weigh impacts, and use a cost index to compare relative impacts. They have three parts:

1) **Life Cycle Inventory (LCI):** a listing of the inputs and outputs which occur in the origin, use, and eventual fate of a product or service;
2) **Life Cycle Assessment (LCA):** An analysis and quantification of

a product's environmental impacts identified in the LCI; and

**3) Economic Valuation (EV):** a computation of the economic costs of a product's environmental impacts. Used here to calculate relative impacts.

To simplify the impact assessment at Ecology, an agency that includes regional offices throughout the state, impacts were measured at Ecology's largest facility, its Headquarters/Southwest Regional Office facility in Lacey. For overall planning purposes, these relative impacts are representative of the agency's statewide impacts. (During implementation, the variations among different facilities will have to be taken into account in specific proposals.)

The biggest impacts at Ecology's Lacey facility were determined to be:

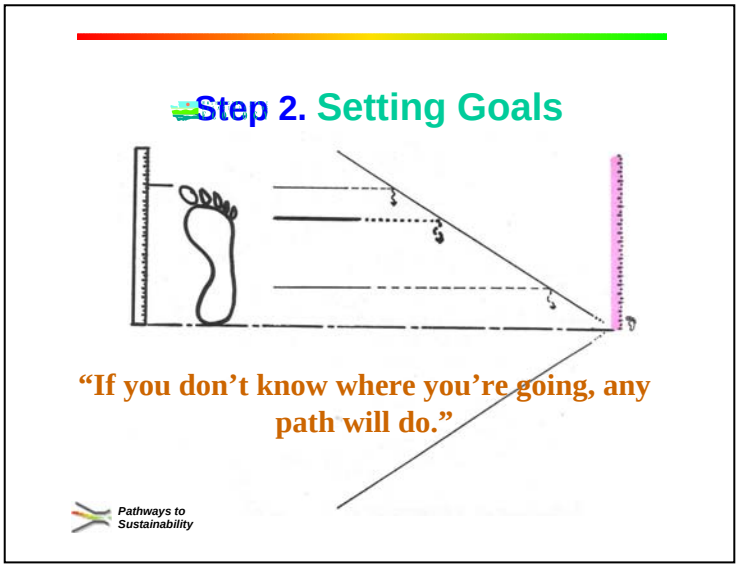
- Facility energy consumption;
- Transportation impacts;
- Computer impacts and paper consumption.

The next tier of impacts is:

- Water use;
- Landscape maintenance impacts;
- Food service impacts.

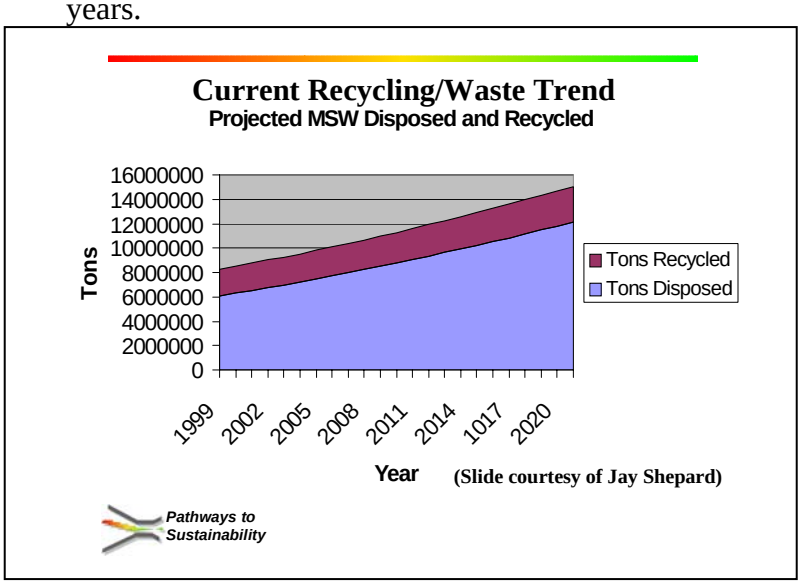
Note: Most public agencies and service businesses, particularly those in the F.I.R.E. sector (finance, insurance, and real estate), probably have similar impacts. Most households would also have a similar profile.

2. **Set 25-year goals:** The next step is to set goals. The general goal is: "We will be sustainable in 25 years." The 25-year planning horizon is consistent with both the Oregon and Washington Executive Orders, and seems appropriate to the scale of change we are making. While 25 may be somewhat arbitrary (and could be changed in the future in response to unforeseen changes in conditions), it strikes a good balance between allowing time for new technology to come on line, and requiring that implementation begin soon.




The importance of committing to the goal of sustainability cannot be overstated. There is a profound difference between moving toward sustainability as opportunities

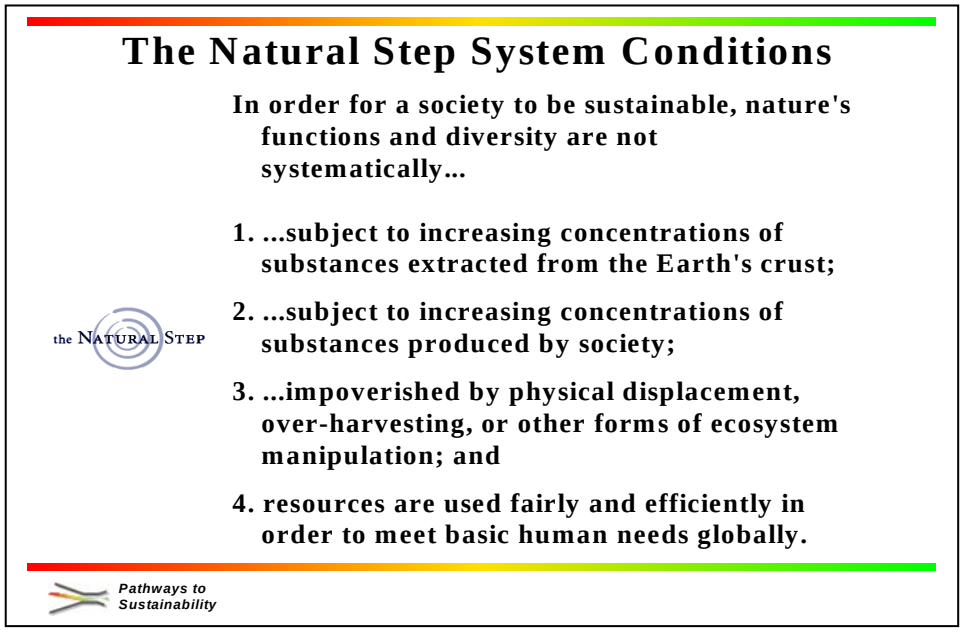
arise, and adopting a long-term goal and strategy of achieving sustainability in 25 years.




Current recycling and waste management trends in Washington State illustrate this problem.[iii] The slide shows that recycling in Washington State (represented by the dark middle band) is projected to increase over time. However, the trend for waste generation is projected to grow more quickly, unless some fundamental changes are made.

Despite increased recycling year by year, we can still get further and further from sustainability, unless we understand what direction to take, and actually move in that direction.

In the Pathways to Sustainability model, goal-setting begins with setting specific 25-year goals for each major functional impact area identified in Step 1. For Ecology, these are: Facility Impacts, Transportation, Information & Communication (computers & paper), Landscape Impacts, and Food Services. The Natural Step System Conditions, which define four system conditions which must be met to achieve sustainability. These system conditions were chosen for goal setting because they offer a good, science-based definition of sustainability.



To augment system conditions three and four for the goal setting process, two additional criteria were added: Natural Capital and Human Capital. These last two categories were often useful when a group of consultants and staff were in a goal-setting work session, since some participants found these concepts more "user-friendly" than their Natural Step counterparts. Later, the goal statements were refined into the four Natural Step categories.

Below is an excerpt from Ecology's Transportation pathway. The complete goal statements for each pathway are available in the report. (Other agencies or organizations may want to use these goal statements as a point of departure, and modify them as needed to fit their own impacts, rather than work through them from scratch.).

**Sustainability Goals** (Transportation Pathway Example): The Natural Step (TNS)

| Resource | TNS System Condition #1 | TNS System Condition #2 | TNS System Condition #3 | TNS System Condition #4 |
|---|---|---|---|---|
| Energy | • **Sources of energy are 100% renewable** | • Vehicles are produced from 100% non-toxic components<br>• Sources of energy create zero pollution<br>• Allow zero release of pollutants | • No net carbon is released to the atmosphere through energy production or consumption<br>• Energy sources and transmission infrastructure are non-polluting and non-toxic to living systems | • Vehicles make the most efficient use of energy resources<br>• Mobility resources are used effectively |

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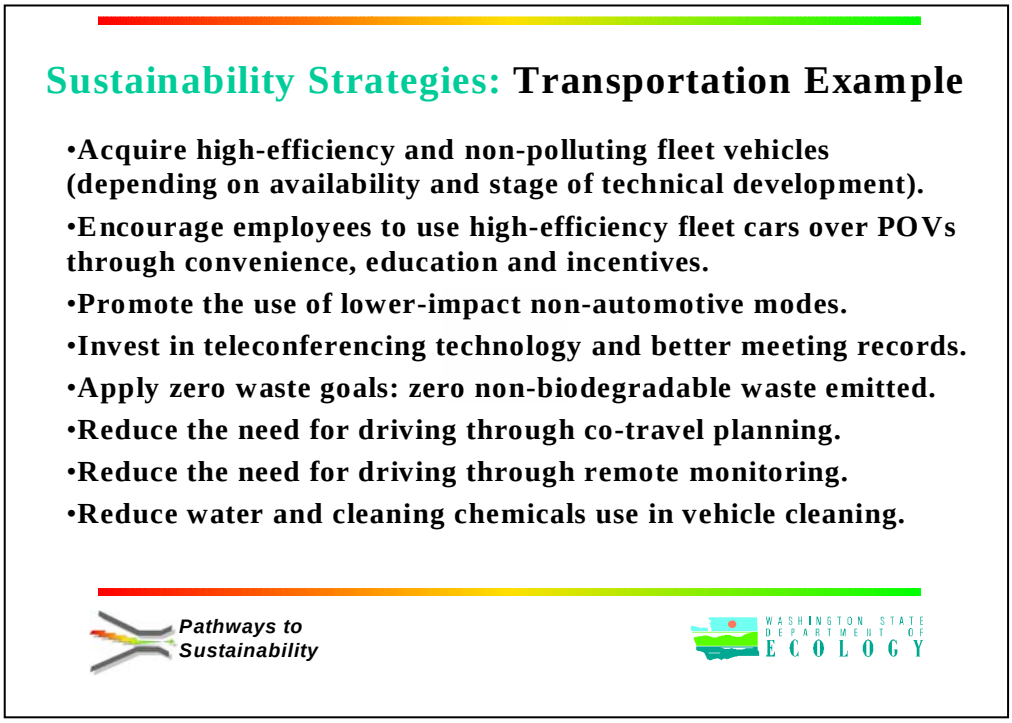
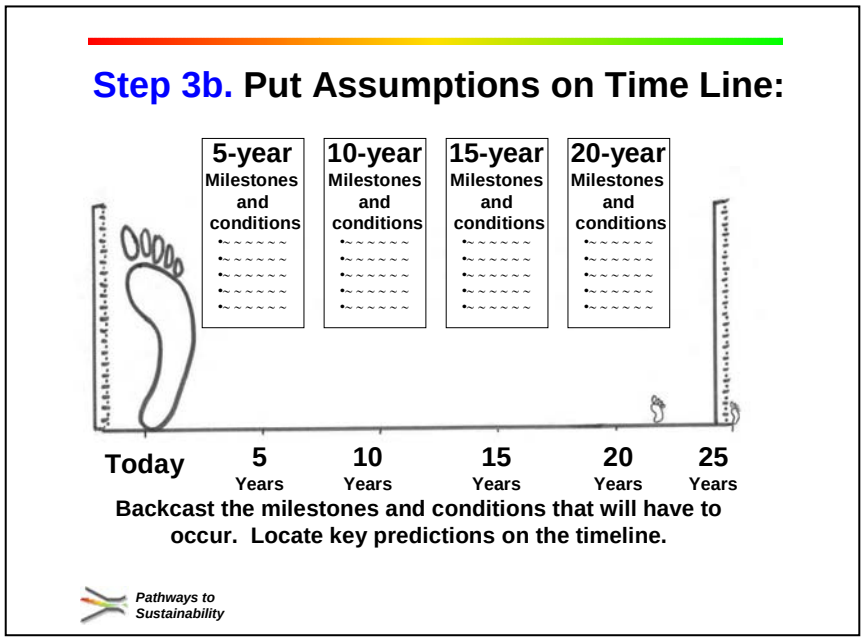
The final stage of the goal setting process is to envision how these goals would be met.

**3. Identify Strategies and Assumptions:** The next step is to outline strategies that can accomplish these goals. The following example from Ecology's Transportation Pathway shows that these strategies are neither outlandish nor difficult to understand.




**Vision of the future:** Once the strategies are understood, a vision of the sustainable state of each pathway can be put together, for use with the goals.

**Timing assumptions:** The next step is to estimate when certain technologies will come on line. For example, we estimate that larger Hybrid Electric Vehicles (using the same technology as the Toyota Prius and Honda Insight available today) will be available within five years. We estimate that the next generation of alternative fuel vehicles -- without greenhouse gas emission -- will start to become available in about twenty years.



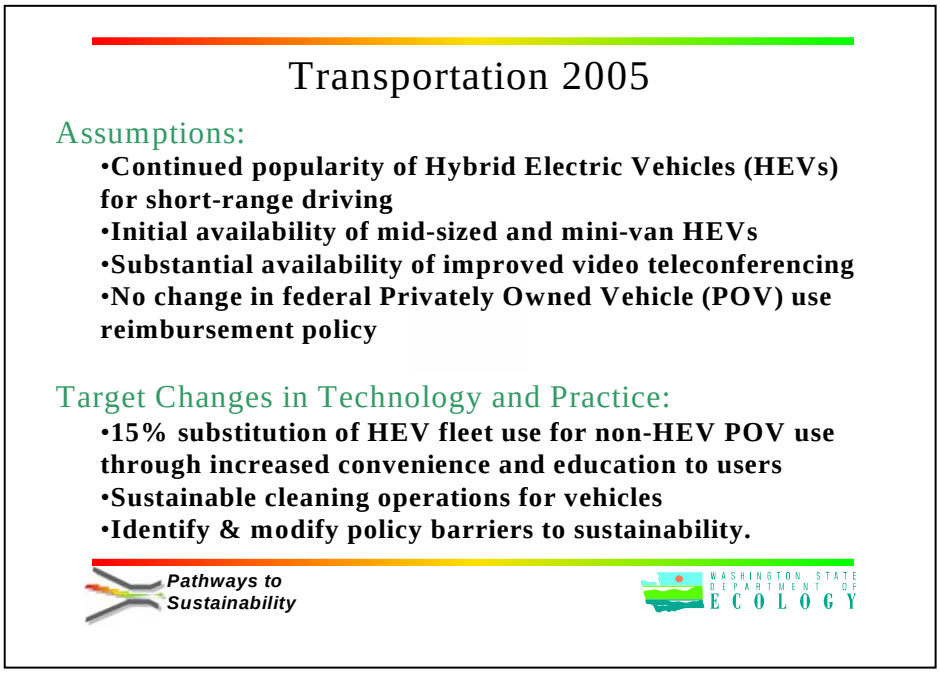
This is also the time to put **major planned events** on the timeline. For example, Ecology's headquarters facility will probably require re-roofing in about ten years. This information helps coordinate the scheduling of related construction projects, such as installation of rooftop solar panels. This coordinated planning and construction can also help keep costs and environmental impacts at a minimum.

The timing estimates for the availability of new technologies are, of course, imprecise. They are based on the consultants' familiarity with the current literature on the subject. (No extensive review of the literature or future study was commissioned.) Assembling these estimates and assumptions for each of the pathways represents one of the innovations of this project, and one of the key benefits of sharing the Pathways model. One of Ecology's support requirements for this project is to **maintain the Pathways technology assumptions on an open web page**, for access by any other enterprise using the model. (This will allow other users of the model to save some time and cost, and allow them to contribute to update sections that are of particular interest to them.)

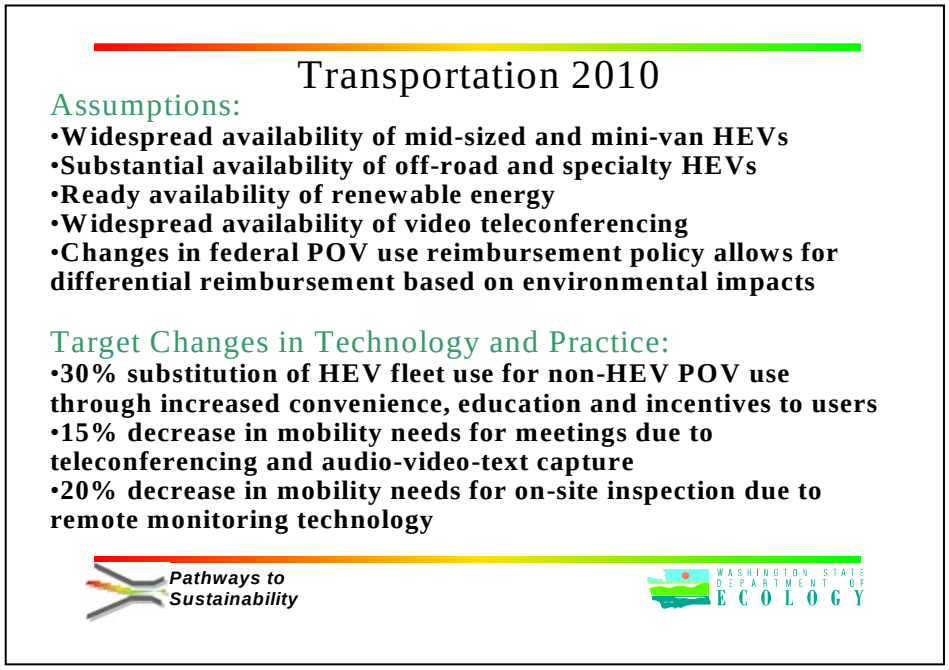
**4. Lay out 5-year sub-goals --target changes in technology and practice, aligned with assumptions:** The preceding work describes the kinds of changes that can achieve sustainability, and makes reasonable estimates about the availability of key technologies. With this information in place, a general timeline for implementation can be planned, in four or five year increments. (The Ecology project was prepared in five-year increments, but four year increments that aligned with electoral cycles might be more useful for public agencies.)

Based on Ecology's highest impacts, this project focused on three functional pathways: Facility Infrastructure, Transportation, and Information and Communications. For each pathway, the report describes goals, strategies, sub-goals and assumptions in five-year increments, and suggestions for action now. The Transportation pathway is used as an example below.

For **2005**, the main strategies in making transportation impacts sustainable are to make the agency fleet less polluting (which will also save the agency money over time by reducing fuel costs) and help staff get out of lower mileage privately-owned vehicles (POVs) and into higher mileage agency fleet vehicles. (This will also save the agency money, since POV reimbursement rates are substantially greater than agency fleet costs.) In fiscal year 2003, Ecology's sedan purchases were exclusively hybrid electric vehicles, averaging over 40 miles per gallon, to replace conventional motor pool sedans at the end of their life cycle. *(See below.)*




The assumptions for **2010** show that Ecology expects to see a wide range of hybrid electric vehicles (HEVs) available, allowing HEV technology to supplant conventional technology for most agency travel requirements. The target for 2010 is for a 30% substitution of fleet HEV use for reimbursed POV use.




Ecology reports that they expect video tele-conferencing technology to improve steadily, and continue to come down in cost, so that some travel for meetings can be reduced without a loss in productivity or effectiveness. In fact, they predict an increase in effectiveness coming from improved communication of meeting summaries for participants, and details for anyone who may have missed a meeting.

## Transportation 2015

### Assumptions:

**•Widespread availability of renewable energy at competitive prices**
**•Video recording and remote monitoring increases efficiency of visits, reducing the unit mobility requirements for inspections**
**•Convenient, cost-effective and low-impact regional transit infrastructure**

### Target Changes in Technology and Practice:

**•50% substitution of HEV fleet use for non-HEV POV use through increased convenience, education and incentives to users**
**•30% decrease in meeting frequency, due to efficiency from digital audio-video-text capture and video teleconferencing**

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By **2015**, we would expect to see a 50% substitution of HEV fleet use for the less efficient POV use for agency business.

## Transportation 2020

### Assumptions:

**•Some availability of cost-effective next-generation zero-impact automobile technology**
**•Widespread availability of renewable energy at lower prices than conventional sources**

### Target Changes in Technology and Practice:

**•All new fleet acquisitions use next-generation zero-impact technology**
**•75% substitution of HEV fleet use for non-HEV POV use**
**•Sustainable cleaning operations for vehicles**

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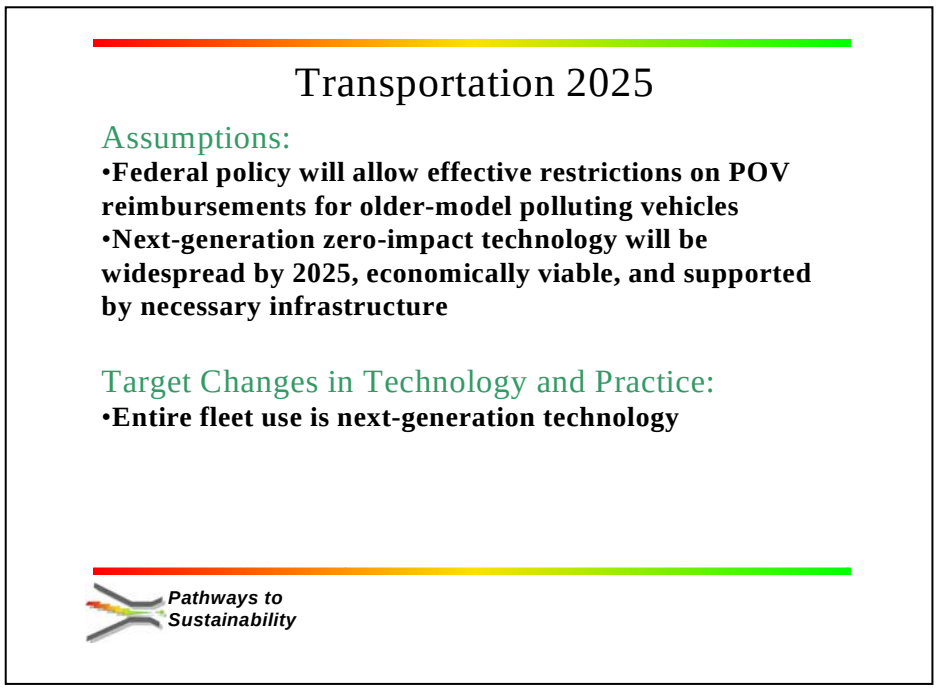
By **2020**, we would expect to see the HEV/non-HEV POV ratio increased to 75%.

By this time, we would expect to see the next generation of vehicle (whether hydrogen car, green electricity powered electric car, or something else) available at competitive prices.

So by 2020, we would be shifting new vehicle purchases to this new technology. This new technology would have to come available by 2020, in order for us to meet the **2025** target of the entire fleet using next-generation technology.




**These four-to-five-year benchmarks** provide a useful planning framework. Using these as a guide, the enterprise can develop specific plans each budget cycle, to move steadily toward the goal, as resources allow.

## 5. Implementation:

**Implementation begins with understanding.** The first steps in implementation are education and training, to ensure that everyone involved understands why change is needed, the scale of change that is needed, and the viability of this long-term approach to change.

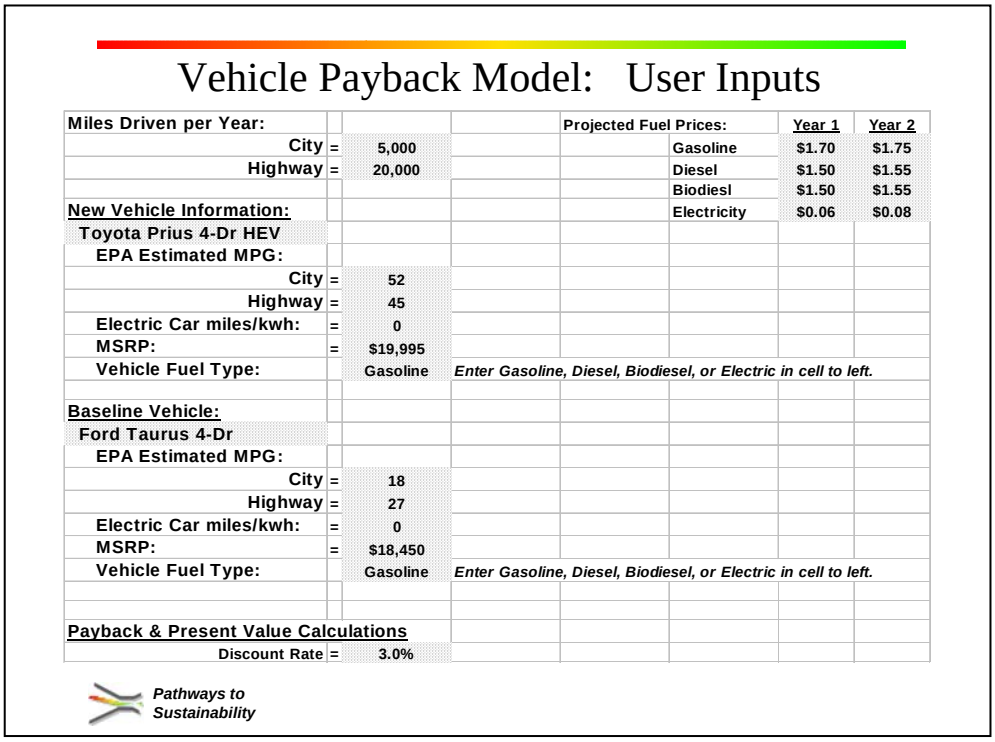
**Implementation requires commitment.** The next step requires resolve. The enterprise needs to make the general commitment to become sustainable in 25 years.

**The Pathways to Sustainability green planning model** can be adopted in whole or in part to support the efforts of the enterprise working towards sustainability. The Pathways model is not a detailed, engineered solution. But it is a powerful 25-year strategic planning framework to help plan and organize change. Within the four-to-five-year sub-goals, specific plans and budgets will have to be prepared each year or two. (Washington's Executive Order requires state agencies to submit an initial plan in 2003, and biennial plans

beginning in 2004.) For many budget items, cost savings from costs avoided in the future can be estimated, along with environmental benefits.

**Wherever practical, implementation planning should be conducted through existing work teams.** With good leadership, education, and communication, existing work groups can factor sustainability planning goals into their on-going operations planning. The Pathways framework is designed to give them the tools they need to do that successfully. Some additional support will be useful to help build confidence in what is not yet a mainstream approach.

**Payback Analysis Tools:** In order to help work groups analyze alternative investment strategies, and support budget proposals for investments in sustainability, the Pathways project includes payback tools. Three working spreadsheets were prepared for Ecology by one of their consulting economists, to help staff working on specific proposals calculate future savings in fuel and energy use. Part of the theory of the "funnel" is that we can expect (non-green) energy costs and other natural-resource-based costs to rise as we experience shortages (approach the wall). We do not expect that all environmental costs will necessarily be adequately reflected in these rising resource costs.



Vehicle Payback Model: User Inputs

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Miles Driven per Year: | | | | Projected Fuel Prices: | | Year 1 | Year 2 |
| City | = | 5,000 | | | Gasoline | $1.70 | $1.75 |
| Highway | = | 20,000 | | | Diesel | $1.50 | $1.55 |
| | | | | | Biodiesl | $1.50 | $1.55 |
| New Vehicle Information: | | | | | Electricity | $0.06 | $0.08 |
| Toyota Prius 4-Dr HEV | | | | | | | |
| EPA Estimated MPG: | | | | | | | |
| City | = | 52 | | | | | |
| Highway | = | 45 | | | | | |
| Electric Car miles/kwh: | = | 0 | | | | | |
| MSRP: | = | $19,995 | | | | | |
| Vehicle Fuel Type: | | Gasoline | *Enter Gasoline, Diesel, Biodiesel, or Electric in cell to left.* | | | | |
| Baseline Vehicle: | | | | | | | |
| Ford Taurus 4-Dr | | | | | | | |
| EPA Estimated MPG: | | | | | | | |
| City | = | 18 | | | | | |
| Highway | = | 27 | | | | | |
| Electric Car miles/kwh: | = | 0 | | | | | |
| MSRP: | = | $18,450 | | | | | |
| Vehicle Fuel Type: | | Gasoline | *Enter Gasoline, Diesel, Biodiesel, or Electric in cell to left.* | | | | |
| Payback & Present Value Calculations | | | | | | | |
| Discount Rate | = | 3.0% | | | | | |

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But we do expect that turning to a sustainable way of doing business requires investments that reduce future environmental risks. These will tend to reduce financial risks from rising prices of natural resource-based goods and services. Since the investments cost money and it requires effort to make changes, the corresponding

## Vehicle Payback Model: Money Payback Results

| Payback & Present Value Calculations | | | | | | |
|---|---|---|---|---|---|---|
| Discount Rate = | 3.0% | | | | | |
| | | | | | | |
| New vs. Baseline Price Differential = | $1,545 | amount to be paid back through fuel savings | | | | |
| | | | | | | |
| Projected Fuel Cost Savings: | Year 1 | Year 2 | Year 3 | Year 4 | | |
| Not Discounted | $812 | $836 | $860 | $884 | | |
| Discounted | $789 | $788 | $787 | $786 | | |
| | | | | | | |
| Cumulative Not Discounted | $812 | $1,649 | $2,509 | $3,393 | | |
| | | | | | | |
| Payback Period (years) | 1.9 | | | | | |
| | | | | | | |
| Net Present Value | $1,605 | | | | | |

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financial as well as environmental benefits need to be communicated to support this turning toward sustainability. These payback models incorporate environmental benefits into the payback analysis, thus connecting financial and environmental criteria in the analysis of investment strategies for sustainability.

## Vehicle Payback Model: Monetary + Environmental Payback

| Environmental Impacts | Emissions Reductions (thousand lbs) | Estimated Environmental Cost Savings: Low Estimate (annual $) | | High Estimate (annual $) |
|---|---|---|---|---|
| Annual Atmospheric Emissions | | | | |
| Particulates (Total) | 0.0 | $37 | | $189 |
| Nitrogen Oxides | 0.0 | $16 | | $180 |
| Hydrocarbons (non CH4) | 0.1 | $17 | | $261 |
| Sulfur Oxides | 0.0 | $0 | | $15 |
| Carbon Monoxide | 0.3 | $2 | | $139 |
| CO2 (biomass) | 0.0 | $0 | | $0 |
| CO2 (non biomass) | 10.0 | $2 | | $122 |
| Ammonia | 0.0 | $0 | | $0 |
| Lead | 0.0 | $0 | | $0 |
| Methane | 0.0 | $0 | | $0 |
| Hydrochloric acid | 0.0 | $0 | | $0 |
| | | $74 | | $906 |

| Payback & Present Value Calculations Including Environmental Cost Savings | | | | |
|---|---|---|---|---|
| Projected Total Cost Savings: (Fuel+Average Environmental) | Year 1 | Year 2 | Year 3 | Year 4 |
| Not Discounted | $1,303 | $1,326 | $1,350 | $1,374 |
| Discounted | $1,265 | $1,250 | $1,236 | $1,221 |
| | | | | |
| Cumulative Not Discounted | $1,303 | $2,629 | $3,979 | $5,354 |
| | | | | |
| Payback Period (years) | 1.2 | | | |
| | | | | |
| Net Present Value | $3,427 | | | |

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**Communicating Results (the case for an open system):** Wherever possible, the results of using this model should be open for sharing with other users and potential users. In the private sector, this is not always possible, since competitive advantage can be compromised by too much disclosure of investment strategies. But in the public sector, this information can always be shared, and can save the public money as a result.

Keeping an open model in the public sector also can have substantial benefits for the private sector. Small businesses and households do not generally have the expertise or resources to hire consultants to work through the kind of planning information provided through the Pathways project. They must rely on public sources of information to make their plans and choices.

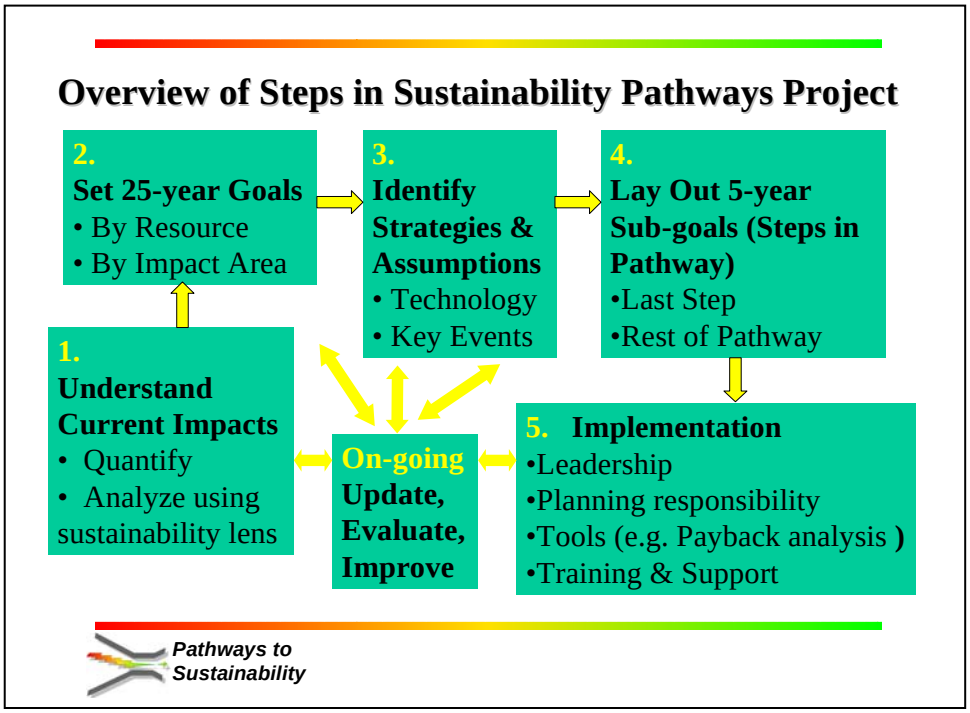
Keeping this long-range planning data public has another benefit for the private sector, as well as the larger society and economy. Predicting when public agencies plan to shift to new technologies can help private entrepreneurs develop and produce these technologies. In this sense, private enterprise likes predictability. By facilitating predictability, the public sector helps break the chicken and egg cycle that prevents production of new technologies until the private sector is sure that there will be a demand, while at the same time new demand does not happen until the technology is widely and economically available.

**Next Steps:** At this time, each enterprise will look ahead and determine their next steps. In Washington State, Governor Locke's Executive Order on Sustainability requires state agencies to prepare initial sustainability plans in 2003. For Ecology, Pathways provides a practical framework for articulating long-term goals and direction, and for making short-term plans in each of the five pathways to sustainability that have been developed:

- Facility Infrastructure Impacts
- Transportation
- Information and Communications
- Food
- Landscape impacts

Ecology is also involved in other efforts that will be woven into the sustainability plan. These include Environmentally Preferred Purchasing and waste reduction efforts already underway.

Preparing these Pathways materials for use by households and small businesses will require additional resources to make the materials easier to understand and use. Externally, as resources permit, Ecology would like to begin to make these materials available to sister state agencies, local governments, and other public organizations.




## Conclusion:

## What the Pathways to Sustainability Project Accomplishes:

- **The cognitive belief that sustainability in 25 years is attainable.** This, in itself, is a significant accomplishment. It is very difficult to get the best work from work teams if they don't believe the result is possible.
- **A planning framework an agency, business or other enterprise can use now, and refine in the future where necessary.** This 25-year planning framework is very useful. It is an appropriate time horizon for the amount of work that needs to be done, yet it offers near-term targets that will accomplish the goal.
- **This framework is good for building internal cooperation.** This framework is useful for mapping the changes the enterprise (state agency, business etc.) intends to make. This helps reduce internal conflict over competing projects, and creates the conditions for cooperation to achieve the near-term goals first, then move on to the others.
- **A framework that lends itself to budget proposal development in a cost-cutting climate:** By emphasizing and quantifying the future costs associated with energy and natural-resource-related requirements, this framework can help make planning and budgeting for sustainability successful.
- **An open approach to sustainability planning:** This is a sharable green planning model. It is readily adaptable to other state agencies, local governments, large and small businesses -- even households can use it.

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**For further information on Ecology's work, please consult our Sustainability Web Site at www.ecology.wa.gov/sustainability or consult a member of the project team:**

**Ecology Project Team**

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*Pathways to Sustainability*

The Pathways reports are available to download at www.ecy.wa.gov/sustainability. Public agencies may request an MSWord version of the reports by contacting John Erickson at 360-407-7042, or e-mail jeri461@ecy.wa.gov.

Also, if you require this publication in an alternate format, please contact John at the contact information above or TTY (for the speech or hearing impaired) 711 or 800-833-6388.

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[i] Benyus, J., 1997: *Biomimicry: Innovation Inspired by Nature*, Quill, William Morrow, New York, New York.

ii Hawken, P., Lovins, A., and Lovins, L.H., 1999: *Natural Capitalism: Creating the New Industrial Revolution*, Little, Brown, and Company, Boston, MA. Available through twbookmark.com and elsewhere.

[iii] Thanks to Jay Shepard of Ecology's Solid Waste Financial Assistance Program for the "Current Recycling and Waste Trend" slide.