A Forum on Sustainability, Well-Being, and Environmental Protection: What's an Agency to Do?

December 2, 2005; Washington, DC

Rapporteur's Summary

Introductory Remarks

Alan Hecht, Director for Sustainable Development, U.S. EPA:

Dr. Hecht thanked participants for attending and noted that the U.S. Environmental Protection Agency (EPA) is celebrating its 35th anniversary, providing a good opportunity to look ahead and achieve cost-effective solutions to improve the quality of life, keep the economy strong, and protect the health of the environment. EPA's Office of Research and Development (ORD) is sponsoring this forum to explore the relevance of sustainability to EPA's environmental protection mission and to develop ways to use concepts of sustainability to accomplish this mission.

Panel 1: Basis

Moderator: Herman Daly, Professor of Public Affairs, University of Maryland:

Sustainability is a troublesome abstract noun that is hard to discuss. Agreement on a definition can be difficult. Dr. Daly proposed a definition that recognizes that the biosphere is doing the sustaining, and the economy is being sustained. The panel discussed the following questions:

- ✧ Is intergenerational equity a reasonable definition of sustainability? Conceptually and operationally, how do you conceive and define intergenerational equity (e.g., as constant or non-declining utility, GDP, throughput, manmade capital, natural capital, total capital, etc.)?
- ✧ How does concern for sustainability comport with the claim that each generation is generally better off than those that preceded them? Is this claim historically true? If so, over what time period, and is it likely to remain true?
- ✧ How does sustainability relate to environmental protection?

Tony Janetos, Vice President, The Heinz Center:

Sustainability is based on the concept of non-declining human utility or well-being and includes the goal of non-declining capacity in the environmental foundations of the economy. Indicators in a variety of areas show that the present generation is not better off than previous generations, even in developed nations. If the environment is the basis of economic health, then the extraction of resources should not come at the expense of future needs unless investments have been made in research and new technologies to develop substitutes. In some areas, substitutes may be more feasible because of the physical realities of the ecosystem. Science often is able to explain what has occurred after the fact but is not good at predicting what will occur, and this is an area of concern. One challenge for sustainability is the lack of measurement systems to track changes in the components of a sustainable environment. A comprehensive

measurement system is needed for confident decisionmaking and a thorough examination of policy options.

Geoffrey Heal, Professor of Public Policy and Business Responsibility, Columbia University:

Although intergenerational equity is a part of sustainability, it does not provide a complete definition. The fair distribution of economic benefits temporally and controlling the environmental impact of economic activity are two equally important parts of sustainability. The challenge is to determine what is fair and to clarify what is meant by controlling environmental impact. Environmental protection is the essence of sustainability. Economically it is a simple concept—harmful environmental activities are identified, an estimate of value is made, and the environmentally damaging activities are made more expensive through taxes or tradable quotas. A further challenge is determining the harmful impacts and measuring them. Determining the value of ecosystem services is difficult: more research and information are needed in this area. In economic terms, discussion of intergenerational equity is equivalent to discussion of the discount rate. Historically, in industrial countries, generations have been better off than their predecessors; however, dramatic environmental breakdowns could cause future generations to be worse off than those that preceded them. If this were to happen, then income would decrease over time and the consumption discount rate should be negative to provide more weight to future consumption.

Bryan Norton, Professor of Philosophy, Georgia Institute of Technology:

Intergenerational equity should not be part of a sustainability definition if equity is defined as the ability to consume. This narrow definition is problematic and creates a possible conflict between doing well (consuming) in the present and investing in the future. Access to resources and a political system that allows for helping the present poor as well as future generations should be the focus. Building fair institutions that will serve present people and making those institutions strong, lasting, capable of growing and able to meet challenges in the future can accomplish the goals of sustainability. EPA should design programs with multiscaled benefits to create win-win situations, strengthen institutions, and ensure access to land and resources. Measurements should be made at different time scales and include indicators from multiple disciplines. Economic growth possibilities should be determined and then filtered through a "welfare filter" to determine the policies of choice. Dr. Norton's welfare filter includes: (1) improving individual welfare; (2) distributing wealth equitably; (3) protecting ecological health and regional productivity; (4) protecting or enhancing global systems; and (5) controlling population and wasteful consumption to reach a policy of choice.

Questions/Discussion:

Warren Flint, Five E's Unlimited and Sustainability Now!, noted that both inter- and intra-generational equity are important and should be included in a definition of sustainability, but equity is only one issue. He asked what other "fundamental truths" should be included so that the concept of sustainability can be understood and generally accepted Dr. Daly responded that the ideas of finitude and entropy were important. Dr. Norton noted that because of the diverseness of global society, fundamental truths are hard to identify. What should be sustained is a normative concept and should not be reduced to a simple economic equation of a description of income across time. He highlighted the importance of local institutions through which the community articulates what is valuable to sustain.

Steve Kelton, EPA, noting that nations seek economic growth, asked if it is possible for the United States. to grow its way to a sustainable future. Dr. Janetos responded that many of the environmental problems have been "grown into" so the possibility for "growing out" of them is slim. He noted that the United States is the fourth most populous country in the world and is growing rapidly; a fundamental truth is that size matters. The United States consumes one-quarter of the world's energy and produces one-quarter of the greenhouse gas emissions. Dr. Heal noted that there is a need for more technological changes and solutions. Growth in welfare is desirable but not growth in physical consumption.

Joy Hecht, consultant, asked panelists to provide practical implications of the discussion regardless of whether decisions are based on the present or the future. Dr. Daly suggested an emphasis on birth control or policies to limit basic resource use (energy), but noted that these ideas are not popular in today's society. Dr. Norton emphasized creating institutions that allow people to control their lives and provide input on defining the issues and solutions to sustainability problems. First, political decisions are needed and, then, tools such as safe minimum standards can be used to implement the decisions.

John Gowdy, Rensselaer Polytechnic Institute, commented that what should be sustained remains unclear and noted that economists focus on income and equate income with human well-being and that non-economists disagree with this definition. Dr. Heal noted that the issue may not be a disagreement of definition but of perspective. Basic economic principles focus on sustaining welfare—not consumption or income. Maintaining a general capital stock constant is a condition for maintaining welfare. Natural capital (such as global carbon cycle) contributes to welfare even if it is not contributing to consumption. Dr. Norton emphasized that discussion is needed to determine how maintaining general capital relates to the public's definition of welfare.

Dinah Koehler, EPA, highlighted a contradiction that although technology or innovation often is emphasized as a solution to environmental problems, the United States is technologically advanced but cannot be considered sustainable. Dr. Daly responded that this phenomenon is an example of the Jevons Paradox in which technological improvements increase the efficiency with which a resource is used, but then total consumption of that resource increases rather than decreases. Dr. Janetos noted resource depletion has occurred in marine fisheries because of technological advances. The problem is not the development, but rather the application of the technology. Dr. Heal remarked that taxing and other mechanisms of internalizing the costs of environmental impacts would promote technological change and limit the harmful environmental impacts.

Ed Fallon, EPA grantee, commented that sustainability includes social equity, environmental issues, and economic health. Is EPA's role to focus only on the environmental component or should the Agency engage in broader sustainability issues? Panelists noted that important environmental benefits often are not quantified well and therefore efforts by EPA to provide information on the cost of environmental impacts is not only appropriate but also necessary for sustainability discussions. EPA could perform case studies that would provide information for making decisions on environmental benefits that included possible cost savings to companies and society.

Alan Hecht, EPA, commented that many believe that if the market can get the prices right, problems will be solved, but this has not seemed to work for controlling environmental impacts. Dr. Heal indicated that when the goal is to stop depletion of a common good, particularly a global common good, the problem is a political rather than economic issue. Institutions must set limits, and then markets can be used to obtain an appropriate price based on the limit. For a private good with external cost, a tax is needed and an agency is needed to determine the value of the resource. Dr. Norton reiterated that sustainability is not only a matter of economic efficiency but also a political issue, and lack of knowledge at local levels is a problem.

Panel 2: Measurement

Moderator: Kirk Hamilton, Lead Environmental Economist, The World Bank:

If sustainable development cannot be measured or a measurement cannot be agreed upon, then it will be difficult to know if various activities and policies support sustainability. Questions considered by the panel included:

- ✧ What frameworks for sustainable development indicators (national accounts, material flows, etc.) are likely to be most useful for decision-makers?
- ✧ What are the roles, strengths, and weaknesses of biophysical, economic, and social indicators related to sustainable development?
- ✧ Are there assets that are non-substitutable, and how should these affect measurement?
- ✧ Will aggregate sustainable development indicators be useful for environmental agencies, given that environment is simply part of the sustainable development puzzle?

Mark Anielski, Independent Consultant:

Mr. Anielski has developed genuine value accounting, which asks what makes life worthwhile. To address this question, citizens must be engaged to determine what is valued. Mr. Anielski advocates national accounts and integrated environmental and economic accounts. Accounting is important for both governments and individuals. He is working with the Chinese government on green gross domestic product (GDP) accounting. Double entry bookkeeping has been a basis for accounting for 500 years and is an important tool to provide a government with an understanding of its nation's assets and liabilities. Composite indicators can be created and measured to track progress in the area of sustainability. The challenge is to determine the weights or values placed on the indicators. This can be done only with input from society, with the values agreed upon by society. Inventories can be made but, institutionally, countries need to do a better job of acting on the information available. Problems and inequities need to be acknowledged to fully promote sustainability.

Bhavik Bakshi, Professor of Chemical and Biomolecular Engineering, Ohio State University:

Measurement of unsustainable actions is easier than describing sustainable situations. Determining all the conditions necessary to attain sustainable development may be unachievable, but developing metrics that signal unsustainable actions is realistic. Industry is disillusioned with sustainability as an objective; the idea of resilience has more acceptance and could lead to sustainability goals. All systems need to be resilient, at all time and size scales. Environmental and corporate reporting combine resources based on mass or energy measurements, but from a thermodynamic point of view, this can be misleading because quality is not addressed. Metrics of resources used should have both a quality and quantity aspect; thermodynamic metrics can assist by quantifying environmental inputs and showing exergy or available energy. These techniques also can quantify the contribution of ecosystems goods and services. Thermodynamic methods are scientifically rigorous but not well known, and Dr. Bakshi encouraged more collaboration between disciplines. Biophysical metrics cannot capture human valuation, but it can provide important information about ecosystem services and should be included in sustainability measurements.

Joy Hecht, Independent Consultant:

Dr. Joy Hecht outlined four possible ways to measure sustainability. The simplest metric would be a single indicator for each aspect of sustainability—economic, environmental and social. Choosing a single indicator for each area would be difficult and does not allow for integration across the components. Many of the existing sustainability indicator systems are laundry lists that attempt to capture multiple aspects of sustainability. These tend to treat the social, environmental, and economic aspects separately, with no attention to tradeoffs between the areas. Composite indices add together factors, and challenges include the need for a common denominator, assigning weight factors, and substitutability assumptions. The final option would be a vector of indicators, which includes a set of discrete indicators. The difference between a vector and a composite set of indicators is that tradeoffs are not allowed (i.e., if all of the indicators do not increase then sustainability is not being achieved). Dr. Joy Hecht recommended that EPA choose a few different measures and understand the biases and limitations of each. The importance should be the focus on using and publicizing the indicators in ways that will allow the Agency to achieve its sustainability goals.

Lisa Wainger, Research Scientist, University of Maryland:

Sustainability is a vague concept, and Dr. Wainger does not believe agreement can be reached on holistic measures for sustainability. Consensus will be difficult between groups with different risk tolerances on utilization of resources but risk-based measures for sustainability should be explored. Recent environmental indicator research focuses on more "economic" thinking; the ecology community is examining where scarcity exists, how risk can be managed, and performing marginal analyses (i.e., if "x" is removed from the reserve, the viability of the population is reduced by "y"). A utilitarian, economic framework considers what ecosystems provide for humans. In this framework, it is important to consider the full range of what communities value and how natural assets (ecosystem services) contribute to those values. As with any investment, investment in ecosystem assets is to generate benefits into the future and understanding of investors' risk tolerance is needed. Risk tolerance includes both the ability to absorb risk (resiliency) and the willingness to take risk. Economics has tools for managing risk and these can provide a helpful framework. Different options will be available to invest in assets and the ability to think dynamically and continuously reevaluate options is important.

Questions/Discussion:

Alan Hecht noted that EPA produces a Report on the Environment (http://www.epa.gov/indicators/) but the panelists did not mention this report. He asked for comments on the report. Dr. Joy Hecht noted that she was aware of EPA's report but has not read it. Many of the large agency or government reports are not good at communicating issues to the public. A difficulty is that measurements of sustainability that may accurately reflect the status are complex and often problematic. Dr. Wainger replied that better, hierarchical measures of sustainability are needed as well as better ways of explaining and publicizing information.

A participant noted that at the consumer level (e.g., when comparison shopping for shirts), price information is readily available to the consumer but not information on sustainability aspects. Is it important to inject this information at the consumer level? Dr. Joy Hecht responded that decisions are made at every level, and so ideally, information would be available at all levels. Currently, most of the environmental indicators information available is prepared for policy development. Some people pay attention. Some do not. The more individuals are exposed to information, the more it will be used. Ted

Heintz, U.S. Council on Environmental Quality, commented that sustainability will be achieved (or not achieved) because of the billions of actions and decisions made by billions of people. A simple system is needed because people want to make decisions without working hard. Price in the economic system is a simple system that is well understood.

Another participant asked what should be scientists' contribution to the policy process. Dr. Bakshi stressed the importance of good quality data. Government must fund data collection. Without data, individuals will make claims that may or may not be accurate. Meta-analysis of sustainability data is needed across fields and disciplines. The United States currently measures fewer environmental indicators and makes fewer measurements of those indicators than in the past. Numbers cannot be factored into equations and decisions cannot be made if measurements are not collected or if support is not provided for development and implementation of methods for assessing environmental problems. The economic piece of sustainability has indicators and reliable, long-term data. No equivalent exists for the environmental or social pieces of sustainability. Regardless of the metrics chosen, a commitment to long-term reliable collection of data is necessary.

Tony Janetos, The Heinz Center, noted that scientists and analysts need to communicate better with advocacy groups. Large advocacy groups often use their strength in litigating and getting access to political processes, but the ultimate need is to embed environmental issues into society. Dr. Wainger noted if the indicators that were being measured were considered important to decisionmaking, then societal pressure would push for funding to be made available. One problem could be that scientists are not explaining the connection between what is being measured and what society values. It is important to determine whose decisions need to be affected, and then set goals to lead to the results envisioned.

Panelists were asked to comment on non-economic measurements to be considered. Dr. Bakshi highlighted thermodynamics-based systems with exergy/energy flow formulas that can capture the quality of resources. The resilience concept is important and EPA could connect with the complex systems' research (e.g., Internet and transportation) for research results on resiliency. Mr. Anielski provided an example where in addition to economic accounts created for goods and services, environmental indicators were collected in parallel to answer environmental resource questions. Dr. Wainger reiterated the importance of risk-based measurements to make better decisions.

Bryan Norton, Georgia Institute of Technology, stated that the discussion on choice of environmental indicators appears to be a one-sided discussion focused on government decisions. Mr. Anielski responded that in his work, the community is involved (seniors, youth, etc.). A challenge is that people often focus only on personal goals for themselves and their families. Dr. Bakshi indicated that social preferences are being studied in academic research. He now has a project collaborating on a survey in Central Ohio to determine and value social preferences.

Panel 3: Policy Options

Moderator: Jay Benforado, Director, National Center for Environmental Innovation, U.S. EPA:

Concepts of environmental protection have changed over the years from "dilution as the solution" to a focus on pollution prevention and now a shift to the concept of sustainability. This concept may require the Agency to shift from a focus on the regulated community to a broader framework. The discussion centered on the following questions:

- ✧ What do we mean by "sustainability policy"? How is it different from environmental protection policy?
- ✧ What tools do we need to use to promote sustainability?
- ✧ How should EPA work with other agencies to affect their rules and regulations, which, although not explicitly environmental, affect corporate behavior and the flow of resources through the economy?
- ✧ Should EPA try to influence consumer preferences?

Rich Howarth, Professor of Environmental Studies, Dartmouth College:

Sustainability is fundamentally about stewardship. Environmental resources are the common property of all Americans and future generations and provide sustaining opportunities for human life. The goal of stewardship is to pass on the environment and various natural capital so that future generations can make decisions on their own well-being. The National Environmental Policy Act (NEPA) mandates the government's duty for environmental protection.

Meghan Chapple-Brown, Senior Advisor, SustainAbility:

EPA should focus on stewardship because being a command and control agency will not work. Sustainability means being proactive and leading with preemptive thinking. Collaboration is needed to collect stakeholder perspectives to address the issues and consider systemic change. Sustainability policy should take into account the following concepts: (1) connectiveness, which is needed not just across media but also across geography, (2) transformational change, and (3) complex human dynamics. These three items are critical considerations for promoting sustainability.

Bryan Norton, Professor of Philosophy, Georgia Institute of Technology:

Environmental policy and sustainability are interconnected. Sustainability is good environmental policy over multiple scales of time. History has shown ecologists that making decisions based only on current situations and values results in future problems. Aldo Leopold captured this in his charge to "think like a mountain." It is necessary to stretch time frames and time horizons for decisionmaking. Forums are needed for communities to discuss present values and ask questions about future goals.

Questions/Discussion:

A participant asked how long-term policy decisions can be made in 2- and 4-year political cycles. Dr. Norton agreed that both temporally and spatially, politics do not match environmental problems. This is a challenge and society needs to consciously create forums where long-term thinking can occur. Dr. Howarth commented that current U.S. air quality is better or at least as good as in the 1970s, so EPA does have success stories. Lasting solutions are possible when the public perceives a serious problem and then addresses the problem. Ms. Chapple-Brown commented that corporations have similar challenges, and models exist for organizational transformation. The steps to change include: creating a vision, setting priorities, benchmarking competition, and identifying strengths. This can happen within the Agency either formally or by creating an environment for innovation that could allow such change to happen informally.

Leonard Hirsh, Smithsonian Institution, commented that society's reaction to issues is based on the perception of a problem, and regulation and government intervention often are not viewed positively. He asked how EPA can enact effective policy with this reality. Ms. Chapple-Brown responded that to address perception problems, transparency is needed on indicators chosen and measurements made. Information needs are a valid concern. Dr. Howarth noted that governments still need to have a role in setting goals and priorities because consumers often focus on individual goals, but government agencies should facilitate the inclusion of the public in policy discourses. Ms. Chapple-Brown added that voluntary programs can be helpful, but at a corporate level, regulations often are needed to promote behavior change.

Herman Daly, University of Maryland, noted that the policy options discussed in early panels (i.e., cap and trade systems or taxes) involve raising prices of goods and services and this puts the United States at a disadvantage in a global market with free trade. He asked how policies that promote sustainability can work with a global economy. Dr. Howarth noted that free trade has not resulted in "pollution havens" because the environmental costs of production are such a small percentage of the total cost. In addition, trade rules allow for considerations of life cycle impacts and it is possible to legally favor products from countries that take life cycle impacts into account. Global governance is another way to address trade issues. The World Trade Organization, although not a global governance organization, is a collaboration system that can provide a framework. Environmental law also could facilitate citizens' engagement through the ability to file legal action. Ms. Chapple-Brown provided an example from the electronics industry of how international industry standards can help "level" the global playing field. In addition, she reiterated the importance of raising public awareness (e.g., explaining that a tradeoff of sustainability is that the cost of goods may increase but more local employment may result if local factories benefit and remain local).

Tony Janetos, The Heinz Center, emphasized the need for appropriate endpoints. He remarked that although a cap and trade policy worked for sulfur emissions and is touted as a success, the pH of rain in the Northeast has not changed nor have the number of acid lakes declined. Dr. Howarth commented that the success of the sulfur program was that the use of economic principles led to lower costs for controlling that emission.

Alan Hecht, EPA, noted that EPA is a federal agency branded by a mission and public perception, but it is driven by a political agenda. He asked panelists to comment on what the Agency can do within this framework to promote sustainability? Dr. Norton emphasized that EPA has had successes, but the Agency has failed to communicate with the public in a unified and understandable way. Ms. Chapple-Brown proposed that EPA work with industry to assist companies in using sustainability as the driver for market innovation, creating a win-win situation for industry. Dr. Howarth commented that in the 1990s a shift in

EPA's focus from compliance to innovation provided some successes. Energy STAR is an example, which began through the initiative of a few EPA staff members working with the computer industry.

Ken Sandler, EPA, commented that policy discussions need to examine the shape of government. How can agencies apply new theories when barriers exist in the present bureaucratic system? Dr. Norton responded that much of the problem is a communication failure. Agencies and individuals hold onto disciplines. Integration is needed across disciplines and a general language is needed. The science and information needed for informed decisions must be understandable to the public and decisionmakers. He suggested beginning with communities and local discourse to formulate and solve a problem in an iterative process. Problem formulation is the weakest step. Ms. Chapple-Brown noted that community structures are needed to facilitate input; virtual communities are a possibility.

Panel 4: Policy Assessment

Moderator: Tom Tietenberg, Professor of Economics, Colby College:

The assessment process often is as important as the assessments methods used. Assessment should occur prior, during, and after policy implementation. Such a process requires adaptive management that can make adjustments to policies and reassess the policy goals. The overarching question is:

- ✧ Does the adoption of sustainability as a major policy objective suggest the need for changes in the assessment process for EPA?

More detailed questions include:

- ✧ When sustainability is an important policy consideration, what role should cost-benefit analysis (CBA) play? Is maximizing the present value of net benefits sufficient to produce sustainable outcomes? Do persistence and irreversibility of the damage matter?
- ✧ To the extent that CBA, or at least the current form of CBA, is not sufficient to produce sustainable outcomes, what does that imply about the need for other complementary assessment techniques? What techniques might fill the gap?
- ✧ Does a reliance on a sustainability criterion have implications for expanding the scope of assessment? Does a focus on sustainability mean a pollutant-by-pollutant and medium-by-medium analysis is too partial an approach to assessment?
- ✧ What issues, if any, does the introduction of sustainability considerations raise for the practice of discounting, particularly in the case of long-lived problems like climate change? Does it suggest the need to use lower discount rates or hyperbolic discount rates?

John Gowdy, Professor of Economics, Rensselaer Polytechnic Institute:

It is essential to policy analysis to examine costs and benefits, but research advances call into question traditional CBA. Models of preferences and subjective well-being focus on how people make decisions and show that: (1) people value losses more than gains (i.e., people are willing to pay more to keep from losing a good or service they have); (2) appropriate measure of welfare depend on the chosen reference state; (3) income contributes to well-being but is not a substitute for well-being; (4) people have different discount rates for different goods and hyperbolic discounting occurs; and (5) preferences depend on a social context. Problems with traditional CBA include equating per capita income with social welfare,

assuming money is a substitute for everything, and assuming preferences are stable. CBA was developed for local projects (e.g., roads and bridges) and expanding the technique to a regional, national, or global scale causes problems. EPA should explore the use of deliberative methods such as citizen juries and community-valuation workshops and add subjective measures of well-being to analysis of costs and benefits. These methods are new, and research should be directed in this area.

Rich Howarth, Professor of Environmental Studies, Dartmouth College:

Although CBA is an important tool, sustainability cannot be reduced to CBA. In microeconomic theory, optimum resource allocation requires economic efficiency and distributional fairness. CBA is useful for addressing economic efficiency but is inappropriate for determining distributional fairness. Good policy analysis requires examination of distributional effects of the policy. Risk and uncertainty impact the concept of discounting because the rate of return on private capital assets differs based on the level of investment risks. Environmental investments are analogous to insurance policies in a risk context, and low discount rates should be used in efforts of risk abatement. Deliberative mechanisms such as contingent valuation allow for discussion and shared decisionmaking about complex issues and for measurement of willingness-to-pay for non-use goods and services. A challenge is that contingent valuation methods are sensitive to the questions asked and the information provided. Values are not set but constructed in a process of social engagement.

Billy Pizer, Fellow, Resources for the Future:

Problems of persistence, irreversibility, and non-substitutability are important to sustainability discussions because of the long-term consequences, not just for environmental aspects, but also for health, security, and poverty aspects. Irreversibility problems are incorporated in CBA as option values. If an environmental problem is irreversible but the resource is fundamentally substitutable, then options exist to compensate future generations. Many environmental resources, however, do not have substitutes. Contingent valuation is needed to determine how to value environmental resources. Enhanced CBA methods could be used to determine values for the economic component of sustainability, but it is important to realize that the economics are only one part of sustainability decisionmaking. Dr. Pizer reiterated that the ability to convey research results to the public and decisionmakers and to educate citizens is vital for sustainability goals.

Mike Toman, Adjunct Professor of International Relations, Johns Hopkins University:

Economists propose the use of CBA because of the importance of allocations of resources. Sustainability, though focused on long-term goals, is based on short-term choices made in social, environmental, and economic contexts. It is in the short term that a role exists for CBA although an understanding of the problems and limits of the method is important. Combining economics analysis with implications of different choices will help elucidate “hidden” aspects of valuation and stimulate dialogue between analysts and those making valuations. An iterative approach should provide for ongoing evaluation, tracking of results, and the opportunity to revisit and ask new questions. Technical analysis needs to be informed by an understanding of how individuals understand risk, values, and opportunities. Such analysis should shape public discourse in a way that allows for new opportunities to improve policy.

Questions/Discussion:

Herman Daly, University of Maryland, asked panelists to comment on the differences, if any, between non-substitutability and complementarity. Dr. Howarth responded that if zero substitutability exists, then goods are complements. Dr. Pizer indicated that strong evidence exists that natural resources are complements. Individuals have absolute preferences for certain natural capital. Dr. Howarth emphasized the need for specifics when determining resource substitution questions because certain environmental resources may be substitutable but others may not be. He is skeptical of the ability to make substitution determinations when aggregating goods and services.

Participants and panelists discussed issues of policy communication, including the time, effort and resources needed to educate and inform the public. A "translation" problem exists for presenting sound scientific messages. Grassroots efforts may not be feasible or as powerful as needed; therefore, the dissemination of information may need to be driven by government agencies such as EPA.

Panelists agreed that CBA cannot bear the weight of all environmental economic analysis requirements. CBA is a useful tool but it should not be the only tool the Agency uses. Direct measures of well-being and sustainability indicators need to be developed and used. Instead of a traditional CBA, which can be expensive and time consuming, a possible solution is measurements of cost effectiveness over the long term. It is important to recognize that the measurements and analytical methods chosen have important policy implications.

Dr. Howarth reiterated that preferences are information dependent and more research on methods such as contingent valuation is needed. Dr. Bakshi noted that scientifically sound methods such as exergy measurements exist to provide information to inform and enhance decisionmaking, but the lack of dialogue and common language between disciplines is problematic. He stated that integrating the scientific community and using varied research methods are necessary, but the dialogue needs to include the recognition that value judgments are not scientific.

Dr. Howarth noted that using economic valuation mechanisms may not guarantee environmental benefits. Political powers often control how certain resources are used so the answer is not just as simple as finding a technical solution and implementing it. Dr. Howarth noted that statutes such as the Clean Water Act, the Clean Air Act, and the Endangered Species Act do not make economic efficiency the goal, but rather the various executive orders and updates since 1981 that provide the direction for the use of CBA. Tension exists between the tools used for policy analysis as mandated by the White House and the Office of Management and Budget and the environmental goals set by statutory law. Neither CBA nor statutory rules provides a complete framework for sustainability goals. Resilience and ecosystem services matter in ways that are not easily reducible to monetary terms. Protecting rights and entitlements are social and moral issues and need to be addressed with social and political tools.

Closing Remarks

Alan Hecht, Director for Sustainable Development, U.S. EPA:

Dr. Hecht thanked panelists and participants for attending. He noted that the comments and discussion reinforced the importance that EPA engage stakeholders and decisionmakers at all levels of government and society to determine the important values and issues and to consider how the Agency and ORD can use research and science to make its recommendations as operational as possible.