Regional Collaboration for Energy Futures and Energy Security in China and Northeast Asia

Recommended Citation

Gregory Carmichael, Richard Arndt, "Regional Collaboration for Energy Futures and Energy Security in China and Northeast Asia", ESENA, December 01, 1999, https://nautilus.org/esena/regional-collaboration-for-energy-future--and-energy-security-in-china-and-northeast-asia/

Energy, Environment and Security in Northeast Asia:

Defining a U.S.-Japan Partnership for Regional Comprehensive Security

Nautilus Institute and Center for Global Communications (GLOCOM)

Energy, Security, Environment in Northeast Asia (ESENA) Project Final Report
December 1999

Executive Summary

The ESENA Project

The *Energy, Security and Environment in Northeast Asia (ESENA)* project was a three-year policy-oriented dialogue between U.S. and Japanese experts on the nexus of energy, environmental, and security issues in Northeast Asia. The ESENA project was a collaboration between the Berkeley, California-based Nautilus Institute for Security and Sustainable Development and the Tokyo-based Center for Global Communications (GLOCOM) at the International University of Japan, and was funded by the U.S.-Japan Foundation (USJF) and The Japan Foundation Center for Global Partnership (CGP). The aim of the project was to: 1) outline an integrative policy framework to assist policymakers in thinking about the linkages between energy, environmental and security issues, and 2) generate recommendations for small-scale, joint U.S.-Japan initiatives promoting regional energy

and environmental security in Northeast Asia.

A three-year project (1996-1999), ESENA focused in Year One on energy-related transboundary air pollution in Northeast Asia, specifically acid rain; in Year Two on energy-related marine issues in the regional seas of Northeast Asia; and in Year Three on innovative financing mechanisms to promote sustainable energy investment, specifically investment in advanced clean coal technologies in China. In each year, commissioned researchers produced baseline data and analyses that were presented at five workshops attended by U.S., Japanese, and other experts from government, academia, multilateral institutions, the private sector, and non-governmental organizations (NGOs). Workshop participants laid out ideas for a policy framework for U.S.-Japanese cooperation and produced specific recommendations for joint U.S.-Japan initiatives. A draft report synthesizing the five ESENA workshop discussions and their ideas and recommendations was reviewed in a sixth and final workshop held in Berkeley, California in October 1999. This report, *Energy, Environment, and Security in Northeast Asia: Defining a U.S.-Japan Partnership for Regional Comprehensive Security*, is the culmination of the three-year, six-workshop ESENA project.

Section 1 discusses the context for the project. Besides introducing the project and processes utilized to achieve its objectives, the project is situated within the larger imperative to institutionalize regional cooperation at all levels in Northeast Asia, and specifically on the nexus of energy, environmental, and security issues. Section 2 outlines an integrative policy framework developed by the project—regional comprehensive security—which incorporates the concepts of energy and environmental security. This framework will assist policymakers in hammering out a common approach to the nexus of energy, environmental, and security issues. Section 3 presents four recommendations for Japan-U.S. initiatives which would facilitate regional cooperation on energy, environmental, and security issues. It also explains the criteria by which these initiatives were selected. Also, cross-cutting policy themes identified during the course of the project are explained. The final section, Section 4, describes the six ESENA workshops and the ESENA papers commissioned and/or presented during the project.

The Energy-Environment-Security Nexus in Northeast Asia

Northeast Asia (defined as Japan, China, Taiwan, North Korea, South Korea, Mongolia, and the Russian Far East) is one of the least institutionalized regions in the world, with few institutions for cooperation and dialogue encompassing the entire region. This is of concern because Northeast Asia, while not currently experiencing any shooting wars, contains two of the world's military flashpoints (the Korean Peninsula and China-Taiwan) and is the region of the world most likely to draw the U.S. into a conflict with another nuclear power (North Korea or China). The U.S. and Japan, therefore, are deeply concerned about traditional military security issues in the region and have devoted significant resources to addressing them.

Less attention has been paid to non-traditional security issues. In particular, policymakers have given little consideration to the relationship between environmental degradation and regional security. Northeast Asia is suffering from a high and growing rate of resource scarcity and ecological degradation, driven largely by demographic pressures and rapid economic development. Resource scarcity and ecological decline may threaten or compromise not only future economic development but also internal stability and regional political relations. Ultimately, they may be tinder that ignites a flashpoint. For this reason alone, the relationship between environment and security in Northeast Asia merits greater attention from policymakers in the U.S. and Japan.

There are many environmental problems and there are many ways in which environmental problems can affect security issues. Ecological stress in Northeast Asia could exacerbate international political tensions; competition over scarce resources could fuel ethnic conflicts; large movements of

environmental refugees could lead to clashes with resident populations; and massive natural disasters or hard-to-control epidemics could instigate political instability.

One category of environment problems are those arising from the production, transport, and use of energy. The starting point for the ESENA project was energy—large-scale energy use in Northeast Asia. Despite the current financial crisis, rapid economic growth in Northeast Asia will likely drive a massive increase in energy demand in coming decades. The primary projected strategies to meet the demand in the region—expansion of (dirty) coal, imported oil, and nuclear power—are problematic on both environmental and security grounds.

The ESENA project investigated some of the key issues in the relationship between security issues and regional-scale environmental degradation due to transboundary atmospheric and marine pollution, especially that caused by coal and oil.

The relationship between regional-scale environmental degradation and transboundary air and marine pollution, and security issues, has drawn little attention within the region and almost no attention outside it. Transboundary environmental tensions pose a real danger to harmony in the region because they can undermine incentives for broader regional security cooperation. And without a stable peace maintained by multilateral cooperation, not only will economic development be hindered but also the quality of life in Northeast Asia as a whole will suffer.

Currently, the principal atmospheric pollution problems in Northeast Asia relate to climate change, stratospheric ozone depletion, acid deposition (acid rain), and urban air pollution. All of these problems except ozone depletion are significantly related to energy use, primarily fossil fuel combustion. Of these problems, acid deposition is at present of greatest concern in the region as a source of regional-scale ecological degradation. Cross-border acid deposition generated by the emissions of acidic pollutants, especially from China's coal-fired plants, is a major health and environmental issue. There are significant scientific and political efforts underway in the region, led primarily by Japan, to reduce acid deposition.

The U.S. perceives of the transboundary air pollution problem in Northeast Asia as a "localized" problem distinct from its own domestic air quality problems. This, however, may rapidly change. In mid to late 1998, scientists began uncovering evidence for trans-Pacific transport of air pollutants from Asia to North America. This implies that air quality in North America is now coupled to air pollution problems in Northeast Asia. As the U.S. tightens its standards, the impact of Asian emissions on U.S. air quality will become more significant. This may serve as a wakeup call to U.S. officials to reassess U.S. interests in regional-scale transboundary air pollution issues in Northeast Asia.

The trans-Pacific air pollution issue may trigger a complete rethinking of the type and level of international environmental cooperation between and among Asia-Pacific countries. It provides fresh incentive for the U.S. to cooperate with Japan and other countries to address energy-related sources of the air pollutants in Northeast Asia. The ESENA project recommends that a first step in U.S.-Japan cooperation on Asia-Pacific-wide air quality issues is to scientifically examine the interface between the trans-Pacific and Northeast Asian transboundary air pollution issues.

Transboundary marine pollution in the regional seas of Northeast Asia is a "sleeper" issue. While it does not currently draw significant government or public attention, it may in the future become highly controversial. The level of activity and agreement on transboundary marine pollution issues in Northeast Asia is far less than on transboundary air pollution issues. However, sustainable ocean management in Northeast Asia presents enormous opportunities for cooperation on the energy-environment-security nexus of issues in the region. The ESENA project focused primarily on oil

spills, especially in the Sea of Japan, because this area offers perhaps the greatest potential to enhance the institution-building process in Northeast Asia.

Oil spills from the burgeoning maritime oil trade, spawned by the region's deep and growing dependence on imported oil, is a major source of coastal and marine pollution. The levels of oil-related pollutants in the Sea of Japan, for instance, are much higher than in the open ocean. Moreover, the rate of oil spills is increasing.

Why should the U.S. be interested in oil spills in the Sea of Japan? There is no compelling direct reason; however, the lessons leaned by the U.S. in the notorious 1989 Exxon Valdez disaster provide ample indirect reasons. The spill revolutionized U.S. domestic policy on oil spills. The*Exxon Valdez* experience and the wealth of domestic regulatory policies and scientific research gained by the U.S., and the desire by many in the U.S. never to see another *Exxon Valdez* occur, provide sufficient incentive for the U.S. to engage in cooperative activities with Japan on oil spill response mechanisms in the Sea of Japan and elsewhere. In addition to the prevention of a disastrous oil spill, there are indirect benefits for the U.S. to engaging in cooperative activities with Japan. For instance, prevention of oil spills in Northeast Asia helps maintain the smooth flow of maritime commerce, reinforces freedom of navigation in the region, and enhances worldwide marine environmental protection.

The ESENA project urges that Japan and the U.S. engage in cooperative activities related to oil spills and marine pollution. It put forth two candidate project ideas—development of a Web-based marine atlas, and initiation of a "bay-to-bay" transnational cooperative project led by local citizen groups and local governments—to further the cooperative institution-building process in Northeast Asia.

Increase in energy demand in Northeast Asia will come with attendant increases in environmental impacts unless measures are taken to minimize the impacts. One of the many measures that needs to be taken is mobilizing funds for investment in environmentally benign and supply-secure energy development. This lies at the heart of efforts to enhance the region's energy-related environmental security. Bilateral and multilateral sources of aid significantly declined in the past decade. On the other hand, private international capital flows, both foreign direct and portfolio investment, rose dramatically. The key will be to mobilize and leverage private sector investment towards fulfilling environmental objectives that enhance security goals.

The ESENA project explored one type of financing mechanism—a technology risk guarantee mechanism—that uses small amounts of public money to leverage much larger amounts of private investment in environmentally-friendly technologies. The project grounded its investigation of this mechanism in a specific project proposal designed to help fund advanced clean coal technology (CCT) in China.

U.S.-Japan Cooperation in Northeast Asia

The goal of the ESENA project is to nurture U.S.-Japan cooperation in promoting environmentally sustainable and secure energy development in Northeast Asia in such a manner that enhances the prospects for regional peace. The project seeks to achieve this goal by developing a policy framework and a set of recommendations for specific U.S.-Japan joint initiatives on the nexus of energy-environment-security issues in Northeast Asia.

The U.S. and Japan have unique and complementary intellectual, institutional, technological, and economic resources to apply to cooperation on the nexus. Together, these two great powers can enhance the process of environmental cooperation within the Northeast Asian region, especially on issues of region-wide environmental degradation, whereas left to their own devices, Japan may

hesitate and the U.S. may neglect these crucial regional issues. In addition, Japan-U.S. cooperation in promoting energy-related environmental multilateralism in the region will assist in resolving major geopolitical security dilemmas.

The U.S. and Japan have strong, if some times conflicting, interests in environmental problems and energy development in Northeast Asia. As a victim of transboundary air pollution, Japan is especially concerned to promote clean energy use in the region. Japanese policymakers, however, generally think of nuclear energy as "clean energy." There is greater skepticism in the U.S. The U.S., although deeply concerned about the greenhouse gas aspects of increased fossil fuel use, is wary of widespread reliance on nuclear power in the region because of concerns about nuclear weapons build-up and proliferation. Both Japan and the U.S. share vital economic and security interests in maintaining free access to the regional oceans while at the same time keeping them ecologically healthy and clean.

While Japan and the U.S. cooperate on various energy, environmental, and security issues, there is no program of cooperation on an integrated nexus of issues surrounding energy development in Northeast Asia. In forging this type of synergistic cooperation, the environment node of the energy-environment-security triad offers perhaps the best starting point for developing common ground. Assuming that the "environment" is the jump-off point, Japan and the U.S. need to first agree on what aspects of energy-related environmental problems constitute security risks in Northeast Asia.

The ESENA project suggests that the U.S. and Japan acknowledge that degradation of the regional environment in Northeast Asia as a whole is a "threat" to peace in the region. In other words, transboundary pollution problems, especially in the long-term, pose a security risk. Once this "generalized," regional-scale risk is acknowledged, the two countries can proceed to examine the sources of regional environmental degradation.

One source, of course, is the production, transport, and consumption of energy. There may be significant disagreement between Japan and the U.S. about what aspects of energy-induced problems to tackle; however, they should seek to define those aspects they can address jointly. Once this is accomplished, specific projects can be formulated. In essence, the ESENA project sought to assist this process by identifying energy-related problems the two countries can jointly address, and by suggesting concrete projects conducive to Japan-U.S. cooperation relevant to these problems.

Regional Comprehensive Security: An Integrative, Cooperative Framework

Energy, environmental, and security issues are intimately bound together in Northeast Asia. While the issues are integrated, policy frameworks and implementing agencies—at national and regional levels—are not. Energy planning is conducted primarily by energy ministries with analytical tools that often exclude environmental and/or security implications, or include them as an externality to be mitigated after energy planning decisions have been made. Issues of regional security are handled by military and foreign affairs departments whose officials have been trained in traditional concepts of external threats. Given the continuing military tensions in Northeast Asia, including between Taiwan and China and North and South Korea, energy and environmental issues may not be a high priority for security planners. Environmental agencies, in turn, are usually new and often weaker organs of government, and are able to take policy leadership only on fairly narrow issues, especially in relation to foreign affairs.

An important step in promoting U.S.-Japan cooperation, as well as wider regional multilateralism in Northeast Asia, is for both sides to articulate a common conceptual framework and overarching strategic goal. A framework that simultaneously addresses all three prongs of the energy-environment-security nexus is needed. An integrated concept of *regional comprehensive security*

may provide such a framework.

Japan's 1980 Report on the Concept of National Comprehensive Security helped pioneer the concept of comprehensive security. The Report was triggered by the two energy crises of the 1970s. The concept, as outlined in the Report, remains a pillar of present-day Japanese foreign policy. Comprehensive security broadened the definition of security to include non-military concerns, including energy and food security and countermeasures for natural disasters, especially earthquakes. This represented a major break with previous Japanese security thinking born out of Japan's World War II and Cold War experiences. However, the focus of the comprehensive security concept remained on *national* not *regional* security. In other words, multilateral cooperation in Northeast Asia was not seen as a viable avenue to national security.

The notion of comprehensive security surfaced again in Japan and elsewhere after the end of the Cold War in 1989. The end of superpower confrontation triggered a complete rethinking of traditional concepts of national, regional, and global security. Traditional concepts focused on superpower rivalries, the protection of national sovereignty, and external military threats. New thinking emphasizes three additional dimensions: 1) a broader range of external threats and potential sources of international conflict, including environmental degradation and/or resource scarcities, including energy scarcities; 2) a focus on threats to *human* security, that is, to life and livelihood of individuals and communities, within as well as between nations, including economic scarcities (for instance, food), ecosystem degradation, discrimination (ethnic, religious, gender, etc.), human rights abuses, and others; and 3) a focus on cooperation, at both regional and global levels, and by both states and non-state actors, as an essential way to enhance national security.

U.S.-Japan cooperation on the nexus of energy-security-environment issues can be lodged within the overarching framework of comprehensive security and organized around two concepts: environmental security and energy security.

1. *Environmental security* stresses that ecological degradation, resource scarcity, and population pressures are a source of conflict (i.e., that environmental problems "causes" conflict); or conversely, that regional cooperation on environmental issues can play a major role in building confidence and enhancing regional peace (i.e., that environmental cooperation "causes" peace). The environmental security framework incorporates energy use as one source of environmental problems. In the U.S., the environmental security framework is widely discussed and has begun to be adopted in some parts of the government.
2. *Energy security* stresses the need to take measures to reduce vulnerability to energy supply disruption, especially foreign oil. Such measures include diversifying energy fuels, developing fuels and technologies which enhance environmental health and build regional confidence, strengthening demand-side management, and engaging in preventative diplomacy along vital sea lanes. The energy security framework is especially salient in Japan, which is highly dependent on foreign energy sources.

The concepts of environmental and energy security, under the umbrella of regional comprehensive security, provide a common framework to support joint U.S.-Japan initiatives on the nexus of energy-environment-security issues in Northeast Asia. They could provide the foundation upon which a common understanding and language, and common interests, between the U.S. and Japan can be constructed on regional energy, environmental, and security issues. The first step, however, is for a consensus to emerge among key thinkers and opinion-makers in the two countries.

The ESENA project did not attempt to seamlessly weave together the energy and environmental security concepts into a polished regional comprehensive security framework. Instead, it laid out the

basic components and argued that two essential themes of such a framework need to be: 1) attention to the security implications of *regional-scale* environmental degradation, and 2)*regional* energy and environmental cooperation to address this degradation that enhances the multilateral institution-building process in Northeast Asia.

ESENA Recommendations for U.S.-Japan Initiatives

A. Criteria

The overarching goal of the ESENA project was to generate a set of recommendations for specific joint U.S.-Japan initiatives to facilitate regional comprehensive security in Northeast Asia. ESENA participants developed first a set of criteria against which to test the viability and desirability of potential project recommendations. In broad terms, they agreed that bilateral initiatives should accomplish two things: 1) build confidence between the U.S. and Japan, as well as among other countries in the region; and 2) enhance social, institutional, scientific and technological capacity to manage the energy-security-environment nexus.

The project generated eight specific criteria by which to evaluate potential initiatives for U.S.-Japan cooperation:

1. *Promote Common Understanding:* An initiative should assist in creating a common understanding of energy-environment-security linkages. In part, common understanding rests on cooperative scientific assessment.
2. *Build Constituency and Political Will:* An initiative should build a broad constituency and generate political will for further regional environmental cooperation.
3. *Use Complementary Strengths:* An initiative should draw on complementary strengths of the U.S. and Japan (analytic, technological, networks, etc.).
4. *Promote Interdependence and Mutual Interest:* An initiative should stem from recognized mutual interests in Northeast Asia, not only of the U.S. and Japan but also China, North and South Korea, Taiwan, Mongolia, and Russia. From mutual interests it should seek to build a sense of interdependence.
5. *Use (and Reform) Existing Institutional Channels:* The implementation of an initiative should utilize existing institutional channels rather than create new channels.
6. *Require Modest and Shared Cost:* An initiative must be financially modest, with a shared startup cost of less than US$500,000. Over the long term, the initiative should be based on the principle that the costs of regional environmental cooperation are borne by all parties.
7. *Be Fundable, Flexible and Sustainable:* An initiative should be one for which funding can readily be secured. In other words, it fits within the guidelines of present funding agencies. It should be flexible to allow change of the course of implementation, and should have a durability that raises the prospects of continuation beyond an initial implementation phase.
8. *Possess Specific, Measurable Benefit and Short-Term Payback:* An initiative should have a specific and measurable benefit such that there are well-defined benchmarks for success or failure of the initiative. Also, the initiative should have a significant short-term payback.

The ESENA project generated a wide range of recommendations for joint U.S.-Japan initiatives on the energy-environment-security nexus in Northeast Asia. These were boiled down to four specific project recommendations and four cross-cutting themes. These are presented below. Other recommendations that were considered are presented in Section 3.4.

B. Cross-Cutting Themes

1. Work Toward A Common Conceptual Framework and Policy Approach

The U.S. and Japan currently employ a variety of partially defined and nascent conceptual and policy frameworks to shape their foreign policies on energy and environment. Few of these frameworks address the security implications of the energy-environment linkage. In Japan, for instance, the concept of "energy security" is particularly salient given Japan's dependence on external energy resources; however, environmental considerations are not a part of the established concept, which focuses on securing Japan's oil supply lines.

The ESENA project and its workshops revealed that the lack of a common conceptual framework which integrates energy, environment, and security concerns impedes clarity in defining areas of common—and conflicting—interests between the U.S. and Japan in Northeast Asia. While the project makes a start toward outlining such a framework, the two governments need to continue the work through joint research, workshops, intellectual exchanges, and other activities. These activities should bring together senior level managers from a variety of ministries/departments in the U.S. and Japan, as well as academic, NGO, private sector, and other experts.

2. Collaborate in Expanding Scientific and Technical Knowledge and Regional Scientific and Technical Capacity

Before the security implications of regional-scale environmental degradation in general, and energy-related environmental problems in particular, can be fully understood, the character and extent of environmental problems themselves must be understood. Science is the foundation for understanding many environmental problems, and is the foundation upon which common understandings are often built. The U.S. and Japan should strengthen bilateral and multilateral cooperative research, monitoring, and assessment of the environmental impacts of energy and non-energy related activities.

Because many developing countries in the region do not have a strong indigenous scientific capacity from which to address national and transnational environmental problems, the U.S. and Japan should jointly engage in scientific and technical capacity building in the region. A strong, regional scientific capacity is a necessary prelude to creating a common scientific picture of the state of the environment in Northeast Asia. Scientific capacity can not be strengthened without also strengthening social, economic, and institutional capabilities. The U.S. and Japan should accelerate their efforts to build such capacity in the region.

3. Encourage the Participation of Civil Society and Local Government

The U.S. and Japan should recognize the importance of the role of civil society and local governments in shaping and helping to implement joint regional energy-environment initiatives in Northeast Asia. Civil society is generally defined to include non-government, non-business actors, including academic and NGO experts, community and professional groups, philanthropic foundations, etc.

One rich avenue identified by the ESENA project for involving civil society and local governments in regional scale energy-environment-security issues is "regional cooperation at the local level." For instance, cooperative activities between cities and prefectures in Northeast Asia, and between Northeast Asia and the U.S. One such activity—a bay-to-bay marine project—is outlined below.

4. Leverage Private Financial Markets

The capital required to meet energy demand in Northeast Asia is staggering. Only private capital markets are capable of meeting this demand. How they meet it will determine whether environmental and security threats of the future are mitigated or exacerbated. The U.S. and Japan need to explore new, effective ways of harnessing the power of private international financial markets towards promoting ecologically sustainable and security-enhancing energy development in Northeast Asia. They should also explore a common approach to the inclusion of environmental issues in the regulation of private capital markets.

C. Recommendations

1. Initiate Scientific Cooperation on the Interface Between Transboundary Air Pollution Problems in Northeast Asia and the Trans-Pacific Air Pollution Issue

The ESENA project identified the newly emerging issue of trans-Pacific air pollution as an important new area for U.S.-Japan cooperation. Trans-Pacific air pollution is transport of pollutants into and across the Pacific Ocean from emissions sources primarily around the Pacific Rim, but also beyond. As a first step, the U.S. and Japan should begin intellectual exchanges, and consider co-sponsoring an international scientific conference on the issue. The conference would spell out the current state of science on the issue and identify the most critical areas for future research.

The first step in scientifically understanding trans-Pacific air pollution is monitoring of atmospheric chemistry. A regional monitoring network, the East Asian Acid Deposition Monitoring Network (EANET), is scheduled to begin formal operation in 2000. This network, however, needs to be coordinated with other Pacific Rim monitoring activities so as to be able to assess the nature and extend of long-range transport of air pollutants into and out of the Northeast Asian region. EANET needs to be coordinated with monitoring in North America and in the Arctic, for instance. Eventually, it will be necessary to establish a network that monitors the changing air quality in the entire Pacific Basin. The U.S. and Japan should cooperate to ensure the success of EANET, and begin discussion on coordinating its activities with monitoring elsewhere in the Pacific Rim.

Over and above monitoring, a complete set of tools for integrated assessment of changes in the chemistry of the atmosphere in Northeast Asia and the Pacific Ocean is needed. These include standardized emission inventories, regional-scale atmospheric computer models, ecological and non-ecological research, and economic cost-benefit analyses. These tools need to be brought together into an "integrated assessment" package, often a computer model. Ultimately, the U.S. and Japan should work to develop a compatible set of integrated assessment tools to address the Northeast Asian and trans-Pacific air quality problems.

2. Develop a Web-Based Marine Atlas

The state of scientific knowledge of marine issues in Northeast Asia significantly lags that of atmospheric issues. Furthermore, policymakers' and the public's understanding of the issues lags scientific understanding. As a vehicle to synthesize scientific and other knowledge, and engage policymakers and citizens in marine issues in the region, the ESENA project recommends that the U.S. and Japan develop a Web-based dynamic marine atlas of the Sea of Japan (East Sea). The Web Atlas would draw on already existing information, and would be grounded in a geographical information system (GIS). It would be constructed as a collective and collaborative project of Sea of Japan littoral states, including China.

The Web Atlas would be used to promote environmental education, development of integrated coastal zone management policies, protection against natural disasters, preservation of aesthetic heritage, and establishment of a cooperative Sea of Japan oil spill response mechanism. Once a Sea

of Japan Web Atlas is complete it can be expanded to the regional seas of Northeast Asia, and even to the Pacific Ocean.

3. Launch a Bay-to-Bay Project

The long coastlines of the U.S. and Japan, as well as other countries in Northeast Asia, are under assault from population pressures, severe industrial pollution, and other forces. One way to protect coastlines from this assault and at the same time build support for regional cooperation in Northeast Asia is to involve those local governments and civic society organizations that have a strong interest in the health of the regional seas of Northeast and the Pacific Ocean in joint projects. The ESENA project recommends that the U.S. and Japan initiate a "bay-to-bay" project. The project would entail selecting three to seven bays in Northeast Asia and the U.S. west coast (e.g., Tokyo Bay, San Francisco Bay, Puget Sound, and the bays around Pusan and Vladivostok)and engaging in which local groups and local government officials in information exchange, capacity building, and policy innovation.

Led by local groups and local governments, in each bay scientists, policymakers, NGOs, foundations, businesses, and others would be brought together to compile a local profile of marine pollution in the bay. The information in the profiles would be standardized for cross-comparison between the bays. The profiles would contain information on the scientific, political, social, and historical aspects of marine pollution in the bays. Local workshops and working groups of stakeholders would be convened to develop local "sustainability" criteria and policy initiatives to achieve the criteria. Following the local workshops, international workshops would be convened to compare each bay's marine pollution sources and solutions, and to assess commonalties, differences, and areas where the cities can help each other. An international working group would assist in implementing the suggested policy initiatives through regionally-coordinated local actions.

4. Explore a GEF Technology Risk Guarantee Mechanism for Clean Coal

Coal will remain a primary energy source in Northeast Asia, especially China, in any conceivable scenario of energy development over the next 10-20 years. To reduce acidic deposition as well as greenhouse gas emissions, there is an urgent need for the U.S. and Japan to cooperate in promoting advanced clean coal technologies (CCTs) in China. Advanced CCTs, such as the Integrated Combined Cycle Combustion technology (IGCC), reduce carbon, sulfur, and other emissions.

One of the obstacles to widespread adoption of advanced CCTs is that some of the newest, most environmentally beneficial technologies are not yet commercially proven. This means that they carry a "technology risk," a form of commercial risk which private financiers will not cover. Moreover, many public sources of funds, including the World Bank, will not provide either grant or loan support for projects which carry technology/commercial risk. The one source that can cover technology risk is the Global Environment Facility (GEF). The GEF could leverage a relatively small amount of funds in the form of a technology risk guarantee to enable a large demonstration advanced CCT project in China. The GEF would provide a guarantee against the risk that the technology will not live up to expectations, but most of the cost of the project would be financed by private investors and traditional multilateral lenders like the ADB and the World Bank.

The U.S. and Japan should cooperate in encouraging the GEF to explore the development of a technology risk guarantee and other innovative non-grant financing mechanisms for funding advanced CCTs in China (and in other developing countries with large indigenous coal reserves). In addition, the U.S. and Japan should cooperate in investigating the feasibility and viability of a technology risk guarantee mechanism through its application to a specific project that meets GEF support criteria.

D. Implementation

There are a wide variety of potential channels between the U.S. and Japan, and within the region, that can be used to implement the candidate initiatives put forth by the ESENA project. Brief consideration is given to implementation of the four recommendations above in Section 3.5. Once crystallized in the form of a project proposal or a concrete project, any of the above recommendations could be considered for inclusion in the U.S.-Japan Common Agenda. The Common Agenda is the most prominent U.S.-Japan forum for discussing environmental issues. Becoming part of the Common Agenda is a worthy objective for any one of the candidate initiatives (projects) suggested in this report. However, before an ESENA project can become part of the Common Agenda it must first find a home in implementing agencies in Japan and the U.S.

ESENA Workshops & Papers

The six ESENA workshops, including a brief summary of discussion at the workshops and a list of participants, is described in Section 4.1. Section 4.2 lists all papers commissioned by the ESENA project. Included also are papers presented at the various workshops but not commissioned by the project. The commissioned and non-commissioned papers can be found on the publications section of the Nautilus Institute's website.

1. Introduction

1.1 The ESENA Project

Northeast Asia faces daunting challenges in its future choice of energy, environmental, and security strategies. In particular, in the coming decades, rapid economic growth will likely drive a massive increase in energy demand. Although the current financial crisis in Asia has damped near-term energy growth throughout the region, energy demand is expected to sharply increase in the longer term as the financial crisis is brought under control. Even if Asia rebounds slowly from its financial slump, Northeast Asia's energy dilemmas remain. Although demand is likely to be greatest in China, it will also be significant in Japan and South Korea. In addition, energy demand is expected to increase in North Korea, the Russian Far East, Mongolia, and Taiwan. The primary projected strategies to meet the demand—expansion of (dirty) coal, imported oil, and nuclear power—are problematic on both environmental and security grounds. For this reason, the *Energy, Security and Environment in Northeast Asia (ESENA)* project undertook the task of analyzing the nexus of energy, security, and environmental issues in Northeast Asia, specifically the security implications of the environmental impacts of large-scale energy use, with the purpose of helping define a creative partnership between the United States and Japan to address Northeast Asia's energy-environmen--security dilemmas.

The U.S. and Japan are key nation-state actors in the region, and a cooperative partnership could do much to alleviate the risks associated with this nexus of issues. Both Japan and the U.S. have major stakes in the economic, environmental, and military security of the region. Toward the goal of developing a partnership between the U.S. and Japan—a partnership dedicated to steering present unsustainable energy strategies towards ones that are sustainable on both environmental and security grounds—the ESENA project: 1) outlined an integrative framework (regional comprehensive security) to assist policymakers in forging the common understandings that are a necessary prelude to developing the partnership, and 2) generated a set of concrete recommendations for small-scale, joint U.S.-Japan policy initiatives directed toward actualizing the partnership.

The ESENA project was a three-year (1996-1999) collaborative effort between the Berkeley, California-based Nautilus Institute for Security and Sustainable Development and the Tokyo-based

Center for Global Communications (GLOCOM) at the International University of Japan. The Japan Foundation Center for Global Partnership (CGP) and the U.S.-Japan Foundation (USJF) provided funding for the project.

During its three years, the project focused primarily on three different energy-related issue-areas in Northeast Asia as a means of defining the U.S.-Japan partnership. They were: 1) transboundary air pollution (acid rain), 2) marine pollution issues in the regional seas of Northeast Asia, and 3) innovative financing of advanced clean coal technology in China.

The heart of the ESENA project was a set of six workshops attended by influential and pragmatic experts—primarily in Japan and the U.S.—from government, research organizations, academia, civic society, and the private sector. Deliberations at the workshops were supported by commissioned background expert papers. Workshop results were disseminated to policymakers, the mass media, and the general public via face-to-face meetings, printed material, and the Internet and World Wide Web.

The "ESENA project process" consisted of the following major steps and tasks:

1. Commissioning of Background Expert Papers

Background expert papers were commissioned to provide an analytical and contextual structure for developing and refining the regional comprehensive security framework and the specific policy initiatives. Papers were commissioned for each of the three ESENA topic areas of transboundary air pollution, regional seas marine issues, and innovative financing mechanisms. The papers were reviewed by the Nautilus Institute and GLOCOM staffs, and external peer reviewers.

2. Convening of Workshops

During each project year, two workshops were convened as follows:
ESENA1: August 1996 Project Design
ESENA2: November 1996 Transboundary Air Pollution
ESENA3: December 1997 Regional Seas Marine Issues
ESENA4: July 1998 Regional Seas Marine Issues
ESENA5: February 1999 Clean Coal Technology in China
ESENA6: October 1999 Synthesis

3. Publishing and Disseminating ESENA Outputs

All commissioned papers and numerous other background papers are posted on the Nautilus Institute website. Notice of the posting of papers and dissemination of a wide variety of other information related to the project was accomplished via ESENANet, the electronic information service supporting the ESENA project.

Two types of policy briefings were periodically held in Japan and the U.S. during the course of the Project: briefings to policymakers, and briefings to the press.

The present document, the ESENA final report, is the culmination of the ESENA Project. It is being distributed to a wide range of policy- and opinion-makers in Japan, the U.S., and elsewhere. In addition, it is accessible on the Nautilus and GLOCOM websites.

1.2 Northeast Asia: The Imperative for Institutionalizing Cooperation

The ESENA project defined Northeast Asia to include China (People's Republic of China–PRC),

Japan, Taiwan (Republic of China-ROC), South Korea (Republic of Korea–ROK), North Korea (Democratic People's Republic of Korea–DPRK), Mongolia, and the far eastern portion of the Russian Federation (Russian Far East).

Northeast Asia is large and highly diverse, and a keystone region in international affairs. Events in Northeast Asia reverberate throughout the world. It incorporates a wide variety of ecosystems, a sizeable fraction of the world's population, a complex of disparate political systems and levels of economic development, and a colorful array of cultures. Despite its importance in the world,*Northeast Asia is one of the least institutionalized regions of the world*. In other words, it is a region with few institutions for cooperation and dialogue that encompass the entire region. This stands in contrast to Europe, for instance, which is one of the most heavily institutionalized regions. One of the overarching goals of the ESENA project was to encourage the process of cooperative institution-building in Northeast Asia.

Forging a denser network of cooperative governance structures is essential for realizing a sustainable and secure future in the region. An explosive build-up of security and/or environmental tensions could torpedo the institutionalization of cooperation. There currently exist in Northeast Asia numerous large and small zones of political insecurity. The four most prominent are: 1) the divided Korean peninsula, 2) the relationship between Taiwan and China, 3) disputes over islands (including the Spratly Islands, Kurile Islands, Tokdo/Takeshima Island, and Diaoyu/Senkaku Islands), and 4) the border between China and Russia. In addition, Northeast Asia is also a zone of "great power" conflict and tension. Weapons of mass destruction remain a salient issue for the great powers and for the regional powers in Northeast Asia. Northeast Asia is the one region of the world most likely to draw the U.S. into a conflict with another nuclear power (North Korea or China).

Small-scale or domestic zones of tension in the region include: 1) famine and the dysfunctional state of the DPRK, 2) ethnic and/or minority tensions (e.g., Tibet, Uygurs of western China, ethnic groups in Russia), 3) economic tensions in China (e.g., disparity in income between coastal and inland areas), and 4) economic tensions in Russia (e.g., lack of economic support from Moscow for the Russian Far East).

Overlapping some of the above zones of political instability are areas of environmental tension. Overarching environmental problem areas in Northeast Asia include those associated with energy use (especially related to coal, oil, and nuclear fuels); the atmosphere (climate change, acid rain, and urban air pollution); inland water resources (scarcity, degradation, flooding, and the Three Gorges Dam in China); fisheries and marine resources (offshore fisheries, undersea resources, and coastal zone management); land degradation (loss of arable land to urbanization, deforestation, and desertification); and population growth and changing demographics (burgeoning population in China, internal migrations to cities, and environmental refugees).

It is imperative that a greater level of cooperation be institutionalized in the region to prevent the various political and environmental tensions, individually or synergistically, from reaching intolerable levels. Both the regional comprehensive security framework and the recommendations for U.S.-Japan joint policy initiatives on the nexus of energy, environmental, and security issues put forth by the ESENA project are designed to encourage the process of institutionalizing cooperation in the region.

1.3 Energy-Environment-Security Nexus in Northeast Asia

The starting point for the ESENA project was energy—large-scale energy use in Northeast Asia. Energy use is fundamentally driven by economic growth, though the correlation is not necessarily linear. Northeast Asia contains the world's second largest economy—Japan—and one of the world's

fastest growing economies—China. Most of Northeast Asia witnessed rapid economic expansion in the 1980s and 1990s up until the financial crisis which started in Southeast Asia in late 1997. Currently, Northeast Asian economies have contracted or experienced significant slowdown. However, the region is already recovering and it is expected that the long-term pattern of economic expansion will resume in all countries with the possible exception of North Korea and Mongolia.

Rapid economic expansion fueled a large demand for energy, and the past choices made to meet this demand have resulted in numerous security and environmental dilemmas. The three energy sources that pose the greatest security and/or environmental risks are coal, oil, and nuclear fuels. Though the current financial crisis has slowed growth in energy demand throughout the region, it has not removed the risks associated with large-scale use of coal, oil, and nuclear fuels.

Coal: The region is rich in coal reserves. China has the world's largest coal reserves and is the largest user of coal for electric power generation in the world. China's coal-fired power plants are a major source of greenhouse gas emissions, acid rain precursor emissions, and other pollutant emissions that affect local, regional, and global air quality. Without a doubt, China is the center of coal-related energy use problems in Northeast Asia, and such problems will dominate energy use in China for the foreseeable future.

Oil: Most of Northeast Asia is highly dependent on imported oil. The two most sophisticated economies in the region—Japan and South Korea—are almost totally dependent on imported oil, primarily from the Middle East. There are two basic oil resource-related tensions in region: tensions associated with the import of oil, and tensions associated with oil exploration in the regional seas. Northeast Asian reliance on imported oil (with the exception of the Russian Far East) is expected to increase in the next decades. Politically, this means the region's oil lifeline is tied to events in the Middle East, Central Asia and Southeast Asia, and to events along the sea corridors that are used to transport the oil leading from these locations to Northeast Asia. Of all environmental tensions related to oil in Northeast Asia, the two that currently stand out are those associated with oil spills and those associated with emission of air pollutants from refineries and combustion in motor vehicles.

Nuclear: Nuclear energy is a small fraction of the total energy picture in Northeast Asia, but looms large in its potential environmental and nuclear weapons proliferation risks. There are two basic types of nuclear power—open cycle and closed cycle—each with associated environmental and security problems. Open cycle refers to the fact that nuclear material is used only once in the electricity generation process. Nuclear waste is produced that must be disposed. Closed cycle refers to the fact that radioactive materials are reprocessed and reused. In the process plutonium is produced. The three central environmental hazards associated with nuclear fuel use in both processes are: 1) leakage of radioactive materials if an accident occurs, 2) storage of radioactive waste, and 3) transport of radioactive materials. Japan is the only country which is actively developing a closed nuclear fuel cycle. There are several countries with open cycle nuclear programs, including China, Japan, South Korea, North Korea, Taiwan, and Russia. The region has experienced numerous environmental tensions associated with nuclear power, including the recent (September 1999) nuclear accident in Japan, the dumping of nuclear waste in the Sea of Japan by Russia, and the export of nuclear waste by Taiwan to the DPRK and Vietnam.

The ESENA project did not attempt to examine the relationship between the full set of security issues and the environmental impacts of coal, oil and nuclear energy. The project, for instance, did not examine the relationship between nuclear energy and security issues; an area where the linkage between energy and security is most obvious. Instead, *the ESENA project focused on the relationship between security issues and regional-scale ecological degradation due to transboundary atmospheric and marine pollution—particularly that caused by coal and oil*.

This is a relationship that has drawn little attention within the region and almost no attention outside it. Transboundary environmental tensions pose a real danger to harmony in the region because they can undermine incentives for broader regional security cooperation. And without a stable peace maintained by multilateral cooperation, not only will economic development be hindered but also the quality of life in Northeast Asia as a whole will suffer.

Transboundary Air Pollution

Currently, the principal atmospheric pollution problems in Northeast Asia relate to climate change, stratospheric ozone depletion, acid deposition (acid rain), and urban air pollution. All of these problems except ozone depletion are significantly related to energy use, primarily fossil fuel combustion. Energy use, however, is by no means the only source of air pollutants. There are a vast range of industrial and non-industrial sources that contribute a wide variety of organic and non-organic pollutants. China is by far the largest emitter of air pollutants in the region. China's greenhouse gas emissions have resulted in environmental tension between China and the industrialized nations of the United States, Europe, and Japan. The U.S. Congress, for instance, demanded that countries such as China pledge to reduce greenhouse gas emissions before it will sign the Kyoto Protocol to the U.N. Framework Convention on Climate Change. At the regional level there is tension between China, and Japan and South Korea over transboundary air pollution, in particular cross-border transport of acidic air pollutants. Local air pollution in China due to power plants and industrial facilities has reached crisis proportions in most large urban areas. Such pollution is increasing domestic environmental tension—and citizen activism—over air pollution issues.

Of these atmospheric pollution problems, acid deposition (acid rain) is the regional-scale problem of greatest concern as a source, or potential source, of regional-scale ecological degradation.

Northeast Asia is one of three regional-scale transboundary air pollution "hot spots" in the world. The other two are Europe and North America. The aspect of transboundary air pollution that first drew attention in each of these three areas is the problem known as "acid rain." Japanese scientists discovered evidence of long-range transport of acidic pollutants from mainland Asia in the mid-1980s. China was quickly fingered as the largest emitter of such pollutants. The problem, it turned out, was a result of the 1979 market-oriented economic reforms in China and the industrial boom that followed. The main emission source of the acidic pollutants involved in long-range transport in the region is China's coal-fired power plants.

1.4.1 Coal & the Environment in China

China is one of the largest producers and consumers of energy in the world. About 70% of its primary energy production and consumption comes from coal—the highest share of any major economy in the world.[1] China is the second largest electricity producer in the world after the United States. China had a total installed power generation capacity of 270 gigawatts (GW) in 1998. Of this, approximately 70% is coal, 21% oil, 2% natural gas, 6% hydro, and 1% nuclear power generation. Therefore, coal-fired power plants constitute about 190 GW of China's 1998 total installed power generation capacity.[2] Coal-fired power plants accounted in 1997 for about 33% of primary coal consumption, more than 95% of thermal power generation, and 82% of the total power generation.[3] The reason for the dominance of coal in the power generation sector is China's gigantic coal reserves, the world's largest. In 1998 coal reserves accounted for about 90% of China's proven fossil fuel reserves.

The massive size of China's present coal consumption (and infrastructure), and limited oil and gas reserves (and infrastructure), lead to the conclusion that a rapid shift away from coal is impossible

under any economic growth scenario for China. And it is unrealistic to expect countries like China to forego development of their vast coal deposits. In 1996 China consumed 666 million tonnes of coal, about 30% of the world total.[4] The total consumption of coal in China is expected to increase at an average annual rate of about 3.7% between 1996 and 2010.[5]

Coal prices are low relative to other energy sources. This is due not only to the large reserves, but also other factors such as the large number of small mines. Small mines are actually increasing in China because of cheap labor, decentralization of financial investment, high transport costs, and decentralized demand structure.[6] The low price of coal reinforces the conclusion that coal will be the primary source of energy in China and will continue to play a dominant role in power generation. However, power generation from coal in China is inefficient and environmentally damaging.

In general, among all energy options, coal-fired power plants are the largest emitter of particulate matter (PM), sulfur oxides (SO_x), and the greenhouse gas carbon dioxide (CO_2). They are also a major emitter of nitrogen oxides (NO_x).

China's coal-fired power plants contribute to severe local air pollution (many of the world's most polluted cities are located in China); regional scale acidic deposition, or acid rain (China is the largest exporter of acidic air pollutants to neighboring countries in Asia); and global climate change (China is the world's number two emitter of greenhouse gases). About 90% of total PM, SO_x, and NO_x emissions in China are due to coal burning. A major fraction of these emissions is from coal burning in power plants (another significant fraction is small-scale, residential use for cooking and heating).

1.4.2 Transboundary Air Pollution in Northeast Asia

The ESENA project focused on regional-scale transboundary transport of air pollutants, especially those related to China's coal-fired power plants, because transboundary air pollution and China's coal-fired power plants are central components of the energy-environment-security nexus in Northeast Asia. The project did not consider local or global scale atmospheric problems, nor did it consider important pollutants emitted by sources other than coal-fired power plants. The project deemed these other problems and other pollutants to be less directly applicable to the energy-environment-security equation in the region at this point in time. Although a wide variety of pollutants are transported across national borders, sulfur dioxide has to date received the most attention within the Northeast Asia.

Within the next two to three decades, as regional sulfur dioxide emissions increase (by as much as a factor of 3), sulfur deposition levels are anticipated to reach levels which are higher than those observed in Europe and North America during the 1970s and 1980s, and in some cases may exceed those observed previously in the most polluted areas in central and eastern Europe.[7]This increase in sulfur emissions will severely threaten the sustainable basis of many natural and agricultural ecosystems in the region. The levels of sulfur deposition may cause significant changes in the soil chemistry over wide areas in Asia, affecting growing conditions for many natural ecosystems and agricultural crops. Furthermore, ambient levels of sulfur dioxide would exceed World Health Organization (WHO) health guidelines not only in cities, but also in many rural regions. If no countermeasures are taken, a degradation of the environmental quality to unprecedented levels could result. This, in turn, has worrisome security implications. Other pollutants are likely to follow patterns similar to sulfur dioxide. To avoid such a grave situation, energy must be used more efficiently and more cleanly.

There are a variety of measures that could be taken to reduce sulfur emissions and thereby reduce/avoid widespread excess damage in the region. These include changes in fuel use, energy efficiency measures, and the use of simple to advanced control technologies. Advanced emission

control technologies could reduce emissions below current levels even in a high growth energy scenario, albeit at extremely high costs.

Illustrative scenarios demonstrate the potential for an increase in the cost-effectiveness of strategies if measures are focused on specific fuels, technologies, economic sectors, emission sources, or ecologically sensitive regions. All of these activities make a difference. However, the analysis leads to the conclusion that in the long run a strategy relying solely on control technologies with modest removal efficiencies will not be able to preserve important agricultural areas from serious excess deposition. Energy planning is also an important factor for controlling adverse environmental effects, in particular acidification. The development of carefully designed energy systems is of particular importance for controlling emissions in those countries considering an expansion or replacement of the present energy infrastructure.

To help quantify and anticipate environmental impacts associated with the growing emissions it is imperative that a greater understanding of the mechanisms of long-range transport of pollutants in Northeast Asia be established. Increased monitoring and modeling activities are needed, which could be conducted as regional and/or bilateral initiatives. These activities are necessary because there is considerable uncertainty associated with modeling acid deposition in a region as large as Northeast Asia. The lack of a comprehensive observation network prevents a rigorous evaluation of model performance. Furthermore, the present modeling efforts make use of parameterizations which have been derived based on modeling studies at the mid-latitudes in North America and Europe. Although extensive experience can be drawn from Europe and North America, the Northeast Asian situation is sufficiently different in terms of mixes of pollutants, meteorology, etc., that Asia-specific information on the mechanisms of acid deposition and long-range transport is required. Present estimates are not yet sufficiently robust to serve as the foundation for policy analysis related to allocation of responsibility and liability for transboundary air pollution in the Northeast Asian region.

At present sulfur compounds are the main component of acid deposition in Northeast Asia (especially in China). However, the contribution of nitrogen compounds is rising along with the increase in NO_x emissions. An increase in NO_x emissions will not only lead to an increase in acid deposition, but will also pose additional environmental concerns through increases in ambient ozone levels. Increasing levels of ozone have major environmental impacts, including impaired human health and reduced crop yields. Initial studies suggest that the increase in NO_xemissions and fertilizer use in Northeast Asia, may lead to ozone levels sufficiently high to threaten rice, wheat, and corn production. Ozone, like acid deposition, is a regional problem, which will require regional cooperation and emission reduction policies to control.

The regional aspect of acid deposition poses a considerable challenge to Northeast Asia. The situation in Northeast Asia is much different than that in Europe and the U.S. when they encountered acid deposition. In Europe, the European Union provided a forum for countries to discuss the problem and develop policies aimed at reducing sulfur and nitrogen emissions. In addition, there were active collaborations and joint research activities among the countries that provided scientific input into the deliberations. Both research and policy fora will need to be further developed in Northeast Asia to address its transboundary air pollution problems.

Currently, Japan is the scientific and political leader in the region in tackling transboundary air pollution problems, and is actively promoting international scientific and political cooperation. The Environment Agency of Japan (EAJ) is the prime force behind establishment of the East Asian Acid Deposition Monitoring Network (EANET). EANET is the principal locus of regional scientific cooperation on transboundary air pollution issues. The EAJ began efforts to create EANET in 1992. An intergovernmental agreement to formally launch EANET is expected to be signed in late 2000. EANET is performing a pioneering function in the institutionalization of international environmental

scientific cooperation in Northeast Asia, and is the first region-wide, cooperative and collaborative scientific network to be established in the region. It may provide the springboard for international political agreements on transboundary air pollution similar to those that exist in Europe and North America.

The U.S. has not been directly involved in the establishment of EANET, nor in most scientific collaborative activities in the region, although it has willingly shared its experience in dealing with North American transboundary air pollution problems through various individual and organizations contacts. Similarly, the U.S. has not been involved in any political efforts on the issue in the region. There is a limit to the degree to which the U.S. can directly involve itself in the transboundary air pollution issues in Northeast Asia.

Until recently the U.S. perceived of the transboundary air pollution problem in Northeast Asia as completely distinct from its own air quality problems. This, however, may change rapidly. In mid to late 1998, evidence for trans-Pacific transport of air pollutants from Asia began emerging. The advent of long-range transport of air pollutants from Asia ties the U.S., Japan, and the rest of Northeast Asia to a common, Asia Pacific-scale transboundary air pollution problem.

Trans-Pacific Air Pollution

Trans-Pacific air pollution is long-range atmospheric transport within the troposphere of contaminants into or across the Pacific Ocean from sources originating in Pacific Rim countries or beyond. Such air pollutants can alter the properties of the atmosphere above the Pacific Ocean, adversely affect marine and terrestrial ecosystems in and around the Pacific Ocean, and negatively impact human and wildlife health in the Pacific Rim. The types of pollutants involved in the problem include aerosols (such as soil particles), gaseous species (such as sulfur dioxide and ozone), and toxics (such as persistent organic pollutants (POPs) like DDT and doxin, heavy metals like mercury, and radionuclides).

The aspect of trans-Pacific air pollution that has drawn the most attention to date is transport of pollutants from emission sources in East Asia across the Pacific Ocean to the west coast of North America. While currently drawing the lion's share of attention, it is by no means the only pathway of pollutant transport in the Pacific region. Pollutant sources are located throughout the Pacific Rim. However, due to global atmospheric circulation patterns, the East Asia-North America axis is of primary interest because East Asia contains the greatest concentration of emission sources upwind of the Pacific Ocean.

Evidence for trans-Pacific air pollutant transport comes from three main sources: monitoring data, computer modeling, and ecological studies. Each is briefly discussed below.

The first hard-core scientific evidence documenting transport of air pollutants from Asia to the west coast of North America was published in March 1999.[8] The work was conducted by Dan Jaffe of the University of Washington-Bothell and his colleagues and is the first to correlate air current trajectories with air pollutant measurements. Jaffe et al.'s data show that air masses that never passed over North American territory carry a significant load of pollutants (carbon monoxide, ozone, peroxyacetyl nitrate (PAN), radon, aerosols, and non-methane hydrocarbons). Trajectory models that traced the air masses carrying the "elevated" levels of the pollutants show them originating in Asia. Jaffe et al. announced their results at the December 1998 annual meeting of the American Geophysical Union where they were immediately picked up by the mass media. In addition to Jaffe et al.'s work, other monitoring data on various atmospheric species done by Japanese, American, and Canadian scientists also suggest trans-Pacific transport of pollutants.

Computer models are now capable of doing reasonably detailed analysis of atmospheric transport across the Pacific. Modelers who are working on regional-scale models include Itsushi Uno of Kyushu University in Japan, Greg Carmichael of the University of Iowa, and Douglas Westphal of the Naval Research Laboratory at Monterey, California. Modelers who are applying global tropospheric chemistry models to trans-Pacific transport of pollutants include Terje Berntsen of the University of Oslo and Daniel Jacob of Harvard University. Published results demonstrate the possibility, in not the reality, of cross-Pacific transport of pollutants.[9]

Jacob et al.'s simulations suggest that a tripling of eastern Asian anthropogenic emissions from fossil fuel combustion from 1985 to 2010 may increase monthly mean ozone concentrations by 2-6 ppbv in the western U.S. and by 1-3 ppbv in the eastern U.S. (The current background level of ozone is about 40 ppbv.) This increase, the researchers state, would more than offset the benefits of a 25% domestic reduction in nitrogen oxide and hydrocarbon emissions in the western U.S. over the same time period.

Ecological studies are providing circumstantial evidence for trans-Pacific transport of pollutants. For instance, a recent study of organochlorine contaminants in bald eagle populations in the Aleutian Islands hypothesizes that Asia may be a source of the contaminants via either marine or atmospheric pathways. In particular, the fact that the concentrations of contaminants increased in eggs from east to west along the Aleutian Island chain suggests that Asia is a source region of these pollutants.[10]

Also, an Environment Canada study on the Fraser River in British Columbia deduced that toxic airborne pollutants from Asia may be a major source of contamination in fish stocks in four British Columbia lakes. Tests on fatty livers of certain fish show elevated levels of the pesticide toxaphene. The study suggests that POPs such as DDT and toxaphene (which are banned in Canada), as well as PCBs, accumulate in the aquatic foodchain in British Columbia. These findings are consistent with other findings in high mountain lakes in the Yukon, Arctic, and Rocky Mountain national parks.[11]

In conclusion, there is a confluence of scientific evidence pointing to the existence of trans-Pacific transport of air pollutants, and its potentially detrimental effects. The evidence, though, is scattered among a wide array of programs and projects primarily in the United States, Canada, and Japan.

Trans-Pacific air pollution has significant, and as yet largely unrecognized, policy implications. Since the end of atmospheric testing of nuclear weapons, trans-Pacific air pollution is the first Pacific Rim-wide environmental pollution issue to confront the countries surrounding the Pacific Ocean. The following are some areas in which the accumulating scientific evidence is important to policymakers in the United States, Japan, Canada, China, and other countries of the Asia-Pacific region.

1. *Changing chemistry of the Pacific troposphere*: Trans-Pacific transport of air pollutants from Asia could have a profound impact on the chemistry of the troposphere above the Pacific Ocean. It could change the oxidizing nature of the atmosphere in the whole Pacific region. The Pacific troposphere is one of the few remaining, relatively pristine regions of the Earth's atmosphere and its alteration could have wide-ranging ripple effects.

1. *Extension of transboundary air pollution in East Asia*: Trans-Pacific air pollution is in part an extension of transboundary air pollution problems in East Asia. Thus, efforts in North America at addressing the trans-Pacific issue need to be linked to, and integrated with, the already major scientific and political efforts related to East Asian transboundary air pollution.

1. *Impact on air quality standards*: Trans-Pacific air pollution could affect air quality along the west coast of North America. Cities may not be able to meet air quality standards due to import of pollutants. Some cities or regions (such as Class I regions) may be pushed over the standards. The affect of imported pollutants may be especially severe during certain strong "funnel events" in which emissions emanating from Asia are rapidly conveyed across the Pacific in the spring—in some cases in as few as four days.

1. *Monitoring networks*: Some type of Pacific Rim monitoring network may need to be established. As a first step, monitoring at existing stations in the Asia-Pacific region need to be coordinated. From this beginning, a Pacific Rim-wide monitoring network may evolve.

1. *Mix of technologies transferred to developing countries*: The trans-Pacific air pollution issue may urge a rethinking of the current North American technology transfer programs to Asia. Perhaps greater support for a different blend of emission-reducing technologies is appropriate. The United States' present technology transfers to China, for instance, are overwhelmingly directed toward greenhouse gas-reducing technologies. More support for technologies related to non-methane hydrocarbons may, for example, be justified. This would improve air quality in cities in Asia as well as diminish trans-Pacific transport of pollutants. In addition to technology transfer, the types of information dissemination, training, and intellectual exchanges in which countries like the U.S., Japan, and Canada engage in with developing countries may need to be rethought.

1. *Degradation of Arctic environment*: The Arctic Monitoring and Assessment Programme (AMAP) issued its mammoth assessment report in 1998 which, among other things, documents the role of Eurasian air pollutants in degradation of the Arctic environment. Policies to protect the Arctic environment will need to be coupled to policies addressing trans-Pacific air pollution. In short, the trans-Pacific air pollution problem and Arctic environmental problems are intimately linked, and must be considered simultaneously.

1. *Climate Change*: Many aspects of the trans-Pacific air pollution problem are closely tied to global climate change issues. The scientific and political linkages between the two issue domains needs to be scrutinized.

The trans-Pacific air pollution issue may trigger a complete rethinking of the type and level of international environmental cooperation between and among Asia-Pacific countries. The U.S. and Japan need to exhibit leadership on the issue, and use it as an opportunity to develop a broader framework for environmental cooperation in the Asia-Pacific region. As far as the ESENA project's investigation of the energy-environment-security nexus in Northeast Asia is concerned, the existence of trans-Pacific air pollution implies that the Northeast Asian transboundary air pollution problem

now directly affects the United States. This may serve as a wakeup call to U.S. officials to reassess U.S. interests in regional-scale transboundary air pollution issues in Northeast. The trans-Pacific air pollution provides fresh incentive for the U.S. to cooperate with Japan and others on policy initiatives that address energy-related sources of the air pollutants in Northeast Asia.

1.5 Transboundary Marine Pollution[12]

Transboundary marine pollution is a "sleeper" issue in Northeast Asia. It is an issue that does not currently draw significant government or public attention but that in the future may become highly controversial. The level of activity and agreement on the transboundary marine pollution issues in Northeast Asia is far less than political activity and agreement on transboundary air pollution issues. However, the issue-area presents enormous opportunities for cooperation on the energy-environment-security nexus of issues in the region.

There are a wide range of environmental problems related to the oceans and regional seas of Northeast Asia. There are pollution and coastal zone management problems, and fisheries and marine (open ocean and undersea) resource problems. The most controversial marine issues are associated with tiny specks of islands that were overlooked until the U.N. Convention on the Law of the Sea (UNCLOS) legitimatized the 200-nautical-mile Exclusive Economic Zone (EEZ) in 1982. This opened a Pandora's Box of territorial disputes over previously worthless islands such as the Spratly Islands in the South China Sea, Tokdo/Takeshima Island in the Sea of Japan/East Sea, and Diaoyu/Senkaku Islands in the East China Sea. Suddenly the islands became valuable not for the miniscule land space itself, but for the 200 nautical mile zone surrounding the land and the fishery and undersea resources that they contain. The most hotly contested island complex is the Spratly Islands, simultaneously claimed by China, Taiwan, Vietnam, Malaysia, Brunei, and the Philippines. The Spratly Islands are a valuable strategic prize not only because they lie among major shipping lanes, but also because they lie atop substantial undersea oil and gas reserves.

Fisheries disputes are a simmering issue in Northeast Asia. The regional seas of Northeast Asia and the North Pacific are among the most heavily fished—and over-fished—waters of the world. However, no region-wide agreements are in place to regulate fishing. There currently exists a web of bilateral fisheries agreements in force in Northeast Asia involving all the region's governments in one or more agreement. There is, however, no single fishery-related forum which involves all the nations simultaneously.

The most contentious marine pollution issues are those related to contamination of the semi-enclosed seas of Northeast Asia—Sea of Japan (East Sea), Yellow Sea, East China Sea, and South China Sea. The most important sources of pollution are those from land-based sources. In addition, industrial waste dumping, radioactive waste disposal, and oil exploration and transport are sources of pollution. Transboundary marine transport within the region of various pollutants is emerging as a major problem.

Of all the marine pollution issues, the ESENA project chose to focus primarily on oil spills, especially in the Sea of Japan, as offering greatest potential to enhance institution-building in turn can enhance the peacemaking process in Northeast Asia.

1.5.1 Sea of Japan (East Sea)

To enhance regional political security via international environmental cooperation, the U.S. and Japan would do well to focus efforts on the Sea of Japan (or East Sea, as it is known in the Koreas). Why focus on the Sea of Japan, a relative "backwater" of Asian regional seas, to achieve energy and environmental security objectives?

First of all, the Sea of Japan is a relatively unspoiled regional sea and therefore is a prime candidate for preservation. The littoral states include Japan, the Russian Federation, North Korea and South Korea. China also affects the environmental status of the Sea of Japan by virtue of the Tumen River watershed which encompasses Chinese territory, and via the pollutants carried by ocean currents from the Yellow Sea. It may be easier to facilitate cooperation among the littoral states in the Sea of Japan rather than in the more contentious areas of the Yellow Sea, East China Sea, or South China Sea.

Second, the Sea of Japan—although formerly the site of Cold War tension—is expected to experience significant development in the near-term future. The Russia Far East, the Sea of Japan coastal area of Japan, the southeastern coast of the ROK especially around Pusan and Ulsan, the east coast of the DPRK, and the Tumen River basin are all being developed or are poised for development. If sustainable development measures can be incorporated into development plans in the region in the early phases (such as is being attempted in the Tumen River watershed) the worst by-products of development may be avoided, and the integrity of the sea preserved.

Third, at present there are no multilateral political institutions and few political arrangements which include all the states in the Sea of Japan region. As Mark Valencia of the East-West Center puts it: "In few other semi-enclosed seas are multilateral measures for marine pollution control as deficient as those in the Sea [of Japan]."[13] There are, for instance, no multilateral cooperative scientific efforts which simultaneously involve all Sea of Japan countries; no fora where all Sea of Japan fishing nations can meet to discuss the distribution of catches; and no regional emergency response mechanisms in place to deal with oil spills.

Therefore, as compared to other regional seas in Northeast Asia, the Sea of Japan not only involves all the major political actors in the region, but also, for the reasons outlines above, seems to offer a fine opportunity for cooperation on marine pollution that would encourage the process of multilateral confidence-, capacity-, and institution-building in the region.

The two main energy-related marine issues in the Sea of Japan concern oil pollution and contamination from nuclear waste (primarily through ocean dumping of radioactive wastes or an accident during the transport of radioactive materials). Since oil pollution issues not only involve all the littoral states, but also are more conducive to multilateral cooperation than issues of nuclear waste, the ESENA project chose to focus attention on fostering cooperation related to oil pollution, especially those related to oil spills.

1.5.2 Oil Spills in the Sea of Japan

Even though open ocean pollution from oil constitutes only 10-20% of all ocean pollution (coastal and land-based pollution constitutes the other 80-90%), and oil spills constitute only 10-20% of open ocean pollution (dumping of oily wastes constitutes the other 80-90%), the dread of the potential impacts of catastrophic oil spills is a major driver of public opinion and of policy action on environmental protection of oceans, especially along coastal areas. If Sea of Japan nations act to institute a regional oil spill response mechanism, this may prevent future ecological and public relations disasters.

Oil spills have occurred in the Sea of Japan (for instance, the January 1997 *Nakhodka* spill off Fukui Prefecture), and will likely occur with greater frequency in the future. The *Nakhodka* spill clearly demonstrated that Japan and the Sea of Japan countries are not prepared to deal with catastrophic oil spills. Thus, there is need to develop a regionally-based, cooperative oil spill response mechanism.

The region is already aware of this need as exemplified by efforts such as: a) the exchange of information under the US-Japan Cooperative Program in Natural Resources (UJNR); b) cooperation on oil spill mitigation under the U.S.-Japan Common Agenda; and c) attempts to devise a regional response mechanism at Northwest Pacific Action Plan (NOWPAP)-sponsored workshops. However, none of these efforts have succeeded in launching a cooperative oil spill response mechanism.

Danger of a catastrophic oil spill lurks in the offshore oil and gas developments currently underway off the northeast coast of Sakhalin Island, especially the Sakhalin II project.[14] It is well established that the greatest risk for catastrophic oil spills comes from transport of oil via tanker. Given that VLCCs (or Very Large Crude Carriers) with 2 million barrel capacity will transport oil from the island, the potential for loss of an entire cargo is a possibility. At projected production levels of 90,000 barrels/day, one tanker transit every 5-6 days is expected, or about 36 each operating season. An environmental impact assessment by Sakhalin Energy, the organizations overseeing development, suggests that "the potential of a transport tanker release is classified as unlikely." In University of Alaska researcher Rick Steiner's opinion, "for such a serious threat as a catastrophic tanker spill along the east coast of Sakhalin or further south off Hokkaido, this is an entirely unacceptable assessment." To understand and fully appreciate the potential severity of damage that could be caused by a catastrophic oil tanker spill, one need only examine the tremendous impacts of the *Exxon Valdez* Oil Spill in Alaska. As Rick Steiner states: "The spill became for the oil industry worldwide what Chernobyl had become for the nuclear industry and Bhopal for the chemical industry—the symbolic, defining standard against which all other such disasters are measured."

Why should the U.S. be interested in oil spills in the Sea of Japan? There is no compelling *direct*reason for the U.S. to be interested; however, the lessons leaned by the U.S. in the notorious 1989 *Exxon Valdez* disaster provide ample *indirect* reasons. The spill revolutionized U.S. domestic policy on oil spills. The *Exxon Valdez* experience and the wealth of domestic regulatory policies and scientific research gained by the U.S., and the desire by many in the U.S. never to see another *Exxon Valdez* occur, provide sufficient incentive for the U.S. to engage in cooperative activities with Japan on oil spill response mechanisms in the Sea of Japan and elsewhere. In addition to the prevention of a disastrous oil spill, there are indirect benefits for the U.S. to engaging in cooperative activities with Japan. For instance, prevention of oil spills in Northeast Asia helps maintain the smooth flow of maritime commerce, reinforces freedom of navigation in the region, and enhances worldwide marine environmental protection.

1.6 Innovative Financing

Demand for energy is expected to resume high growth rates in Northeast in the coming decade, even after adjusting for the effects of the Asian financial and economic crisis. Increase in demand will come with attendant increases in environmental impacts unless measures are taken to minimize the impacts. One of the many measures that needs to be taken is mobilizing funds for investment in environmentally benign and supply-secure energy development. This lies at the heart of efforts to enhance the region's energy-related environmental security. Bilateral and multilateral sources of aid significantly declined in the past decade. On the other hand, private international capital flows, both foreign direct and portfolio investment, rose dramatically. The key will be to mobilize and leverage private sector investment towards fulfilling environmental objectives that enhance security goals. Thus, in its final year the ESENA project examined an innovative financing arrangement—a technology risk guarantee mechanism.

The ESENA project explored one type of financing mechanism that uses small amounts of public money to leverage much larger amounts of private investment in environmentally-friendly technologies. The project grounded its investigation of the public leveraging of private capital in a specific project proposal designed to help fund advanced clean coal technology (CCT) in China. As

has already been discussed, coal and coal-fired power plants have a massive environmental impact on China and the region. China needs to increase the efficiency (amount of energy gained from each ton of coal burned) and lessen the environment impact (reduce emissions and waste) of its coal-fired power plants. Advanced clean coal technologies are one option for doing this. They are designed to both increase efficiency and decrease environmental impacts. Examples of advanced CCTs include electrostatic precipitators, low NO_x burners, advanced process controls, supercritical (SC) steam cycle technology, fluidized bed combustion (FBC), flue gas desulfurization (FGD) devices, and integrated gasification combined cycle (IGCC) technology.

Issues affecting the development and deployment of advanced CCTs in China include: 1) economic viability of the technology, 2) risk in developing and/or deploying new technologies, 3) questions of maintenance and operation of the technology, and 4) political/legal issues. Despite the financial crisis in Asia, there is still a forward, albeit slowed, momentum for financing the introduction of advanced CCTs in China. There are many financial tools available to encourage this process. One tool is innovative non-grant financing mechanisms which use public monies to help leverage greater monies from the private sector. And one highly influential organization able to wield this type of tool is the Global Environment Facility (GEF). Section 3.3 of the final report discusses a GEF-based "technology risk guarantee mechanism" to promote financing of advanced CCTs in China, and Japanese and U.S. cooperation to establish such a mechanism.

1.7 The Knot of U.S.-Japan Cooperation

Since the end of the Second World War, Japan and the U.S. have established a highly productive and cooperative relationship. However, despite this history of friendly relations, cooperation of the nexus of energy, environmental, and security issues is by no means a foregone conclusion. Both countries have converging and diverging interests regarding these issues. The task of the ESENA project was to clarify their various interests in a search for common ground. Ultimately, both countries have a vested interest in peace in the region, but the means to that peace may differ.

The U.S. and Japan have unique and complementary intellectual, institutional, technological, and economic resources to apply to cooperation on the nexus of energy-environment-security in Northeast Asia. These capabilities arise out of their respective security, economic, and technological positions. Together, these two great powers can enhance the process of environmental cooperation within the Northeast Asian region, especially on issues of region-wide environmental degradation, whereas left to their own devices, Japan may hesitate, and the U.S. may neglect these crucial regional issues. U.S.-Japan cooperation on regional energy-related environmental issues is an important component of a regional comprehensive security strategy.

The United States has significant "conventional" national security interests in Northeast Asia. These include defense of South Korea where 35,000 troops are stationed, guarantees written into the U.S.-Japan Security Treaty, safeguarding Taiwan, and protection of U.S. citizens and industry throughout the region. In addition, the U.S. plays the role of guarantor of freedom of navigation for international commerce and oil supplies in the region.

While the U.S. has paid detailed attention to its conventional security interests, it has done little to consider the relation between environmental issues and its conventional military issues. There are some exceptions, such as the CIA and National Intelligence Council's MEDEA Study on the Future of Chinese Agriculture published in January 1998 that looked at the potential effects of rising grain prices on political stability induced by a deteriorating agricultural economy in China. However, overall, U.S. policymakers have not recognized that just as strategic military changes in Northeast Asia affect U.S. security interests, so too will environmental changes impinge on them. For instance, emission of greenhouse gases in the region, which in conjunction with emissions worldwide, may

trigger a change in the global climate that in turn may be politically destabilizing to many countries around the world, including those in Northeast Asia.

Why has the U.S. not exhibited much concern about environmental problems in Northeast Asia? First, the U.S. emphasizes economic not environmental relations with Northeast Asia. Second, it is sensitive about China's reactions to multilateral cooperation. U.S.-China bilateral environmental relations are good, but there have been major problems with China in environmental and non-environmental multilateral fora. The recent agreement with the U.S. over Chinese membership in the World Trade Organization (WTO), though, may signal a change. Third, the U.S. is sensitive to Japanese reaction to U.S. actions in the region. Northeast Asia is in Japan's "backyard." The U.S. must avoid the image that it is meddling in affairs where it does not belong.

However, U.S. perceptions of its interests in the region may alter significantly with the recognition that regional environmental problems in Northeast Asia may directly affect human and ecological health in the U.S. The recent discovery of trans-Pacific air pollution in which pollutants are carried by the prevailing westerlies from Northeast Asia to North America may present a threat to U.S. ecological security, especially in Alaska. Circumstantial evidence is emerging of ecological impacts (high DDT concentrations in bald eagles and high PCB concentrations in killer whales) that might be due to transport of toxics from Asia. The atmosphere is not the only suspected pathway. Though not yet conclusively documented, marine transport of pollutants from Northeast Asia to the U.S. may also be occurring. Other environmental changes in the marine, terrestrial, and atmospheric environments in Northeast Asia may individually or in combination threaten various U.S. ecological and human health interests. Thus, the spill-over of Northeast Asian regional environmental problems to North America may provoke a major shift in the U.S. attitude toward environmental problems in Northeast Asia.

Japan obviously has a major stake in the economic, political, and environmental well-being of Northeast Asia. This basically accords with U.S. interests. However, beneath this overarching agreement there lie many divisions. One of the most striking divisions is Japan's vulnerability to supply disruption of a wide variety of goods, ranging from foodstuffs to timber, oil, and minerals. Simply stated, Japan is vastly more dependent on imports than the U.S. Japan is therefore much more cautious of actions that will disrupt its various supply lines. A second key division is that Japanese and U.S. industries often compete for the same markets. Thus, they often find it difficult to cooperate where competition for markets is at stake.

While cooperation exists between Japan and the U.S. on various energy, environmental, and security issues, cooperation on the nexus of all three issues does not. In forging this type of synergistic cooperation, the environment node of the energy-environment-security triad offers perhaps the best starting point for developing common ground. Assuming that the "environment" is the jump-off point, Japan and the U.S. need to first agree on what aspects of environmental problems constitute security risks in Northeast Asia. It is argued here that U.S. and Japan must acknowledge and agree that degradation of the regional environment as a whole is a "threat" to peace in the region. In other words, transboundary pollution problems pose a security risk. Once this "generalized," regional-scale risk is acknowledged, the two countries can proceed to examine the sources of regional environmental degradation. One source, of course, is the production, transport, and consumption of energy. There may be significant disagreement between the U.S. and Japan about what aspects of energy-induced problems to tackle; however, they should seek to define those aspects they can address jointly. Once this is accomplished, specific projects can be formulated. In essence, the ESENA project sought to lay the foundation for the above process by identifying energy-related problems the two countries can jointly address, and by suggesting concrete projects conducive to Japan-U.S. cooperation on these problems.

2. Regional Comprehensive Security

For the U.S. and Japan to successfully cooperate on the energy-environment-security nexus of issues in Northeast Asia, the two countries need to develop a conceptual framework for analyzing and integrating the issues. One of the central objectives of the ESENA project was to define such a framework. While a fully-developed and polished framework was not achieved, a solid beginning was made. The framework is called "regional comprehensive security." It draws on strands of new and old thinking on security issues in both the U.S. and Japan. For instance, it draws on Japan's pioneering work on national comprehensive security in the 1980s, and it draws on the fields of study known as "energy security" and "environmental security." Essentially, the ESENA project sought to incorporate regionally-based, cooperative approaches to energy and environmental security into a comprehensive security framework.

2.1 National and Regional Security

Since energy and environmental issues in Northeast Asia have, or are projected to have, a strong connection to security issues, the first question we need to ask is: what is security? Answering this question entails answering several attendant questions: what is the object being secured, what is it being secured against, who is securing it, and how is it being secured? In the realm of international relations, security, as commonly used, refers to a nation-state (i.e., national security). The object being secured is the sovereignty of the nation and the lives and welfare of its citizens. Thus, national security can be defined as protection of the nation (i.e., ensuring the survival and integrity of the nation), and protection of the lives and livelihoods of the citizens of the nation. Typically, the threats to be protected against are assumed to be military threats arising from beyond the country's borders. However, new perspectives on national security emphasize non-military threats and threats arising from *within* the borders of a country, in addition to external military threats.

The environmental side-effects of large-scale energy use fall within the category of non-military threats, and they may either be internal or external to the country. Transboundary environmental problems, for instance, may constitute an external threat to a nation. Japan views the import of sulfur compounds from coal-fired power plants in China as an external threat to its well-being. While transboundary environmental problems generally don't constitute a military threat to a nation, they can be a threat to the lives and welfare of citizens within a country. In this manner, the current intensification of many cross-boundary environmental problems around the world is forcing a rethinking of how best to secure a national against such threats.

The ESENA project advocates that a regional perspective is more appropriate than a strictly national perspective when securing a country and its citizens against cross-border environmental impacts. In other words, national security in relation to the environment is inextricably embedded in regional security. Thus, as far as transboundary environmental impacts of large-scale energy use in Northeast are concerned, securing the region as a whole against the impacts is a prerequisite to securing the nation. And the best way to secure the region is to build a comprehensive security framework via development of multilateral, region-wide institutions for cooperation.

2.2 Comprehensive Security

Japan's 1980 Report on the Concept of Comprehensive Security helped pioneer the concept of comprehensive security. The report was triggered by the two energy crises of the 1970s. The

concept, as outlined in the report, remains a pillar of present-day Japanese foreign policy. Comprehensive security broadened the definition of security to include non-military concerns, including energy and food security and countermeasures for natural disasters, especially earthquakes. This represented a major break with previous Japanese security thinking; thinking that was borne out of Japan's World War II and Cold War experiences. However, the focus of Japan's comprehensive security concept remained on *national* not *regional* security. In other words, multilateral cooperation in Northeast Asia was not seen as a sure route to national security.

The notion of comprehensive security surfaced again in Japan and elsewhere after the end of the Cold War in 1989. The end of superpower confrontation triggered a complete rethinking of traditional concepts of national, regional, and global security. Traditional concepts focused on superpower rivalries, the protection of national sovereignty, and external military threats. New thinking emphasizes three additional dimensions: 1) a broader range of external threats and potential sources of international conflict, including environmental degradation and/or resource scarcities, including energy scarcities; 2) a focus on threats to *human* security, that is, to life and livelihood of individuals and communities, within as well as between nations, including economic scarcities (for instance, food), ecosystem degradation, discrimination (ethnic, religious, gender, etc.), human rights abuses, and others; and 3) a focus on cooperation, at both regional and global levels, as an essential way to enhance national security.

There are a myriad of security categories housed under the rubric of comprehensive security, but the two that are most relevant to developing a common understanding of and approach to the energy-security-environment nexus in Northeast Asia are environmental security and energy security.

1. *Environmental security* stresses that ecological degradation, resource scarcity, and population pressures are a source of conflict (i.e., that environmental problems "causes" conflict); or conversely, that regional cooperation on environmental issues can play a major role in building confidence and enhancing regional peace (i.e., that environmental cooperation "causes" peace).

1. *Energy security* stresses the need to take measures to reduce vulnerability to energy supply disruption, especially foreign oil. Such measures include diversifying energy fuels, developing fuels and technologies which enhance environmental health and build regional confidence, strengthening demand-side management, and engaging in preventative diplomacy along vital sea lanes. The energy security framework is especially salient in Japan, which is highly dependent on foreign energy sources.

Environmental security thinking incorporates energy use as one source of environmental problems. In the U.S., environmental security is widely discussed and has begun to be adopted in some parts of the government. Energy security thinking incorporates environmental problems as one factor affecting energy vulnerability. Energy security is especially salient in Japan, which is highly dependent on foreign energy sources.

A commitment by the U.S. and Japan to promote ecologically sound and secure energy development is critical to enhancing peace in Northeast Asia. However, before the governments can make such a commitment and crystallize it in the form of joint initiatives, a consensus must emerge among key

thinkers and opinion-makers in the two countries. The environmental and energy security frameworks, under the umbrella of regional comprehensive security, provide a basis for developing this consensus. The frameworks lay the foundation for a common understanding and language, and development of common interests, between Japan and the U.S. relative to regional energy, environmental, and security issues.

2.3 Environmental Security

The intersection of security issues and the environment (or "environmental security") is a dynamic area of academic research and becoming an active object of policymaking, especially in the advanced industrial nations of the West. The concept is newer, and hence in a greater state of flux, than energy security. There is as yet no agreed upon definition of environmental security. On the contrary, there is a wide range of definitions and conceptual orientations depending on the particular point of view used to approach the linkage. There is even a strong debate as to whether the term should be used at all.

While the concept of environmental security has already gained currency in the United States, it is just beginning to be explored in Japan. The Environment Agency of Japan initiated a "Basic Study on Environmental Security" in 1999, the first such study in Japan.[15] The Environment Agency commissioned the study so as to understand how the concept is being used in the West. This understanding will aid in defining its approach to environmental security. Environment Agency officials, and others in government, believe the environment is one of the best areas for building regional and global cooperation. Thus, cooperation on environmental issue may assist cooperation on a broad range of security issues. The Environment Agency study has provoked intense discussion of the meaning and relevance of the environmental security concept in Japan. The ESENA work is therefore timely and will feed into this debate in Japan.

The origin of the concept of environmental security is generally dated from a 1977 paper by Lester Brown of the WorldWatch Institute.[16] This paper, however, did not attract significant notice at the time. Richard Ullman was the first international relations scholar to attempt to broaden the concept of national security.[17] Ullman argued that non-military threats to a state need to be included in a new definition of security. Ullman's work, like Brown's, went largely unnoticed. They pioneered a rethinking of the traditional security agenda, but their ideas gained little scholarly and even less policy attention.

The lack of attention to this early work on environmental security is not difficult to understand. At the time, the world was still in the throes of the Cold War, and the imperatives of the Cold War dominated both theory and practice in the security field. As the Cold War was coming to its sudden and unexpected closure, Jessica Tuchman Mathews picked up on the strand of inquiry pioneered by Brown and Ullman, and in a highly influential 1989 article in *Foreign Affairs*, argued that the concept of national security needed to be expanded.[18] She sought a "broadening [of the] definition of national security to include resource, environmental and demographic issues." Without such a redefinition and accompanying policy changes, she envisioned a grim future of "human suffering and turmoil."[19]

The end of the Cold War triggered a wholesale reassessment of the concept of national security. Analysis of "unconventional" threats to national security entered the space previously occupied solely by conventional, military threats, and security specialists began to turn their attention to analyzing them—threats due to technological innovation, the emergence of powerful non-state actors, the expansion of transnational networks in drug trafficking and terrorism, and environmental degradation, to name a few. A wide-open debate ensued over the meaning of security in the post-Cold War era. One facet of this debate coalesced around the concept of environmental security.

The environmental security concept attracted its first significant attention from policymakers in the early 1990s. In the United States, the environment came to be associated with security issues at the highest government levels. The connection was formally recognized by former President Bush in the "National Security Strategy of the United States" in 1991. Though acknowledged, the connection was tenuous at best. Two events radically altered this situation. The first was a briefing in 1993 to the National Security Council (NSC) by Thomas Homer-Dixon of the University of Toronto on the link between environmental degradation/resource scarcity and violent conflict,[20] and the second was an article published in the *Atlantic Monthly* by Robert Kaplan on the same theme.[21]

In a landmark speech in April 1996, former Secretary of State Warren Christopher stated that "environmental initiatives" were "low-cost, high-impact tools in promoting our national security."[22] One year after Christopher's speech Secretary of State Madeleine Albright released the State Department's first Annual Report—*Environmental Diplomacy: The Environment and U.S. Foreign Policy*—which described current and future State Department activities. The report identified five global environmental challenges that the U.S. regards as most urgent: climate change, the use of toxic chemicals and pesticides, loss of biological diversity, deforestation, and ocean pollution and over-exploitation. It also established five regional-level priorities: water resources, air quality, energy resources, land use, and urban and industrial growth.

The above brief history of the concept of environmental security is by no means complete either in terms of content or geographical coverage. However, it gives an indication of how quickly the idea gained acceptance in the United States. The U.S. is currently one of the most active centers of academic scholarship on environmental security, and arguably the most active in promoting environmental security initiatives. Other centers exist in Canada and Europe.

Even though the concept has firmly taken root in academic and policymaking circles in the West, there exist a tremendous range of definitions and orientations. Fundamentally, they split over the object requiring protection. Candidate objects include the nation-state, individuals, groups, societies, natural ecosystems, the international system, and the biosphere.

The broadest definitions are premised on the fact that environmental degradation and resource scarcity may adversely affect the whole of humanity. The "threat" posed by environmental change is a threat to the health and livelihood of all humans on the planet. This version is often termed "human security." Proponents of this view tend to emphasize ecological sustainability as the ultimate goal of environmental security. Critics say that such a reading renders the term security meaningless.

More conservative definitions are premised on the fact that environmental degradation and resource scarcity may adversely affect traditional military security interests. This view holds that environmental change may be a significant contributing factor to political instability and/or violent conflict, and is the view popularized by Homer-Dixon and Kaplan.

The ESENA project adopted a "regional" orientation in its use of the term environmental security. It is assumed that regional-scale environmental degradation and resource scarcity may adversely affect national security. Thus, national environmental security is indelibly linked to regional environmental health. In a sense, this is an acknowledgement of ecological interdependence and the fact that ecosystems do not respect political borders.

The ESENA project also adopted the view that the most productive approach for the U.S. and Japan to environmental security is to emphasize a "environmental cooperation causes peace" orientation. This contrasts to the view that "environmental degradation causes conflict." Therefore, international environmental cooperation can be seen by the U.S. and Japan as a tool for promoting peace.

Accordingly, a "regional" and "cooperative" perspective suggests that a nation's environmental security entails:

1. protecting the health and welfare of its citizens by promoting ecosystem health in addition to securing them against the adverse consequences of environmental change,
2. protecting the economic interests of the nation by promoting ecosystem health in addition to securing it against the adverse consequences of environmental change,
3. cooperating with other states and non-state actors to enhance environmental management capacities, especially in the context of economic globalization, to reduce transboundary pollution and sustainably mange cross-border issues, and mitigate regional-scale adverse environmental change.

An ethical impulse imparted by the human security school of thinking lurks behind the conventional security concerns contained in the above definition. The last item, in particular, implies that a nation's environmental security is dependent on the environmental security of the wider region beyond the territorial boundaries of the nation, and that a proactive approach to environmental cooperation is the most efficacious way to secure the regional environment.

In the environmental security approach outlined above, the environmental impacts of energy use are pooled with environmental impacts of non-energy activities. The task for Japan and the U.S. is to guard against threats to regional security in Northeast Asia due to the synergistic impacts of energy *and* non-energy related environmental problems.

2.4 Energy Security

Energy, especially fossil fuel energy, is the life blood of modern society. Energy is one of a handful of issues that nations will go to war over. Thus, energy is intimately linked to a nation's security. The concept of "energy security" became popular in the 1970s after the oil embargo of 1973.

National energy security is generally defined as securing an adequate supply of energy so as to protect the nation and run its economy. Conventional views often equate energy security with energy self-sufficiency. The earliest, and still conventional focus of energy security policy in industrial nations, is on securing oil. The reasons for this are not difficult to understand. First, oil is the dominant fuel in the global primary energy supply, constituting about 40% of global primary energy use. Second, the source region of the world's largest oil reserves—the Middle East—is one of the most unstable areas in the world. Thus, oil supply and prices are often influenced by the political decisions of oil suppliers in the Middle East. And third, key sectors of the economy that are heavily dependent on oil (transportation, petrochemical, and military) and that are vulnerable to oil price volatility are strong proponents of "oil security." The supply politics of other fuels such as coal, natural gas, and uranium, for instance, are generally more predictable than oil.

In general, the goals of traditional oil security policy in the major energy importing and consuming countries are to reduce vulnerability to foreign threats or pressure, prevent a supply crisis from occurring, and minimize the economic and military impact of a supply crisis if it occurs.

Besides policies designed to protect its oil supplies, Japan's conventional energy security policies place a heavy emphasis on nuclear energy, especially development of a closed nuclear cycle. The closed nuclear cycle, and attendant fast breeder reactor technology, is a core program in Japan's national energy security policy and has been justified on the basis of its alleged ability to enhance energy self-sufficiency. Japan's dogged pursuit of the fast breeder reactor continues despite serious accidents, the most recent of which occurred in September 1999. The greatest security concern of

fast breeder reactor technology is proliferation of weapons-grade plutonium.

Conventional national energy security policies in both Japan and the United States are being seriously challenged on multiple fronts. New perspectives are emerging. Challenges come from the risks associated with advanced technologies (for instance, the risk of another Chernobyl); from the success of demand-side management measures (if demand is not a given, then security can be gained by reducing demand as well as ensuring a steady fuel supply); and changing post-Cold War international relations (for instance, although the threat of world war has decreased, the risk of regional conflicts has increased).

Challenges to conventional notions of energy security also come from the environmental problems associated with energy production, transport, and consumption. Environmental considerations were not part of traditional, supply-side, nationalistic energy security policies. Relevant to the ESENA project, conventional energy security policies, while securing energy for the nation, may actually create a situation where the environmental effects of the energy used cause political and economic insecurity in the surrounding region. Thus, the regional-scale side-effects of transnational environmental problems associated with energy use, such as transboundary air and marine pollution and global climate change, must be considered in a nation's energy security policies.

The challenges to traditional energy security wisdom are leading to more comprehensive views of energy security. Comprehensive energy security can includes consideration of supply-side management, demand-side management, technological risks and technological diversification, social and cultural issues (such as social justice, and transparency in energy planning and markets), crisis management and prevention, environmental issues, and emphasis on common interests and actions among nations.

Similar to its orientation to environmental security, the ESENA project adopted a "regional" and "cooperative" approach to energy security. Consideration of the regional and global environmental externalities of energy use must become a part of national energy security policies. To mitigate these externalities, greater regional cooperation in the areas of renewable energy technology, institutional reform, and adoption of energy-saving technologies and life-styles, to name a few, need to be emphasized.

In summary, although traditional energy security approaches tend to have powerful national and nationalistic overtones, these need to be softened by employing a comprehensive energy security approaches framework that contains, among other elements, a much stronger emphasis on regional-scale, cooperative institution-building.

2.5 Conclusion

The new environmental security concept and non-traditional energy security perspectives are the central elements of the comprehensive security framework advocated by the ESENA project to guide Japanese and U.S. thinking on the nexus of energy, environmental, and security issues in Northeast Asia. No attempt is made here to seamlessly weave together the energy and environmental security concepts into a coherent comprehensive security framework. Instead, it is argued that two main themes of such a framework need to be: 1) attention to the security implications of *regional-scale* environmental degradation, and 2) *regional* energy and environmental cooperation to address this degradation that enhances the multilateral institution-building process in Northeast Asia.

The U.S. and Japan are urged to use these themes as a basis for working toward a common, integrative regional comprehensive security framework in Northeast Asia. Even though the United States has not paid much attention to regional-scale Northeast Asian environmental problems to

date, the discovery of trans-Pacific transport of air pollutants from Asia to North America and the possibility of trans-Pacific marine transport of pollutants urge a serious rethinking by policymakers of U.S. interests in such problems.

3. ESENA Initiatives

3.1 Criteria for Screening Initiatives

Besides its work on developing the regional comprehensive security framework, the ESENA project generated a set of recommendations for joint U.S.-Japan policy initiatives that are designed to facilitate development of the regional comprehensive security framework by addressing certain aspects of the nexus of energy, environmental and security issues in Northeast Asia. The viability of the recommendations were tested against criteria also defined by the project. In broad terms, the initiatives should accomplish two things: 1) build confidence between the U.S. and Japan, as well as among other countries in the region; and 2) enhance social, institutional, scientific and technological capacity to manage the energy-security-environment nexus.

The project generated eight criteria by which to evaluate potential initiatives for U.S.-Japan cooperation:

1. *Promote Common Understandings:* An initiative should assist in creating common understandings of energy-environment-security linkages. Common understandings are a necessary prelude to effective cooperation. Generation of these understandings will help define the regional comprehensive security framework, and in turn, the framework will help clarify the understandings. In part, the generation of common understandings in the environment field is predicated on cooperative scientific assessment.

1. *Build Constituency and Political Will:* An initiative should build a broad constituency and generate political will for further regional environmental cooperation. In other words, an initiative should not be an isolated bilateral effort between the U.S. and Japan. It must be a springboard for multilateral cooperation.

1. *Use Complementary Strengths:* An initiative should draw on complementary strengths of the U.S. and Japan, including scientific, technological, and institutional. Drawing on complementary strengths means that both countries will benefit from the initiative and will be able to learn from each other at the same time that the countries leverage those strengths to build regional cooperation.

1. *Promote Interdependence and Mutual Interest:* An initiative should stem from recognized

mutual interests in Northeast Asia, not only of the U.S. and Japan but also the other countries of Northeast Asia. Enhancing mutual interests will encourage a sense of interdependence.

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1. *Use (and Reform) Existing Institutional Channels:* If possible, the implementation of an initiative should utilize existing institutional channels rather than create new ones. New channels often require large startup costs and long lead times. The use of existing channels will facilitate implementation of an initiative.

1. *Require Modest and Shared Cost:* An initiative must be financially modest, with a shared startup cost of less than US$500,000. Over the long term, the initiative should be based on the principle that the costs of regional environmental cooperation are borne by all parties.

1. *Be Fundable, Flexible and Sustainable*: An initiative should be one for which funding can readily be secured. In other words, it fits smoothly within the guidelines of present funding agencies. It should be flexible to allow for change in the course of implementation, and should have a durability that raises the prospects of continuation beyond an initial implementation phase.

1. *Possess a Specific, Measurable Benefit and Short-Term Payback*: An initiative should have a specific and measurable benefit such that there are well-defined benchmarks for success or failure of the initiative. Also, although it can contain long-term goals, an initiative should have a significant short-term payback. Projects with some sort of short-range political return, within the context of a larger vision, are the most likely to be funded and to succeed.

The ESENA project generated a wide range of recommendations for joint U.S.-Japan initiatives on the energy-environment-security nexus in Northeast Asia. These were boiled down to four recommendations that were judged to best meet the criteria listed above. In addition, the project identified four cross-cutting themes. The cross-cutting themes emerged during the course of the project as guiding ideas that the U.S. and Japan would do well to keep in mind in any and all work related to energy, environmental, and security issues in Northeast Asia. Following a discussion of the cross-cutting themes, the final four recommendations chosen by the ESENA project are explained in detail. Some of the other recommendations generated by the project are also briefly presented.

3.2 Cross-Cutting Themes

3.2.1 Work Toward a Common Integrative Framework and Policy Approach

The U.S. and Japan currently employ a variety of partially defined and nascent conceptual frameworks to shape their foreign policies on energy and environment. Few of these frameworks address the security implications of the energy-environment linkage. The ESENA project and its workshops revealed that the lack of a common conceptual framework which integrates energy,

environment, and security concerns impedes clarity in defining areas of common—and conflicting—interests between the U.S. and Japan in Northeast Asia. While the project made a start toward outlining such a framework (the regional comprehensive security framework explained above), the two governments need to continue this work through joint research, workshops, intellectual exchanges, and other activities. These activities should bring together senior level managers from a variety of ministries/departments in the U.S. and Japan, as well as academics, NGO representatives, business people, foundation officers, and others.

3.2.2 Collaborate in Expanding Scientific and Technical Knowledge and Regional Scientific and Technical Capacity

Before the security implications of regional-scale environmental degradation in general, and energy-related environmental problems in particular, can be fully understood, the character and extent of environmental problems themselves must be understood. Science is the foundation for understanding many environmental problems, and is the foundation upon which common understandings are built. The U.S. and Japan should strengthen bilateral and multilateral cooperative research, monitoring, and assessment of the environmental impacts of energy and non-energy related activities.

Because many developing countries in the region do not have a strong indigenous scientific capacity from which to address national and transnational environmental problems, Japan and the U.S. should jointly engage in scientific and technical capacity building in the region. A strong regional scientific capacity is a necessary prelude to creating a common scientific picture of the state of the environment in Northeast Asia. Scientific capacity can not be strengthened without also strengthening social, economic, and institutional capabilities. The U.S. and Japan should continued and accelerate their efforts to build such capacity in the region.

3.2.3 Encourage the Participation of Civil Society and Local Government

The U.S. and Japan should recognize the importance of the role of civil society (generally defined to include non-government, non-business actors) and local governments in shaping and helping to implement joint regional energy-environment initiatives in Northeast Asia. One rich avenue identified by the ESENA project for involving civil society and local governments is "regional cooperation at the local level." For instance, cooperative activities between cities and prefectures in Northeast Asia, and between Northeast Asia and the U.S. One such activity—a bay-to-bay marine project—is outlined below.

3.2.4 Leverage Private Financial Markets

The capital required to meet energy and other demands in Northeast Asia is staggering. Only private capital markets are capable of meeting this demand. How they meet it will significantly determine whether energy, environmental and security threats of the future are mitigated or exacerbated. In particular, Japan and the U.S. need to explore new, effective ways of harnessing the power of private international financial markets towards promoting ecologically sustainable and security-enhancing energy development in Northeast Asia. They should also explore a common approach to the inclusion of environmental issues in the regulation of the financial sector.

3.3 Top Four Initiatives

The top four recommendations for U.S.-Japan initiatives on the nexus of energy-environment-security issues in Northeast Asia are explained below. These were the top four ideas culled from the full set of initiatives generated by the ESENA project. They are project "ideas," not full project proposals. To

turn these ideas into full-blown project proposals will require further effort; however, all four were deemed not only to meet the criteria listed above but also to contain the seeds of worthy projects for Japanese and U.S. cooperation.

3.3.1 Workshops to Initiate Scientific Cooperation on the Interface Between Transboundary Air Pollution Problems in Northeast Asia and the Trans-Pacific Air Pollution Issue

The ESENA project identified the newly emerging issue of trans-Pacific air pollution as an important area for U.S.-Japan cooperation. Trans-Pacific air pollution is transport of pollutants into and across the Pacific Ocean from emissions sources primarily around the Pacific Rim, but also beyond. It is in part an extension of transboundary air pollution problems in East Asia. Thus, efforts in North America at addressing the trans-Pacific issue need to be linked to, and integrated with, the already major scientific and political efforts related to East Asian transboundary air pollution. As a first step, the U.S. and Japan should begin intellectual exchanges on the issue.

To scientifically understand the interface, monitoring of atmospheric chemistry is central. A regional monitoring network, the East Asian Acid Deposition Monitoring Network (EANET), is scheduled to begin formal operation in 2000. This network, however, needs to be coordinated with other Pacific Rim monitoring activities so as to be able to assess the nature and extent of long-range transport of air pollutants into and out of the Northeast Asian region. EANET needs to be coordinated with monitoring in North America and the Arctic. Eventually, it will be necessary to establish a network that monitors the changing air quality in the entire Pacific Basin. The U.S. and Japan should cooperate to ensure the success of EANET, and begin discussion of coordinating its activities with monitoring elsewhere in the Pacific Rim.

Over and above monitoring, a complete set of tools for integrated assessment of changes in the chemistry of the atmosphere in Northeast Asia and the Pacific Ocean is needed. This includes standardized emission inventories, regional-scale atmospheric computer models, ecological and non-ecological research, and economic cost-benefit analyses. These tools need to be brought together into an "integrated assessment" package, often a computer model. Ultimately, the U.S. and Japan should work to develop a compatible set of integrated assessment tools to address the Northeast Asian and trans-Pacific air quality problems.

To lay the groundwork for development of these tools, the U.S. and Japan also need to promote scientific and technical capacity building in the region so that they can participate as equals in the development process.

Thus, for the purpose of beginning scientific exchange of information and promotion of scientific capacity-building, the ESENA project recommends that the U.S. and Japan host a series of workshops involving countries from around the Pacific Rim to understand the interface between Northeast Asian transboundary air pollution and trans-Pacific air pollution issues. The workshops can be hosted by the Environment Agency of Japan and the U.S. Environmental Protection Agency.

3.3.2 Develop a Web-Based Marine Atlas

The state of scientific knowledge of marine issues in Northeast Asia significantly lags that of atmospheric issues. Furthermore, policymakers' and the public's understanding of marine issues lags scientific understanding. As a vehicle to synthesize scientific and other knowledge and engage policymakers and citizens in marine issues in the region, the ESENA project recommends that the U.S. and Japan develop a Web-based dynamic marine atlas of the Sea of Japan (East Sea). The Sea of Japan Web Atlas would draw on already existing information, and would be grounded in a geographical information system (GIS). It would be constructed as a collective and collaborative

project of Sea of Japan littoral states, including China.

The web atlas could be used to promote environmental education, the development of integrated coastal zone management policies that link ecological considerations with traditional economic, disaster protection, and aesthetic considerations, and the establishment of a cooperative Sea of Japan oil spill response mechanism. In addition, the web atlas could be expanded to the regional seas of Northeast Asia, and even to the Pacific Ocean.

The Web-based marine atlas idea was put forth by Japanese participants to ESENA workshops, and is based on the Japanese experience with the January 1997 *Nakhodka* oil spill along the Sea of Japan coast of Japan. After the accident occurred, there was widespread confusion on the distribution of the spill, the clean-up coordination efforts, and appropriate methods for retrieving the oil. To prevent future confusion, and to elevate general public awareness about the dangers of marine environmental degradation in general and oil spills in particular, Japanese experts suggested that a Web-based "geoinfomatics" system that combines a GIS system and remote sensing data be constructed.

U.S. experts have also argued for such an atlas in the northern Pacific, and possess useful data and technical skills to help create it. In addition, and crucial to the success of such a project, the U.S. is the most advanced in the world in Web-based software design.

The ESENA project, therefore, recommends that Japan and the U.S. initiate a project to develop a Web-based and lay person-accessible marine atlas of the Sea of Japan. The National Oceanic and Atmospheric Administration (NOAA) and Japan's Science and Technology Agency (STA) could sponsor such a project.

3.3.3 Launch a Bay-to-Bay Project

The long coastlines of the U.S. and Japan, as well as the other countries in Northeast Asia, are under assault from population pressures, industrial pollution, devastating weather events, and other forces. One way to protect coastlines from this assault and at the same time build support for regional cooperation in Northeast Asia is to involve local governments and civic society organizations in joint projects to protect the health of their coastlines. As a step toward ensuring the health of coastal marine environments, ESENA project recommends that the U.S. and Japan initiate a trans-Pacific "bay-to-bay" project.

The project entails selecting three to seven bays in Northeast Asia and the west coast of the United States (e.g., Tokyo Bay, San Francisco Bay, Puget Sound, and the bays around Pusan and Vladivostok) to engage in information exchange, joint capacity building, and mutual policy innovation. The goal of the bay-to-bay transnational maritime cooperation project would primarily be to involve civil society and local governments in promoting transnational cooperation on marine pollution via localized policy initiatives in the select bays. Such local cooperation is seen as one small step to enhancing environmental security in Northeast Asia.

Led by citizen groups and local governments, stakeholders in the health of the bays—scientists, policymakers, NGOs, foundations, businesses, and others—would be brought together to compile a local profile of marine pollution in the bays. The information in the profiles would be standardized for cross-comparison between the bays. The profiles would contain information on the scientific, political, social, and historical aspects of marine pollution in the bays. They would contain, for instance, information related to monitoring, modeling, coastal zone management practices, oil spill response mechanisms, etc. Local workshops and working groups would be convened to develop local "sustainability" criteria and policy initiatives to achieve the criteria.

Following the local workshops, an international workshop would be convened to compare the bay profiles and sustainability solutions, and to assess commonalties, differences, and areas where the bays could help each other. An international working group would assist in connecting larger national, international, and global initiatives to the local sustainability solutions. The bays would also engage in joint capacity building, training sessions, and environmental education.

The bay-to-bay project idea builds on, and expands across the Pacific, the Japanese experience with city-to-city environmental cooperation projects. The most famous example is the Kita Kyushu (Japan)-Dalian (China) partnership. Transnationally-coordinated local initiatives and actions, such as contained in the bay-to-bay project, can help solidify the foundation for international environmental cooperation in Northeast Asia, and hence in the long-run improve environmental security in the region. The bay-to-bay project could be jointly sponsored by bay city governments.

3.3.4 Explore a GEF Technology Risk Guarantee Mechanism for Clean Coal[23]

Coal will remain a primary energy source in Northeast Asia, especially China, in any conceivable scenario of energy development over the next 10-20 years. To reduce sulfur deposition as well as greenhouse gas emissions, there is an urgent need for the U.S. and Japan to cooperate in promoting advanced clean coal technologies (CCTs) in China. Advanced CCTs, such as the Integrated Combined Cycle Combustion technology (IGCC), reduce carbon, sulfur, and other emissions.

One of the obstacles to widespread adoption of advanced CCTs is that some of the newest, most environmentally beneficial technologies are not yet commercially proven. This means that they carry a "technology risk," a form of commercial risk which private financiers will not cover. Moreover, many public sources of funds, including the World Bank, will not provide either grant or loan support for projects which carry technology/commercial risk. The one organization that can cover technology risk is the Global Environment Facility (GEF). The GEF could leverage a relatively small amount of funds in the form of a technology risk guarantee to enable a large demonstration advanced CCT project in China. The GEF would provide a technology risk guarantee, but most of the cost of the project would be financed by private investors and traditional multilateral lenders like the Asian Development Bank (ADB) and the World Bank.

The GEF was created to fulfill a unique niche—providing financing for programs and projects to achieve global environment benefits in four focal areas: climate change, biodiversity, international waters, and ozone layer depletion. GEF, originally set up as a pilot program in 1991, was restructured and replenished with over US$2 billion in 1994. In order to develop a public-private sector partnership, the GEF is currently considering the use of partial risk or credit guarantees, contingent or concessional loans, reserve funds and other "non-grant modalities" for providing direct assistance to private firms in developing countries. Traditionally, GEF grants have gone to governments. There are two operational programs (OPs) in GEF which relate to CCTs in China: OP#5 (removing barriers to energy conservation and energy efficiency) and OP#7 (reducing long-term costs of low greenhouse gas emitting technologies).

A distinct aspect of application of new technologies, such as advanced CCTs, is the incremental risk of using the technologies. Incremental risk refers to the possibility that a project may have cost over-runs, or may fail to operate at the projected levels of availability, efficiency, and/or environmental standards. These risks are often termed "technology risk," and though considered "commercial" risk, are often out of control of project sponsors. Thus, project sponsors do not want to take on this type of risk. At the same time most financiers do not wish to engage in projects which are likely to have such commercial risks.

GEF can be utilized as a source of technology risk mitigation for CCTs. GEF's mandate enables it to

take certain commercial risks, particularly those related to technology transfer and demonstration projects. Specifically, GEF can design and implement a "technology risk guarantee mechanism." The technology risk guarantee mechanism would be established in order to compensate for the additional risks involved in the construction and operation of the new technology, and would be drawn upon only if certain aspects of project construction and performance do not meet the projected standards, and only if these shortcomings are due to the unforeseen aspects of the new technology. This mechanism would remain as a contingent fund and would not be disbursed if the construction and operation proceed according to plan. The transaction arrangements of the guarantee mechanism would be designed considering the requirements of the project sponsors and financiers.

There are two major benefits of a technology risk guarantee mechanism. First, the initial funding of a project—facilitated through the mechanism—related to an environmentally-friendly yet non-commercial technology may lead to future repeating projects. This could reduce the cost and increase the availability of the technology. Second, the money in the guarantee fund may not be disbursed. It would be then returned to the GEF or used in other demonstration projects.

To make the GEF technology risk guarantee mechanism work properly, institutional arrangements need to be designed so that it remains a source of last resort and that project participants revert to the mechanism only if there is a clear failure with the new technology. The legal structure of the mechanism should spell out the conditions under which a contingency can be declared and resources withdrawn. It is also important to have the World Bank or another multilateral agency such as the ADB play a central role in managing the guarantee mechanism. Such an arrangement would provide comfort for project participants.

Much work remains to flesh out the actual design and implementation of a GEF technology risk guarantee mechanism. The ESENA Project investigated the feasibility and viability of the proposed mechanism through its application to specific projects that meets GEF support criteria. The usefulness of the mechanism can be tested, for instance, in the context of developing the GEF technology risk guarantee mechanism as one component of a total financing package for China's first IGCC demonstration power plant in Yantai, China, or for a demonstration supercritical power plant combined with an advanced flue-gas desulfurization device.

The ESENA project urges the U.S. and Japan to cooperate in promoting innovative financing mechanisms within and outside the GEF. The GEF technology risk guarantee mechanism is one such mechanism. In particular, the project urges Japan and the U.S. to explore the viability of a technology risk guarantee mechanism in relation to financing of advanced environmental technologies that meet the GEF criteria. Japan's Ministry of International Trade and Industry (MITI) and the U.S. Department of Energy may wish to sponsor such a project.

3.4 Other Recommendations for Initiatives

The top four ESENA project recommendations for joint U.S.-Japan initiatives on the nexus of energy, environmental, and security issues were described above. Below are four other recommendations that were seriously considered. Besides the eight discussed in this report, numerous other recommendations were put forth during the course of the project. For one reason or another, though, they were dropped. Many, for instance, were a serious miss-match with the criteria by which recommendations were judged.

3.4.1 Encourage Transparency of Long-Range National Energy Planning

Energy planning and emission inventories are essential components contributing to the

understanding of changes in the chemistry of the atmosphere and oceans. Greater transparency in energy planning is a critical confidence-building measure and is the basis for any effective collaboration on energy-related air and marine pollution problems. Standardized emission inventories are necessary to understanding changes in air and water quality and the effectiveness of control measures. The U.S. and Japan need to cooperate to bring greater transparency to national energy planning, and to encourage standardization of emission inventories in the region.

While transparency in energy planning and standardized emission inventories are worthy long-term goals, the ESENA project, however, felt this initiative was too general, and too politically sensitive, to warrant inclusion in its top list of recommendations.

3.4.2 Develop a Marine Monitoring and Assessment Network[24]

At present there is no collective and coordinated monitoring by all nations in the regional seas of Northeast Asia. The type of monitoring that is most needed at this time is "state of the environment" monitoring. In other words, monitoring the present condition of the regional seas. This is a first step in management of the regional seas. Monitoring the state of the system includes monitoring of the water column and sediments in relation to materials or pollutants known to result in problems; monitoring the presence, absence, and/or condition of indicator species; and monitoring of pollutant loads in the tissues of various species.

In addition to the monitoring of water quality, development of a mussel watch monitoring program and a squid watch monitoring program in Northeast Asia were considered by the ESENA project as appropriate avenues of cooperation between the U.S. and Japan. Mussels and squid are sensitive indicator species of ecological change. Mussels are a "sentinel organism" that can be used to monitor chemical contaminants in coastal marine waters. The U.S. has the most advanced mussel watch program in the world. The program, run by the NOAA, is in its twelfth year. There have been attempts to establish an Asian mussel watch program but it has not yet gotten off the ground.

To supplement monitoring, there is a need to develop a simulation models of the regional seas that would incorporate water quality and ecological data. Development of a Sea of Japan model, for instance, could be undertaken jointly by the littoral states of the Sea of Japan. Parallel with its development would be institutional capacity-building activities.

In the end, the ESENA project decided that U.S. interests in marine monitoring and modeling in the region were insufficient at this point in time to warrant a joint initiative.

3.4.3 Promote Ecological Coastal Zone Management[25]

Integrated coastal zone management (ICZM) is essential to ecological preservation in the regional seas of Northeast Asia. The countries of Northeast Asia, with the exception of Japan, practice only rudimentary coastal zone management. Even in Japan's case, the approach to coastal zone management tends to be an engineering rather than an ecological approach. Of Japan's total length of coastline—35,000 kilometers—about one-half requires protection from a variety of natural threats such as typhoons, tsunamis, and erosion. Structures have been built along about two-thirds of this portion. Thus it is not an exaggeration to say that Japan's coastline is essentially an artificial coastline. The U.S. has a strong base of experience in ecological coastal zone management, especially in California. The U.S. and Japan could focus joint efforts to encourage ecological coastal zone management in the regional seas of Northeast Asia.

In the end, as with marine monitoring and modeling idea, the ESENA project decided that U.S. interests in ICZM in the region at the present time were insufficient to warrant a joint initiative.

3.4.4 Institute a Sea Vessel Traffic Control Scheme in the Tsushima/Korean Straits[26]

The Tsushima/Korean Straits could be a model area for whatever forms of safe ship navigation management emerge in Northeast Asia. Most of the elements that require vessel management are found here: narrow sea areas and island-fringed coastlines, intensive fishing activity combined with merchant shipping, and uncertain weather with poor visibility. As an initial step in making the Tsushima/Korean Straits safer for oil and non-oil related traffic, and at the same time furthering marine cooperation in the region, the U.S. and Japan could work together to promote a Traffic Separation Scheme (TSS) for the strait. A Malacca Straits TSS was established after a major oil tanker accident. The Sea of Japan nations have an opportunity to establish such a scheme before an accident occurs.

The ESENA project recognized the need for such a traffic control scheme, but felt that development of such a mechanism is primarily the province of Japan and South Korea, and therefore could not justify promoting a U.S.-Japan initiative on the idea.

3.5 Implementation

Brief consideration is given here to implementing the top four recommendations described above. There are a wide variety of potential channels between the U.S. and Japan, and within the region, that can be used to implement the candidate initiatives put forth by the ESENA project. A few are suggested below.

The most suitable sponsors for the workshops suggested under the recommendation to initiate scientific cooperation on the interface between transboundary air pollution problems in Northeast Asia and the trans-Pacific air pollution issue might be the environment agencies of the two countries—the Environment Agency of Japan (EAJ) and the U.S. Environmental Protection Agency (USEPA). Both agencies have a mandate to address extra-territorial atmospheric pollution issues. The appropriate departments within these agencies are the Global Environment Department of the EAJ and the Office of International Activities of the USEPA.

In the marine area, the "Panel on Coastal Environment Science and Technology" within the U.S.-Japan Cooperative Program in Natural Resources (UJNR) was a group identified by the ESENA project that could be instrumental in implementing the recommendation to develop a Web-based marine atlas. The United States' NOAA and Japan's Science and Technology Agency (STA) are co-chairs of UNJR. The Panel on Coastal Environment Science and Technology seeks to develop joint U.S.-Japan coastal environment research and monitoring programs, exchange scientists and engineers, share data and information, conduct meetings every two years, and publish join documents. The panel held its first bilateral experts meeting in March 1998 in Japan. Experts exchanged technical information on such topics as oil spill mitigation, wetlands reclamation, water quality monitoring and modeling, marine biology monitoring, and coastal zone management. Since the UJNR focuses principally on scientific and engineering oriented activities, it is a highly appropriate forum for coordinating the technical work needed to create a marine atlas.

Co-funding by local government and private foundations in both Japan and the U.S. may be the best route for implementing the recommendation to launch a bay-to-bay project. Of the four top ESENA recommendations the bay-to-bay idea is most conducive to NGO leadership.

There are many organizations that might have an interest in implementing the recommendation to explore a GEF technology risk guarantee mechanism for clean coal. These include the U.S. Department of Energy and Japan's Ministry of International Trade and Industry (MITI), one of the large U.S. foundations such as Ford or Rockefeller, and the GEF itself.

Once crystallized in the form of a project proposal, any of the above recommendations could be considered for inclusion in the U.S.-Japan Common Agenda. The Common Agenda is the most prominent U.S.-Japan forum for discussing environmental issues. To place an item on the Common Agenda, implementing agencies within the countries must bring a project or project idea before the officials in the Ministry of Foreign Affairs of Japan and the U.S. Department of State, the agencies responsible for the Common Agenda. The value added by bringing a project into the Common Agenda is that it provides a mechanism to jointly coordinate projects. In addition, a Common Agenda label can bring a project attention, and help maintain a forward momentum and steady funding, that might not be possible if the project was isolated within one of the countries. Becoming part of the Common Agenda is a worthy objective for any of the candidate initiatives (projects) suggested in this report. However, before an ESENA project can become part of the Common Agenda it must first find a home in implementing agencies in Japan and the U.S.

4. ESENA Workshops

4.1 Workshop Descriptions

4.1.1 ESENA 1: Design Workshop

The first ESENA workshop (22-23 August 1996 in Tokyo) was devoted to project design and to exploring the overlapping and diverging perspectives and concepts related to the basic issues confronting the project. It also reviewed the research design and strategy. Key issues arising from this meeting included the following.

The Japanese emphasized that high profile, direct governmental cooperation between the U.S. and Japan regarding energy development in Northeast Asia is difficult. Instead, there was consensus that a more low-key, non-governmental collaboration (with government support) to address localized issues might be more effective than traditional large-scale overseas development assistance (ODA).

In the modeling work to be conducted as part of the project, the Japanese reacted strongly against overemphasis on a future energy scenarios based solely on "sustainable" sources (renewables, energy efficiency). The general perception among the Japanese members was that a sustainable energy scenario delivers less energy and is thereby a "second" class energy solution in the region.

Japanese participants emphasized that, currently, the social costs of energy supply disruption are the most important consideration for Japan's energy security, with cost minimization as a secondary priority.

Mr. Kazuo Hishida, a retired engineer from the Tokyo Metropolitan Government, gave a presentation on Chinese environmental improvement efforts and Japanese cooperation in this area. Mr. Hishida created many of the environmental laws in Tokyo and has worked privately for over a decade with the Chinese to help design urban and industrial environmental programs and effective regulations. He is very active in directing Japanese ODA towards these issues as well.

Workshop Participants:

UNITED STATES

James BUSSE, US Department of Energy (DOE)

Lee ENDRESS, Headquarters, US Pacific Command, (CINCPAC HQ)
Mark HAMBLEY, US Department of State
Peter HAYES, Nautilus Institute
Doug OGDEN, The Energy Foundation
Jonathan SINTON, Lawrence Berkeley National Laboratory
David VON HIPPEL, Nautilus Institute

JAPAN

Watanabe AKIO, Aoyama Gakuin University
Kazuya FUJIME, Institute for Energy Economics
Kazuo HISHIDA, Tokyo Metropolitan Government
Ryukichi IMAI, Atomic Energy Commission
Naoyuki SAKUMOTO, Institute of Developing Economies
Katsuo SEIKI, Global Industrial and Social Progress Research Institute (GISPRI)
Yasuhide YAMANOUCHI, Center for Global Communications (GLOCOM)

4.1.2 ESENA 2: Transboundary Air Pollution

The second ESENA workshop (16-17 November 1996 in Berkeley, California) was devoted to expert presentations related to transboundary air pollution and to the energy dynamics behind such pollution. Workshop participants also developed a list of generic review criteria for screening potential U.S. and Japanese joint policy initiatives. After much discussion, participants concurred on a short list of candidate initiatives related to transboundary air pollution and energy use in Northeast Asia. General topics of discussion during the workshop include the following.

Municipal Level Exchanges

Yasuhide Yamanouchi suggested that many Japanese cities have initiated the transfer of legal and technical experience to cities in China. This local level of exchange is appropriate for many issues which are more cumbersome at the national level. Feelings of state sovereignty are very strong in Northeast Asia, making it difficult to cooperate on environmental issues; Japan and China both fear interdependence. This problem does not exist at the local level.

Energy Security

Satoru Matsuo suggested that the appropriate format for confidence building measures depends on the energy type and countries involved. The appropriate format also depends on the players: national governments, regional/state governments, NGOs, private sector, etc. Crow stressed that the difficulty with multilateral agreements is the perception that there is a common problem. However, each country has a different set of priorities. For example, the reduction of one ton of SO_2 emissions is perceived as a higher priority in Japan than in China where environmental protection is a lower priority. Any framework ESENA develops will be a means for countries to deal with and better understand foreign interdependence. As countries become more interdependent, their self-interest becomes more intimately linked with actions the other countries. Interdependence diminishes the likelihood of conflict.

Political Issues/Targets

Doug Ogden suggested that an effective joint initiative would target energy ministries and their relation with utilities. The goal of any initiative should be to decrease negative impacts of energy emissions on crops and public health while diversifying the energy base of the region and decreasing

energy dependence. An initiative should focus on the causes of acid deposition, starting with the largest and easiest sources first. There are a number of ways to reduce emissions from energy-producing facilities, allowing for an integrated approach to the problem.

All research of the ESENA project should have a targeted political outcome—pass the "no dust" rule. ESENA research should next focus on calculating crop damage and health problems stemming from energy emissions. Ed Fei added that it would be worthwhile targeting agriculture ministries and public health ministries as well.

Scientific Issues

Peter Hayes pointed out that there is still a dispute over the models for acid rain transport. Our challenge is to get science robust enough to refute a philosophical commitment by politicians to nationalistic energy security.

North Korea

DPRK would never come to U.S. or Japan for technical training due to fear of backlash. DPRK will send people to neutral countries (Singapore, Thailand, China, Indonesia) for short-term, intrinsically valuable training. It could be possible to work with DPRK on long-range energy and environmental planning (methodology and process) without their feeling threatened by giving out data. Katsuo Seiki commented that if each country has to contribute, the project will be limited by DPRK. For energy efficiency and clean coal initiatives, the inability of the DPRK to contribute should not limit the project.

Institution Creation Versus One-Shot Activity

Use of existing institutions versus creating new ones is a critical issue. Fei supported enduring institutions versus a one-shot activity. Hayes, however, was wary of self-sustaining institutions.

Successful Technology Transfer

Yamanouchi suggested successful cases of technology transfer include the relationship between the cities of Kita Kyushu (Japan) and Dalian (China) to cooperate on a demonstration project for environmental small-scale boilers and the export of Honda 50 CC mopeds to Asia.

Hayes commented that a successful regional network will depend on the ability of all countries to contribute. For example in agriculture, the DPRK has an advanced integrated pest management systems which would be valuable for other countries in the region to adopt. There may be opportunities for innovations in energy efficient technology and practices in the lesser developed countries of the region to contribute to the advanced nations.

The Asian Development Bank (ADB) proposed expensive top of stack controls for China; however, the Chinese felt attacked and perceived environmental controls as conditionality on the aid. Thus, there is need to be careful how issues are framed—any project will be a learning process for all. The development banks and the Global Environment Facility (GEF) may be able to control emissions from the big point sources, so the best role for ESENA may be to deal with the more diffuse, chaotic, industrial emissions at the local level.

Liquid Natural Gas As Alternative Fuel

Any gas pipeline project projected for the area will have to cover more than two countries, and thus is problematic. The key question is how much China needs the energy, because pipelines are

expensive. Each country wants to charge maximum rents on the use of their land for the pipeline. There are also political problems with a divided Korea and the Kurile and Sakhalin Islands.

Nuclear Power

All countries in the region except for North and South Korea are decreasing their nuclear programs, and thus there is not much need for a regional nuclear infrastructure. However, there are a number of regional issues to deal with at the "back-end" of the fuel cycle; for instance, what to do with nuclear waste.

The following were proposed criteria for screening proposals for joint U.S. Japan initiatives.

Criteria For Screening Proposals For Joint U.S.-Japan Initiatives

1. Generate constituency and political will in the U.S., and Northeast Asia

- create a common image of the environmental and security issues
- may need to develop an epistemic view (for instance, a remote sensing network) to help characterize problems

2. Draw on complementary strengths (analytic, capacity building, technology) of the U.S. and Japan and match these very carefully with needs

3. Confidence building—initiatives should not break down common identities and should support

- mutual interest (e.g., migratory birds between Japan and DPRK)
- self interest (which does not always build mutual interest or confidence)
- contribution of all parties (no handouts)
- overlapping security and environmental concerns
- environmental interdependence (e.g., all nations share the atmosphere)
- shared identity

4. Existing institutional channels should be used to implement joint initiatives. Examples of institutions that could be used include:

- UNDP/ESCAP Northeast Asian Regional Environment Program (NEAREP): issues -- donors not funding it; technology ministries versus foreign ministries; U.S. and Canada are not members
- Asian Institute of Technology (AIT): Program for Asia Cooperation on Energy and Environment -- originally proposed by France
- APEC working groups: issues -- multilevel process; diffuse; no concrete agenda
- ADB: issues -- DPRK is not a member; biggest funder of NEAREP
- UNEP's Northwest Pacific Action Plan (NOWPAP): resources to do something on cooperative ocean management; integrated coastal zone management already signed off on; agenda is momentous in scope; DPRK attended every meeting -- but the process is now stalled
- Korean Energy Development Organization (KEDO): only "big power" multilateral institutional framework for engaging DPRK; although it is now confidence destroying -- DPRK extorting threat to go nuclear (extortion destroys trust); parties are learning but not trusting; open-ended agenda --

can include issues beyond energy

- parallel NGO track -- U.S. and Japanese foundations went to the DPRK to negotiate areas for cooperation (agriculture/biotechnology, medical technology, energy and environment, cultural)
- Concerted bilateralism by U.S. and Japan: carve out an area at margins in countries where Japan and U.S. have relations
- Tumen River Area Development Project (TRADP): UN-spawned activity; big vision, no reality; have MOU on environmental principles -- already signed; progressive
- Northeast Asia Economic Forum: run by East-West Center; will take up environmental issues next year
- Northeast Asia Cooperation Dialogue (NEACD): Track 2, funded by DOE; senior officials discuss political/security issues; DPRK mostly not involved

5. Costs - must be shared with small startup costs - less than $500,000

Expected results should be:

1) confidence;

2) institutional and human capacity to deal with problems we are defining; and

3) environmental benefit which is specific and measurable

The following were the proposed candidates for joint U.S. Japan initiatives relating to transboundary air pollution in Northeast Asia. The "votes" column indicates workshop participant and observers' choice for the top initiative.

Candidates For Joint U.S.-Japan Initiatives	*Votes*
• Acid Rain Monitoring Network: can build on Japanese monitoring network, RAINS-Asia passive monitoring system, remote sensing, or popular monitoring (schools, public etc.)	5
• Local Government Capacity Building: exchange and train staff on issues of air pollution, energy efficiency, green buildings, public health, environmental regulations, etc.; U.S. and Japan have complementary strengths and weaknesses; the Raijin Sorbon economic zone in the DPRK could participate; Japanese proposal to NEAREP	
• NGO-Public Education Campaign: focus on acid rain; Northwest Pacific Environment Forum run by The Asia Foundation	
• Transparency Of Long Range Energy Planning: confidence-building measure that would be basis for any effective collaboration; energy security implications -- regional commitment to energy efficiency at the national level	7

• Energy Efficiency And Clean Coal Fund: technology demonstrations; adapt technology to reduce costs; operations and maintenance	5
• Air Pollution Regulatory Policy And Implementation Network	2
• Nuclear Fuel Cycle Cooperation: spent fuel, waste storage and disposal	

Workshop Participants:

UNITED STATES

Greg CARMICHAEL, Iowa University
Robert CROW, Bechtel Corporation
Lee ENDRESS, Headquarters, U.S. Pacific Command, (CINCPAC HQ)
Ed FEI, U.S. Department of Energy (DOE)
Mark HAMBLEY, U.S. Department of State
Peter HAYES, Nautilus Institute
Doug OGDEN, The Energy Foundation
Arian L. PREGENZER, Sandia National Laboratories
David STREETS, Argonne National Laboratory

JAPAN

Hiroshi HAYAMI, Central Research Institute of Electric Power Industry (CRIEPI)
Satoru MATSUO, Global Industrial and Social Progress Research Institute (GISPRI)
Naoyuki SAKUMOTO, Institute of Developing Economies
Katsuo SEIKI, Global Industrial and Social Progress Research Institute (GISPRI)
Watanabe AKIO, Aoyama Gakuin University
Yasuhide YAMANOUCHI, Center for Global Communications (GLOCOM)

4.1.3 ESENA 3: Transboundary Marine Pollution

The third ESENA workshop (8-10 December 1997 in Berkeley, California) brought together about 30 Japanese and U.S. scientists, policymakers, and other experts on energy and marine issues. The most significant accomplishments of the workshop included: 1) deciding to focus on the Sea of Japan for the ESENA 4 workshop instead of all regional seas around Japan, 2) deciding to focus on oil-related pollution, 3) establishing the specific topics for further inquiry in the ESENA 4 workshop, and 4) formulating a three-tiered approach to recommendations for joint U.S.-Japan policy initiatives related to energy-related marine pollution issues.

The workshop decided to focus on the Sea of Japan because a) it is a relatively unspoiled regional sea and therefore is a prime candidate for preservation, b) it is expected to experience significant development in the near-term future, c) there are no multilateral political institutions and few political arrangements which include all the states in the Sea of Japan region, and d) it involves all the major political actors in the region and seems to offer the best prospects for joint U.S.-Japan initiatives that would encourage the process of multilateral confidence-, capacity-, and institution-building in the region.

The workshop also established a set of specific topics for further inquiry in the ESENA 4 workshop. These included: a) cooperation in developing a regional marine monitoring network and developing a regional-scale numerical model of the Sea of Japan, b) cooperation in developing systems of integrated coastal zone management in the circum-Sea of Japan region, c) cooperation in developing a sea vessel traffic control scheme in the straits between Korea and Japan, and d) cooperation in developing oil spill response mechanisms in the region.

The third major accomplishment of the workshop was to formulate a three-tiered approach to making recommendations of joint U.S.-Japan policy initiatives related to energy-related marine pollution issues. The three tiers can be expressed in the following three questions: 1) What overarching *objectives* should the U.S. and Japan pursue relative to energy-related marine issues in the Sea of Japan?, 2) What types of *issues* are most important for the U.S. and Japan to pursue relative to energy-related marine issues in the Sea of Japan?, and 3) What specific *programs* or activities should the U.S. and Japan pursue relative to energy-related marine issues in the Sea of Japan, and how should they be implemented?

The workshop also included members of the Nautilus Institute's Pacific Asia Regional Energy Security (PARES) project. The PARES project seeks to develop a comprehensive concept of energy security in Northeast Asia, and a framework for implementing it. Currently, the focus is on Japan's energy security. The project is constructing a new operational concept of energy security to underlie Japan's energy policy. Specifically, the PARES project is creating methodologies for analyzing decision-making options related to energy security. These methodologies will be used to catalyze widespread acceptance of a well-grounded concept of energy security to be used as a basis for energy policy in Japan and elsewhere in Northeast Asia.

Workshop Participants:

UNITED STATES

Peter HAYES, Nautilus Institute
Suzanne JONES, Princeton University
Larry LIDSKY, Massachusetts Institute of Technology (MIT)
Marvin MILLER, Massachusetts Institute of Technology (MIT)
Paul MLOTOK, Global Business Network
Tom NEFF, Massachusetts Institute of Technology (MIT)
Terri PALUSZKIEWICZ, Pacific Northwest National Laboratory
Linda PAUL, Ocean Law & Policy Institute
Hossein RAZAVI, The World Bank
David VON HIPPEL, Nautilus Institute
Susan WARE, National Oceanic and Atmospheric Administration (NOAA)
Ken WILKENING, Nautilus Institute

JAPAN

Tetsuro DOSHITA, Security Affairs Office, Office of the Prime Minister
Shintaro GOTO, Kanazawa Institute of Technology
Masahiko ISOBE, University of Tokyo
Tomonao KOBAYASHI, Science University of Tokyo
Hideaki NAKATA, University of Tokyo
Jim NICKUM, University of Tokyo
Tomohiro SHISHIME, Environment Agency of Japan
Tatsujiro SUZUKI, Central Research Institute of the Electric Power Industry (CRIEPI)

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Robert PARK, Department of Energy (DOE)
Yuka SHINDO, Center for Global Communications (GLOCOM)
Kirk SMITH, University of California-Berkeley
Allan SONG, US-Japan Foundation (USJF)
Lyuba ZARSKY, Nautilus Institute

4.1.4 ESENA 4: Transboundary Marine Pollution

The fourth ESENA workshop (11-12 July 1997 in Tokyo) brought together almost 30 scholars and policymakers from Japan, the Republic of Korea, and the United States. The first day of the workshop was devoted to 12 presentations on the four topics areas decided at the ESENA 3 workshop. These laid the groundwork for large and small group discussion and debate on the second day. By the end of the second day, workshop participants came to consensus on a series of potentially fruitful U.S.-Japan joint policy initiatives related to the Sea of Japan, as follows:

- *develop a mussel watch monitoring program and a squid watch monitoring program in the Sea of Japan (mussels and squid are sensitive indicator species of ecological change);*

- develop a Sea of Japan-wide simulation model which would incorporate water quality and ecological data, and which would involve institutional capacity-building in the Sea of Japan littoral states to support model construction activities;

- engage in a bay-to-bay comparative study in which three to seven bays in the Sea of Japan and the U.S. would be studied using the same methodologies (the study would include activities related to monitoring, modeling, coastal zone management practices, and oil spill response mechanisms); and

- establish a cooperative Sea of Japan oil spill response mechanism which would utilize and invigorate existing programs such as those within the Northwest Pacific Action Plan (NOWPAP) and the U.S.-Japan Common Agenda.

These four recommendations for U.S.-Japan policy initiatives were deemed by workshop participants to be the most likely to stimulate international cooperation in the Sea of Japan region and to have the greatest potential to mitigate oil-related marine pollution problems.

Workshop participants also identified the "Panel on Coastal Environment Science and Technology" within the U.S.-Japan Cooperative Program in Natural Resources (UJNR) as a crucial expert group that can help bring the recommendations to fruition.

Workshop Participants:

UNITED STATES

Alan BECKER, PCCI, Inc.
Charles ('Bud') EHLER, National Oceanic and Aeronautics Administration (NOAA)
Peter HAYES, Nautilus Institute
Alan KAUFMAN, US Navy
Hyon-Jin KIM, Harvard University
Terri PALUSZKIEWICZ, Pacific Northwest National Laboratory (PNNL)
Raul ('Pete') PEDROZO, US Navy
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Akio OKAYASU, Yokohama National University
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Tomohiro SHISHIME, Environment Agency of Japan
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Esook YOON, University of Maryland

4.1.5 ESENA 5: Innovative Financing of Advanced Clean Coal Technologies in China

At the fifth ESENA workshop (27-28 February 1999 in Berkeley, California), the 40 participants discussed innovative methods of financing advanced clean coal technologies (CCTs) in China. The workshop drew a highly prestigious, international, interdisciplinary, intersectoral group of experts on advanced CCTs, innovative financing strategies, and U.S.-Japan-China relations. A total of 40 participants attended the workshop from China, Japan, the United States, and multilateral organizations. Presentations and discussion at the workshop revolved around three basic themes: 1) trends in energy and coal use in China; 2) advanced CCT options; and 3) financing, especially through the GEF.

The centerpiece of the workshop was a paper by Hossein Razavi proposing a Global Environment Facility (GEF)-based technology risk guarantee mechanism to help fund China's first demonstration integrated gasification combined cycle (IGCC) power plant. During discussions on various aspects of Razavi's proposal, the workshop highlighted key obstacles and opportunities in relation to introducing advanced CCTs into China, including:

- deep technological and competitive divisions between the U.S. and Japan in the field of advanced CCTs
- GEF's keen interest in exploring non-grant modalities of financing technology transfer
- the technological, financial, and institutional complexities of introducing advanced CCTs into China.

Participants agreed that China, with the largest coal reserves in the world, will continue to be heavily reliant on "dirty" coal as a source of energy far into the future. Two major questions regarding coal's future in China relate to rate of increase of coal usage, and the types and rates of introduction of CCTs. Given the already enormous environmental and human health damage and large contribution to greenhouse gas emissions of coal combustion, many workshop participants expressed the urgency of speeding the introduction of CCTs into China.

Members of the Chinese delegation explained in detail China's energy and coal sectors. Qing Yang of the State Power Corporation described reform and development in China's power industry. Introduction of advanced CCTs is a major pillar of China's development strategy. Weiping Hao of the State Development Planning Commission outlined China's CCT options, and the current work to introduce advanced CCTs. Zhesheng Jiang of the State Power Corporation discussed the planned IGCC demonstration power plant in Yantai in Shandong province.

Qualitative discussions about China's energy and coal futures were given quantitative grounding through a description of modeling work done by David Von Hippel of the Nautilus Institute on clean-coal scenarios to 2020 for China. Initial modeling results indicate that large environmental benefits can be derived by the introduction of advanced CCTs, but that they come with a large price tag.

The workshop explored two "advanced CCT + financing" packages: (1) a GEF-based technology risk guarantee mechanism to finance an IGCC pilot power plant, and (2) GEF support to finance a supercritical steam cycle power plant outfitted with a new flue-gas desulfurization (FGD) method.

Workshop participants both applauded and criticized the GEF technology risk guarantee idea. Ted Atwood of the Department of Energy, for instance, asked: How do you calculate the incremental technology risk? How do you determine which risk caused a failure? How do you prevent the mechanism from being abused? He suggested that establishment of the proper market price incentives may be a better long-term approach. Despite the fact that much work remains to flesh out the actual design and implementation of a GEF technology risk guarantee mechanism, most participants agreed that it is an idea worth further investigation.

The Japanese delegation presented an alternative plan to fund a technology package consisting of a supercritical (SC) steam power generating unit and a new type of FGD. Masayoshi Sadakata of Tokyo University described a new FGD dry process that produces a useful byproduct (gypsum & fly ash) which can be used to improve alkaline soils. The delegation argued that this FGD process could be linked to SC power generation and that the whole package could be funded under GEF OP#5 or OP#7, or under the Clean Development Mechanism (CDM) of the UN Framework Convention on Climate Change.

The Japanese presentation touched off a "technology debate" between IGCC (where the U.S. has an edge) and SC (where Japan has an edge). An intense discussion ensued over which technology was better, until it was pointed out that the key question is not one of which technology is better, but when and how each technology is deployed. Both technologies are essential—SC is especially important in the short and medium term, and IGCC in the long term.

Chandra Shekhar Sinha of the World Bank outlined GEF financing options in China's coal sector. There are two operational programs (OPs) in GEF which relate to CCTs in China: OP#5 (removing barriers to energy conservation and energy efficiency) and OP#7 (reducing long-term costs of low greenhouse gas emitting technologies). IGCC technology is specifically identified as a target technology in OP#7. Thus, a technology risk guarantee mechanism related to an IGCC project falls under the purview of GEF's mandate. A SC+FGD technology package is more applicable to OP#5 than OP#7. In this case, a justification for GEF financing for such a package would be based on barrier removal related to, say, the higher perceived cost of the SC+FGD combination.

The workshop's deliberations coincide and reinforce the GEF's interest in developing public-private sector partnerships. Sinha emphasized that GEF is currently considering the use of partial risk or credit guarantees, contingent or concessional loans, reserve funds, and other "non-grant modalities" for providing direct assistance to private firms in developing countries. Traditionally, GEF grants have gone to governments.

The following series of recommendations for U.S.-Japan cooperation on Global Environment Facility (GEF)-based financing of advanced CCTs in China emerged from the workshop.

- *The key issue in introducing CCTs in China is not one technology versus another, or one financing mechanism versus another. China will need to develop and deploy a wide variety of technologies and utilize a wide variety of financing mechanisms. The U.S. and Japan should cooperate on promoting a variety of "technology + financing" packages relevant to CCTs in China.*

- The U.S. and Japan should cooperate in encouraging the GEF to continue considering innovative non-grant financing mechanisms for funding advanced CCTs in China (and in other developing countries with large indigenous coal reserves).

- The U.S. and Japan should cooperate in encouraging China to consider non-grant financing mechanisms for funding advanced CCT projects, in addition to direct grant mechanisms.

- The U.S. and Japan should cooperate in encouraging further development of the technology risk guarantee idea. The mechanism can be used to enhance development and deployment of a variety of advanced CCTs in developing countries around the world. A technology risk guarantee mechanism can be based in the GEF, Asian Development Bank (ADB), or some other appropriate institution.

- Given the immense potential environmental benefits of IGCC technology, and mindful of the long lead time in realizing these benefits, the U.S. and Japan should cooperate to encourage the development and deployment of IGCC technology in general, and within China in particular. Development of an indigenous Chinese manufacturing capability in IGCC components is also desirable. Development of IGCC both within and outside China will likely dramatically reduce the cost of IGCC power plants.

- The U.S. and Japan should cooperate in investigating the feasibility and viability of a technology risk guarantee mechanism through its application to a specific project that meets GEF support criteria. The usefulness of the mechanism can be tested, for instance, as one component of a total financing package for China's first IGCC demonstration power plant in Yantai, China.

- The U.S. and Japan cooperate in encouraging the consideration of financing of innovative (commercial) technology combinations such as SC+FGD under GEF OP#5 (removal of barriers).

Workshop Participants:

UNITED STATES

Ted ATWOOD, Department of Energy (DOE)
Peter EVANS, Massachusetts Institute of Technology (MIT)
Neville HOLT, Electric Power Research Institute (EPRI)
Charles JOHNSON, East-West Center
Mark LEVINE, Lawrence Berkeley Laboratory (LBL)
Jeffrey LOGAN, Pacific Northwest National Laboratory (PNNL)
Jack SIEGEL, Energy Resources International, Inc.
Kirk SMITH, University of California-Berkeley
David VON HIPPEL, Nautilus Institute
Ken WILKENING, Nautilus Institute
Changhua WU, World Resources Institute (WRI)
Ben YAMAGATA, Clean Coal Technology Coalition
Lyuba ZARSKY, Nautilus Institute

JAPAN

Nobuhiro HORII, Institute of Developing Economies, Japan External Trade Organization (JETRO)
Haruo ISHIKAWA, Central Research Institute of the Electric Power Industry (CRIEPI)
Aki MARUYAMA, Institute for Global Environmental Strategies
Masayoshi SADAKATA, Tokyo University
Takeo YAMADA, Idemitsu Kosan Co.
Yasuhide YAMANOUCHI, Center for Global Communications (GLOCOM)

CHINA

Shouyi CHEN, Ministry of Science and Technology
Weiping HAO, State Development Planning Commission
Zhesheng JIANG, State Power Corporation
Yanjia WANG, Energy and Environmental Technology Center
Yong WANG, State Power Corporation
Qing YANG, State Power Corporation

MULTILATERAL ORGANIZATIONS

Edu HASSING, Asian Development Bank (ADB)
Nandita MONGIA, United Nations Development Programme-Global Environment Facility (UNDP-GEF)
Hossein RAZAVI, World Bank
Chandra Shekhar SINHA, World Bank
E. Stratos TAVOULAREAS, World Bank

OBSERVERS

Alison CHAMBERLIN, Monterey Institute of International Studies

Virginia FUNG, Science and Technology Research, Inc.
Peter HAYES, Nautilus Institute
Shieh-Tsing HSIEH, Tulane University
Jiang LIN, Lawrence Berkeley Laboratory (LBL)
Stephanie OSHITA, Stanford
Jean PRUITT, Department of Energy D(OE)
Scott SMOUSE, Department of Energy (DOE)
Akira TSUNETO, University of California-Berkeley
Jim WILLIAMS, Nautilus Institute

4.1.6 ESENA 6: U.S.-Japan Cooperation on Environmental Security in Northeast Asia

The sixth and final ESENA workshop (2-3 October 1999 in Berkeley, California) brought together a dynamic group of synthetic thinkers who endeavored to weave the various strands of the ESENA project into a coherent package. Among the elements of this daunting task were to outline what a "regional comprehensive security" framework might look like, to review and add to the criteria for initiative selection, and to select and refine a short list of candidate initiatives.

The workshop began with a presentation on the concept of environmental security in Japan by Yuji Mizuno of the Nomura Research Institute. The concept is just emerging as a topic of discussion and policy debate in Japan. Next William Dilday of the U.S. Department of State outlined the state of environmental diplomacy in Northeast Asia. The U.S., he explained, is more focused on economic than environmental issues, and is cautious in its to multilateral diplomacy. The U.S. has chosen to concentrate on bilateral efforts. Kazuo Matsushita of the Institute for Global Environmental Strategies stated that peace-making through environmental cooperation in the Asia-Pacific region environmental issues can be used forge mutual trust in Northeast Asia. Miranda Schreurs gave a comprehensive overview of cooperation on energy and environmental issues in Northeast Asia, and compared this to cooperation in Europe, emphasizing that Europe has a wealth of institutions while Northeast Asia has few.

Nobuhiro Sawano of Seiryo Women's College presented a scheme for a web-based GIS systems for tracking the environmental health of the Sea of Japan. (This scheme was developed by Shintaro Goto of Rissho University, together with Sawano and others.) Mark Valencia of the East-West Center delineated "maritime environmental insecurities" in Northeast Asia and cooperative responses aimed at a larger regime building exercise in the region. Yasuko Kawashima of the Institute for Environmental Studies explained how regional cooperative efforts could assist in tackling the global climate change issue. David Von Hippel of the Nautilus Institute reviewed the modeling work he has done for the ESENA project during all three years, and summarized conclusions and options for cooperation. Finally, Ken Wilkening of the Nautilus Institute ended the first day with a brief look at the newly emerging trans-Pacific air pollution issue.

The second day began with the review of the work on innovative financing by Jusen Asuka of Tohoku University and Lyuba Zarsky of the Nautilus Institute. The rest of the second day was occupied with intense discussion over the screening criteria for U.S.-Japan initiatives and consensus on the top four initiatives. The final four related to trans-Pacific air pollution, a web-based marine atlas, a bay-to-bay project, and leveraging private investment.

Workshop Participants:

UNITED STATES

Rory COX, Pacific Environment and Resources Center (PERC)

William DILDAY, U.S. Department of State
Kirea DRAYTON, SAIC
Peter HAYES, Nautilus Institute
Jason HUNTER, Nautilus Institute
Daniel M. KAMMEN, University of California, Berkeley
Miranda SCHREURS, University of Maryland
Jonathan SINTON, Lawrence Berkeley Laboratory (LBL)
Mark VALENCIA, East-West Center
David VON HIPPEL, Von Hippel Planning & Analysis
Ken WILKENING, Nautilus Institute
Jim WILLIAMS, Nautilus Institute
Lyuba ZARSKY, Nautilus Institute

JAPAN

Jusen ASUKA, Tohoku University
Nobuhiro SAWANO, Seiryo Women's College
Yasuko KAWASHIMA, National Institute for Environmental Studies (NIES)
Kazuo MATSUSHITA, Institute for Global Environmental Strategies (IGES)
Yuji MIZUNO, Nomura Research Institute
Yasuhide YAMANOUCHI, Center for Global Communications (GLOCOM)

4.2 ESENA Papers

The following is a list of all the papers commissioned by the ESENA project. Included are papers presented at the various workshops, but not commissioned by the project. All papers can be found on the Nautilus Institute website.

Theme 1: Energy & Transboundary Air Pollution

Baseline Assessment of Acid Rain in Northeast Asia
Gregory Carmichael, University of Iowa***Innovative Approaches to Financing Environmentally Sustainable Energy Development in Northeast Asia***
Hossein Razavi, World Bank

China's View of Acid Rain in Northeast Asia and Regional Cooperation Strategies
Jonathan Sinton, Lawrence Berkeley Laboratory

Regional Cooperation Strategies to Mitigate Acid Rain in Northeast Asia
Jonathan Sinton, Lawrence Berkeley Laboratory

Energy and Acid Rain Projections for Northeast Asia
David Streets, Argonne National Laboratory

Global Dimensions of Energy Growth Projections in Northeast Asia
David Von Hippel, Von Hippel Planning & Analysis

Technological Alternatives to Reduce Emissions from Energy Production in Northeast Asia
David Von Hippel, Von Hippel Planning & Analysis

Theme 2: Energy & Transboundary Marine Pollution

Maritime Preventative Diplomacy and Japan's Sea-Lane Oil Tanker Traffic

Tetsuro Doshita, Security Affairs Office, Office of the Prime Minister of Japan***Prospects For Marine Governance In Northeast Asian Seas***
Peter Haas, University Of Massachusetts-Amherst

Tumen River Area Development Program and Transboundary Water Pollution
Jason Hunter, Nautilus Institute

A Theory of Integrated Coastal Zone Management in Japan
Masahiko Isobe, University of Tokyo

Marine Environmental Cooperation in Northeast Asia: The South Korean Perspective
Hyon-Jin Kim, Harvard University

Environmental Problems and Environmental Management of Japanese Coastal Waters: An Ecosystem Perspective
Hideaki Nakata, University of Tokyo

A Vessel Traffic System Analysis for the Korea/Tsushima Strait
Linda Paul, Ocean Law & Policy Institute

Promoting a Plan for a Marine Environment Monitoring Network in the North Pacific
Tomohiro Shishime, Environment Agency of Japan

Ocean Management Regimes in the Sea of Japan: Present and Future
Mark Valencia, East-West Center

Nautilus Framework Paper: U.S.-Japan Policy Initiatives on Energy-Related Marine Issues in the Sea of Japan
Ken Wilkening & Jason Hunter, Nautilus Institute

GLOCOM Framework Paper: Towards the Development of an Ocean Environment Network
Yasuhide Yamanouchi, GLOCOM

Communities, Markets and City Government: Innovative Roles For Coastal Cities to Reduce Marine Pollution in the Asia-Pacific
Lyuba Zarsky & Jason Hunter, Nautilus Institute

Theme 3: Innovative Financing Mechanisms

Proposal for a Global Environment Facility (GEF) Technology Risk
Hossein Razavi, World Bank***Integrated Gasification Combined Cycle (IGCC) in China***
Nautilus Institute

Financing Clean Coal in China
Nautilus Institute

Endnotes

1. Charles J. Johnson, "Assessing the Potential for Clean Coal Technologies in Asia," a paper

presented at the ESENA workshop "Innovative Financing of Clean Coal in China," 27-28 February 1999, Berkeley, California, p 2, fig 3.

2. From a talk by Qing Yang of the State Power Corporation of China, "The Reform and Development of China Power Industry," presented at the ESENA workshop "Innovative Financing of Clean Coal in China," 27-28 February 1999, Berkeley, California," 2-3 October 1999, Berkeley, California.

3. P.N. Fernando, "Asian Development Bank Initiatives Towards Efficiency Improvement of Coal-Fired Power Generation in the PRC," a paper presented by Edu Hassing of ADB at the ESENA workshop "Innovative Financing of Clean Coal in China," 27-28 February 1999, Berkeley, California, p 8.

4. From a talk by Weiping Hao of the State Development Planning Commission of China, "Clean Coal Technology Options in China," presented at the ESENA workshop "Innovative Financing of Clean Coal in China," 27-28 February 1999, Berkeley, California," 2-3 October 1999, Berkeley, California.

5. P.N. Fernando, "Asian Development Bank Initiatives Towards Efficiency Improvement of Coal-Fired Power Generation in the PRC," a paper presented by Edu Hassing of ADB at the ESENA workshop "Innovative Financing of Clean Coal in China," 27-28 February 1999, Berkeley, California, p 1.

6. From a talk by Nobuhiro Horii of the Institute of Developing Economies in Japan, "Coal Utilization in China," presented at the ESENA workshop "Innovative Financing of Clean Coal in China," 27-28 February 1999, Berkeley, California.

7. Unless otherwise stated, statistics pertaining to transboundary air pollution in Northeast Asia are taken from Gregory R. Carmichael and Richard Arndt, "Baseline Assessment of Acid Deposition in Northeast Asia;" David G. Streets, "Energy and Acid Rain Projections for Northeast Asia;" and David Von Hippel, "Technological Alternatives to Reduce Acid Gas and Related Emissions from Energy-Sector Activities in Northeast Asia."

8. Dan Jaffe et al., "Transport of Asian Air Pollution to North America," *Geophysical Research Letters*, 26(6): 711-714 (1999).

9. Terje K. Berntsen, Sigrún Karlsdóttir and Daniel A. Jaffe, "Influence of Asian emissions on the composition of air reaching the North Western United States,"*Geophysical Research Letters*, 26(14), pp 2171-2174 (1999); and Daniel J. Jacob, Jennifer A. Logan and P.P. Murti, "Effect of rising Asian emissions on surface ozone in the United States," *Geophysical Research Letters*, 26(14): 2175-78 (1999).

10. R.G. Anthony, A.K. Miles, J.A. Estes, and F.B. Isaacs, "Productivity, Diets, and Environmental Contaminants in Nesting Bald Eagles from the Aleutian Archipelago,"*Environmental Toxicology and Chemistry*, 18(9): 2054-2062 (1999).

11. Larry Pynn, "Airborne Asian chemicals polluting B.C. waters: Report," *The Vancouver Sun*, 27 November 1998: 1.

12. See Peter M. Haas, "Prospects for Effective Marine Governance in the Northwest Pacific Region;" Hyon-Jin Kim, "Marine Environmental Cooperation in Northeast Asia;"Ken Wilkening and Jason Hunter, "Nautilus Framework Paper: U.S.-Japan Policy Initiatives on Energy-Related Marine Issues in the Sea of Japan;" and Yasuhide Yamanouchi, "GLOCOM Framework Paper: Towards International Cooperation on the Northeast Asian Ocean Environment."

13. Mark J. Valencia, "Ocean Management Regimes in the Sea of Japan: Present and Future."

14. Information on the potential for a catastrophic oil spill in the area around Sakhalin is taken from a paper by Rick Steiner of the University of Alaska, "Oil Spills: Lessons from Alaska for Sakhalin," that was delivered at the "Russian Regions: Economic Growth and Environment Symposium" in Sapporo, Japan in July 1999.

15. The description of this study is based on a talk by Yuji Mizuno of the Nomura Research Institute, "The Concept of Environmental Security in Japan: Results of Basic Study on Environmental Security," presented at the ESENA workshop "U.S.-Japan Cooperation on Energy, Environment & Security in Northeast Asia," 2-3 October 1999, Berkeley, California.

16. Lester Brown, "Redefining Security," Worldwatch Paper No. 14, (1977).

17. Richard H. Ullman, "Redefining Security," *International Security*, 8: 129-153, (1983).

18. Jessica Tuchman Mathews, "Redefining Security," *Foreign Affairs*, 68: 162-177, (1989).

19. Both quotes from Mathews 1989:162, *op cit.*

20. Thomas Homer-Dixon, "On the Threshold: Environmental Changes as Causes of Acute Conflict," *International Security*, 16: 76-116, (1991).

21. Robert Kaplan, "The Coming Anarchy: How Scarcity, Crime, Overpopulation, Tribalism, and Disease are Rapidly Destroying the Social Fabric of Our Planet," *The Atlantic Monthly* (February): 44-75 (1994).

22. During the summer of 1996 key officials in the CIA, Department of Defense, Environmental Protection Agency, and Department of Energy signaled their commitment to Christopher's objectives. Also, in August 1996 the Deputy Undersecretary of Defense for Environmental Security described the development of early warning systems and promotion of "military environmental cooperation" as key aspects of former Secretary of Defense William Perry's concept of "preventive defense."

23. Nautilus Institute, "IGCC in China;" Nautilus Institute, "Financing Clean Coal in China;" and Hossein Razavi, "Proposal for a Global Environment Facility (GEF) Technology Risk Guarantee Mechanism."

24. See Tomohiro Shishime, "Promoting a Plan for a Marine Environment Monitoring Network in the North Pacific."

25. See Masahiko Isobe, "Toward Integrated Coastal Zone Management in Japan;" andHideaki Nakata, "Environmental Management of Japanese Coastal Waters: An Ecosystem Perspective."

26. See Linda Paul, "A Vessel Traffic System Analysis for the Korea/Tsushima Strait."

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