Island Bellwether:
Climate Change and Energy Policy Strategy for Small Island Developing States

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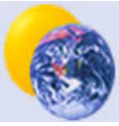

Center for Energy and Environmental Policy

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1. BACKGROUND

There could have been no more tragic demonstration of the vulnerability of small islands and coastal areas in developing nations than the Southeast Asian tsunami of 26 December 2004. The event overshadowed the international meeting in January 2005 in Mauritius to review the decade-old *Barbados Plan of Action for the Sustainable Development of Small Island Developing States* (BPOA+10). The vulnerability of small island developing states (SIDS) was recognized in the original Barbados Plan of Action (BPOA) as providing a major rationale for promoting sustainable development, including addressing the threats of future climate change impacts and the role of energy in sustainable development (United Nations, 1994).

Much has transpired since the BPOA in the fields of climate change and energy, providing the BPOA+10 meeting with an opportunity to consider these developments and to formulate responses to further promote sustainable development to reduce the vulnerability of SIDS to both natural disasters and the consequences of unsustainable development. In the draft *Mauritius Strategy* (United Nations, 2005) produced by the BPOA+10 meeting, the international community affirmed its commitment to addressing climate change through the UN Framework Convention on Climate Change, and specifically called for greater promotion of renewable energy, more support for SIDS to develop renewable energy sources, development and transfer of technologies to SIDS to assist in addressing climate change, sought SIDS sustainable development planning to incorporate adaptation to climate change, sought greater scientific monitoring of climate and promoted greater SIDS coordination on climate change (in Section I of the Strategy). Section VII of the *Mauritius Strategy* addresses energy resources, indicative of the meeting's greater awareness of the potential for renewable energy sources and calling for SIDS energy strategies based on renewable energy sources and it urges greater progress in implementation (in Section VII of the Strategy).

There are strong links between the world's energy system and the problem of climate change (IPCC, 2001a; UNDP, 2002),[1] and these produce a distinct set of issues that impinge on the sustainable development of SIDS, many of which were earlier identified by the BPOA (United Nations, 1994). On-going research and experiential learning has further strengthened and extended these earlier findings, as noted by the Intergovernmental Panel on Climate Change (IPCC, 2001a and b), the World Energy Assessment (UNDP, 2002) and other studies (e.g., Farinelli, 1999; Ghina, 2003; Headly, 1997; Jensen, 2000; OECD/IEA, 2002; Weisser, 2004 and Yu et al 1997). A summary of these factors includes:

- Industrial nations and industrial activities are the primary sources of greenhouse gas (GHG) emissions, whose increasing atmospheric concentration is directly responsible for current and forecast global warming
- Fossil fuel energy systems are the primary cause of GHG emissions, predominantly the combustion of coal, oil and natural gas
- Rising temperatures and other climatic changes will produce profound ecological and environmental changes that will impact SIDS in a wide variety of ways
- Sea level rise is associated with global warming and will continue for the next several hundred years at least
- SIDS are vulnerable to highly vulnerable to climate change impacts and to rising sea levels
- Energy service needs are an important aspect of sustainable development, influencing education, health, communication, drinking water, productive enterprise development and other opportunities
- Most SIDS have poor access to modern energy services
- Many SIDS rely on imported fossil fuels
- Renewable energy technologies have continued to develop, have become cheaper, and more effective policies for support and implementation have been devised, and
- Many SIDS have renewable energy resources, but these are largely undeveloped.

National governments, international agencies, non-governmental organizations, research centers and other groups have contributed to a growing body of policy and research that addresses the issues of climate change and energy, and on which the continuing development of the BPOA process can draw. Our understanding of the role of energy in promoting social, economic and environmental objectives in developing countries has also continued to advance through specific programs, research findings and experience. Significant international developments since the

[1] Human activities are causing the release of 'greenhouse gases' (GHGs) into the atmosphere, primarily through the combustion of fossil fuels (coal, oil and gas) and, to a lesser extent through vegetation clearance, agriculture, land use change and industrial activities. Global climate is being altered by the increasing concentrations of these anthropocentric GHG emissions (particularly carbon dioxide, methane, nitrous oxide and selected hydrofluorocarbons). Future global warming will continue for at least several hundred years but cutting global GHG emissions is essential for reducing the extent of future climate change impacts. Reducing these emissions requires substantial changes to the conventional industrial energy systems through measures that reduce fossil fuel use by conserving energy, increasing energy efficiency, and greatly increasing the use of renewable energy sources.

1994 BPOA meeting, and prominent on-going activities (see, e.g., Cicin-Sain et al 2004a; CROP, 2002; Deda, 1999; Forum for Energy and Development, 1999; IEA, 2002; Jensen, 2000 and United Nations, 2002), include:

- *World Summit on Sustainable Development* in 2002 and the subsequent *Johannesburg Plan of Action*
- Intergovernmental Panel on Climate Change's release of its third assessment report series in 2001
- Ratification of the *UN Framework Convention on Climate Change*'s (UN FCCC) *Kyoto Protocol* (in February 2005) that sets binding targets for GHG emission reductions from developed nations
- *UN Commission on Sustainable Development* will focus on energy/ climate change/ atmosphere/ air pollution in its 14th and 15th sessions in 2006 and 2007
- Release of the UN *Millennium Development Goals* that relate to energy
- *World Solar Commission*'s *World Solar Programme* 1996-2005
- *Global Environment Facility*'s climate change activities as a funding source for renewable energy, energy conservation and climate change projects
- *International Energy Agency*'s *Solar Heating and Cooling Programme*
- *OECD Development and Climate Change Project*
- *Pacific Islands Energy Policy and Plan* and *Rarotonga Declaration* in 2002
- *South Pacific Regional Environment Program*'s climate change and sustainable development projects, and
- *Caribbean Renewable Energy Development Program.*

The BPOA specifically addresses energy and climate change issues in two sections, in Section I: Climate Change and Sea Level Rise and in Section VII: Energy Resources (United Nations, 1994). These sections focus on the links between energy and climate change policy, and we examine both issues in terms of these links.[2] Below we inventory these developments and discuss policy strategies that can build upon the BPOA.

Some of the developments since the BPOA are of particular importance. For the energy sector, there are grounds for considerable optimism regarding the use of renewable energy options. Although the BPOA found only a modest role for renewables in the short and medium term, there are many reasons to suggest that the leading renewable energy technologies are sufficiently mature and economical to warrant serious attention.[3] Further, the BPOA gave little attention to the role of energy efficiency and energy conservation in creating sustainable energy systems, but there is now considerably more experience on which policymakers can draw, and a stronger case can be made for incorporating these elements into national and regional energy planning. Thus, major changes in SIDS energy policy since BPOA appear to be warranted with many of the

[2] See Cicin-Sain et al (2004b), a companion paper to this article, for a treatment of climate change as related to coastal and marine impacts.

[3] As used here, renewable energy includes wind, solar thermal, solar electric (commonly relying on photovoltaic (PV) or solar cell technology), bioenergy (mostly energy crops and crop residues), microhydroelectricty and, in limited instances, geothermal energy.

energy service needs of SIDS to be met through greater energy efficiency, energy conservation, and the development of renewable energy systems.

Key aspects of current SIDS energy systems are vulnerable. SIDS face a number of pressing energy problems, urgently prompting the case for accelerated reform of the energy sector and for increased attention by policy makers to this crucial component of social and economic development. Inefficient and expensive conventional energy systems increase the economic vulnerability of SIDS and impose high social and environmental costs for their communities. SIDS have responded to these challenges and many valuable lessons have been learned since the BPOA through programs of energy conservation, energy efficiency improvements and selective applications of mature renewable energy technologies.

Increasing atmospheric concentrations of GHGs, which have been largely the result of the combustion of fossil fuels, have produced changes in the global climate system that are capable of having deleterious effects on SIDS. Islands have a vital interest in the global community curtailing the use of fossil fuels in order to best protect island societies and ecosystems. The threat of inundation from rising sea levels and the risks of climate change impacts on temperatures, winds, waves, and water temperatures put islands at greater risk than their continental counterparts. Of course, SIDS also have a local responsibility to assess their vulnerability, reduce their levels of risk and undertake programs of adaptation to climate change impacts. In particular, these concerns are being pursued through international climate change programmes, which have developed since the BPOA, both in terms of research activities and international planning, together with regional and national initiatives by SIDS. With the Kyoto Protocol having come in to force in early 2005, a number of conceptual issues and policy questions regarding SIDS and climate change can be identified that deserve attention of island policymakers, businesses and communities.

1.1 Island Uniqueness, Vulnerability and Sustainable Development

SIDS face unique challenges on the pathway to sustainable development, over and above those of other developing nations. Of particular concern is each island's vulnerability to outside influences and natural disasters and its limited options and response mechanisms compared to continental states. Bloomestein et al (1996) have reviewed the issue of island developmental uniqueness and concluded that SIDS development problems tend to be more intractable in small, and particularly very small, island countries (these are summarized in Table 1; see also Byrne and Inniss, 2002).

Table 1. Socio-economic Characteristics of Small Island Developing States Impinging on Sustainable Development

- Diseconomies of scale due to small population, Gross Domestic Product and natural resource base
- Comparatively high costs of transportation and communications
- Open and dependent economies characterized by a high ratio of external transactions to GDP and concentration on a few export commodities and services, which create vulnerability to world economic conditions
- Weak technological, human resource and financial capacity due to their small populations
- Limited public and private savings, leading to dependence on external and concessional aid and an accompanying vulnerability to the international aid system
- Frequently high levels of monopolistic and oligarchic conditions in production and trade
- High costs of non-tradable goods and services
- Skewed population distribution towards the higher and lower age ranges due to high rates of migration, and
- Higher costs of secondary and tertiary education leading to low rates of enrollment and loss of trained population to emigration.

Source: After Bloomestein et al, 1996.

Barnett and Adger (2003), Pelling and Uitto (2001) and others identify a range of factors that make SIDS intrinsically vulnerable to natural disaster and global change: small size, insularity and remoteness, that many have seasonally-based economies especially vulnerable to international economic circumstances, disaster mitigation capabilities are often modest and special environmental factors (including greater exposure to high-intensity storms and high waves). Most SIDS are small with dispersed land areas (several are archipelagic states) and it follows that their natural resource base will be relatively limited and the likelihood of resource abundance, less than for larger territories. Land uses tend to be used more intensively and infrastructure, development and other physical assets are usually concentrated especially along narrow coastal zones. Resource use, land and marine management activities and other productive relationships with the natural environment are close and immediate in SIDS societies.

Often SIDS lack conventional energy resources and are highly dependent on imports of fossil fuels for their energy needs. As a result they are vulnerable to the vagaries in oil, coal and natural gas prices with resultant energy costs being high for electricity generation, transportation and domestic consumption. Subsidies are usually implemented to alleviate the impact of high energy costs, particularly on low income consumers and rural communities, but these tend to have limited success as energy planning traditionally focuses on the provision of technology and not on energy services. Cheaper, but inefficient and environmentally harmful, energy sources predominate. There have been efforts to address these problems including the increased exploitation of indigenous energy sources (e.g., solar, hydro and wind) (e.g., Forum for Energy

and Development, 1999; Island Solar Summit, 1999 and Jensen, 2000;) but these also encounter significant barriers, which curtail their progress (see, e.g., Yu et al, 1996). Decision makers have recognized that these barriers are mainly related to policy, finance, institutional and public awareness factors and have sought to address them.

As with natural resources, SIDS typical small populations have a smaller human resource base in comparison with larger states, limiting the capacity to undertake a range of activities. Also, as with the infrastructure on SIDS, population tends to be concentrated, usually along the coastal zone, often with a single, dominant urban center. In addition, the purchasing power of SIDS populations tends to be limited as the majority are categorized as lesser developed countries (with some notable higher income exceptions). Consequently, providing services and infrastructure on SIDS can be expensive, as SIDS are unable to take advantage of the economies of scale available to larger states.

These social factors are tied to many economic aspects of SIDS vulnerability, which simultaneously reflect both the internal dynamics of their economies and the influence of the global economy and the forces of globalization. Small economies have modest internal markets, few opportunities for economic diversification and tend to be based on a few key economic activities; in the case of SIDS, their economies are highly dependent on local natural resources and a few specialized industries. SIDS are also generally dependent on foreign sources of finance. Most SIDS have some familiarity with global markets reaching back to the colonial era of international trade, and in this sense are experienced with the influences of external markets. In terms of trade, SIDS are highly dependent on imports, face uncertainties in transport and have little influence over the prices of imports. For SIDS closely tied to the global market, there are a number of economic and other vulnerabilities. While some SIDS may prosper from the global economy, it is a relationship dependent on the preferences of the global market and the continued viability of select local economic activities, such as agricultural production, fisheries and tourism. As the BPOA expounds, sustainable development offers a means to address the particular problems of SIDS vulnerability through strategies, policies, plans and projects that address climate change and energy issues.

1.2 The Pursuit of Sustainability – a Problem for SIDS

Achieving sustainability by any nation state, developed or developing, is a daunting task (Byrne and Glover, 2002). The problem is exacerbated for SIDS because of their unique socio-economic, geographical and ecological settings (Byrne and Inniss, 2002). Insular natural resources such as water, vegetation, soil, air, near-shore systems and wildlife, ultimately dictate the capacity of islands to accept and sustain development. Marine pollution, degradation of local fisheries, salinization or other contamination of water resources and loss of agricultural productivity can be socially, environmentally and economically devastating to SIDS. Primary production and downstream processing industries are not the only sectors vulnerable to such effects, as other industries, including tourism, can be highly dependent on the condition of natural resources and ecological systems. When these conditions are affected by extreme climatic events and natural disasters, devastating impacts can result, as was experienced by many

Caribbean islands during the 2004 hurricane season and across the Indian Ocean in the wake of the 2004 Southeast Asian tsunami.

SIDS susceptibility to natural disasters is generally higher than their continental counterparts. As states, SIDS are typically smaller in size and economic capacity, so that the costs of natural disasters are greater per unit area and per capita than for continental states (Briguglio, 1995).[4] Severe natural disasters can impede social and economic development for many years, and cause great cultural and social losses. Economic impacts include devastation of agricultural sectors, setbacks in tourism industries due to extensive damage to beaches and coastal ecosystems and disruption of communications services which impact all sectors, but especially the tourism and international and off-shore business sectors — staples of many island economies.

Although the full toll of the Southeast Asian tsunami has yet to be reckoned, it is clear that it is one of the great natural disasters of the modern era and was unusually widely dispersed. Some 13 nations were afflicted, with 170,000 lives lost, 130,000 persons missing and over one million directly displaced (USAID, 2005); several million more are without immediate access to food and water. A nation-by-nation assessment of the economic costs stated: Indonesia $4b for reconstruction at Aceh; Sri Lanka $1.5b for reconstruction; about 1 million jobs have been lost in Indonesia and Sri Lanka; Southeast India $1.2b; India's Andaman and Nicobar Islands $600m (with 70% of their jetties destroyed, the fishing industry that provides two-thirds of local employment will be strongly affected); Maldives $304m for reconstruction; Malaysia $25m and Seychelles $30m damages (BBC, 2005).[5]

Even more routine natural disasters have taken a great toll on SIDS. Estimates of the impact of 2004's Hurricane Ivan on the island of Grenada in the Caribbean are $900m in damages, more than *twice* the current value of its GDP (OECS, 2004). Housing represented the bulk of the cost, as 89% of the country's dwellings were damaged, with about 30% beyond repair. For the main economic sectors of the island (agriculture and tourism), total direct and indirect damages were at $130m and $54m, respectively, while infrastructural damages (electricity, telecommunications and water) accounted for $82m and $31m in total and indirect damages, respectively. These are losses that will take many years for a small economy to recoup (a summary of these costs is shown in Table 2).

The prospect of climate change with a possible increase in the frequency and intensity of storms (IPCC, 1996), combined with continuing sea level rise, means that island vulnerability is likely

[4] In developing an index of economic vulnerability, Briguglio (1995) used disaster proneness as a key variable. Using data from the UN Disaster Relief Office for the period 1970-1989, an index of disaster damage as a percentage of Gross National Product (GNP) was developed for sixty-five countries. Disasters included droughts, floods, earthquakes, hurricanes, cyclones, storms, typhoons, fire, volcanic eruptions, famine, landslides, accident, power shortages, epidemics and civil strife. The study revealed the proportion of the costs of disasters as a proportion of GNP was 52% for island developing countries and 67% for SIDS. Findings for other groups of countries were: all countries with disaster incidence (28%); non-island developing countries (21%); developing countries (30%) and developed countries (5%).

[5] Monetary values in US dollars throughout; 'billion' refers to 1000 million.

to grow. The implications of the new climate regime are that the ecology and economies of SIDS will become more vulnerable and achieving sustainability will become more difficult.

Table 2. The Cost of Hurricane Ivan to Grenada in 2004: Summary of Direct and Indirect Damages (Millions of US Dollars)

Sector	Direct damage ($)	Indirect damage ($)	Total ($)
Agriculture	20	17	37
Manufacturing	7	2	8
Wholesale and retail trade	...	4	4
Tourism	113	37	150
Electricity	26	8	34
Water/sewage	3	Less than 1	3
Telecommunications and broadcasting	28	23	51
Cable	3	2	5
Education	72	Less than 1	73
Transport	4	Less than 1	4
Housing	508	3	511
Health	4	0	4
Total	787	97	884

Source: After OECS, 2004.

1.3 SIDS Vulnerability to Climate Change

The Intergovernmental Panel on Climate Change (IPCC) has concluded that global average surface temperature has increased by about $0.6 \pm 0.2^{o}C$ since the late 19^{th} century and that global average sea level rose between 10 and 20 cm during the 20^{th} century (IPCC, 2001a). Additional changes have occurred in precipitation but are dependent on geographical zone (e.g., increases in high latitudes of the Northern Hemisphere in contrast to decreases in sub-tropical Northern Hemispheric areas). Projections suggest that these trends will continue, with severity dependent on the measures implemented to mitigate changes taking place within the global atmosphere. Global mean sea level is projected to rise between 9 and 88 cm between 1990 and 2100, with a corresponding rise in global average surface temperature of 1.4 to $5.8^{o}C$ (IPCC 2001a).

SIDS are highly vulnerable to climate change impacts. IPCC (2001b) reports that, in addition to sea level rise, small island states are likely to be affected by changes to rainfall regimes, soil moisture budgets, prevailing winds and wave patterns. These climatic changes will influence a range of social and environmental factors impinging on important aspects small island development and sustainability, including beach and coastal changes, biological systems (including coral reefs, mangroves and sea grasses), biodiversity, water resources, agriculture, and fisheries, human health, settlement and infrastructure and tourism (IPCC, 2001b)). Higher sea levels will make storm surges and high waves greatly more destructive, given the extent to which SIDS infrastructure, settlements and economic activities are concentrated in coastal zones. Losses to marine resources due to climate change impacts on marine characteristics, coral reefs, mangroves and coastal wetlands could produce great impacts on economic capacities, human nutrition and indigenous cultures. Saline intrusion into freshwater supplies due to elevated sea level and other impacts will reduce agricultural productivity, threaten nutritional security, degrade drinking water quality and threaten water supply. A wide array of ecological and biodiversity values will also be eroded by climate change impacts. Importantly, and perhaps underappreciated to date, is that these climate change impacts will strain and invariably harm indigenous cultures, practices and traditional ways of life on SIDS.

Modeling of the effects of climate change on coastal areas can provide an indication of the magnitude of these future impacts. Using the IPCC IS92 scenarios for projected sea level rise, resulting from stabilization of CO_2 concentrations at 450 parts per million (ppm), projections indicate severe and damaging effects (see Figure 1). For a 20 cm rise, 18 million additional people worldwide will experience yearly storm surges and at an 80 cm rise in sea level, 65% of the Marshall Islands and Kiribati will be inundated. It is estimated that a 100 cm rise in sea level could inundate 70% of the landmass of the Seychelles (UN/DPI, 1999). The implications for coastal land loss under these scenarios are severe and more so for island states, where the majority of their populations are concentrated along coastal zones and their tourism industries are typically coastally based; likewise most of the tourism infrastructure is concentrated in the coastal zone. For example, the majority of Caribbean tourism facilities are concentrated within 800 meters of the high water mark of each island (Bloomestein et al, 1996). In Jamaica, 60% of tourist accommodation units are less than 15 meters from the high water mark. The vulnerability of these tourism units within the islands was clearly demonstrated with the passage of the Hurricane Ivan across Grenada. Direct damage estimates for buildings and infrastructure from the accommodations sector of Grenada's tourism industry is about $62m (OECS, 2004).

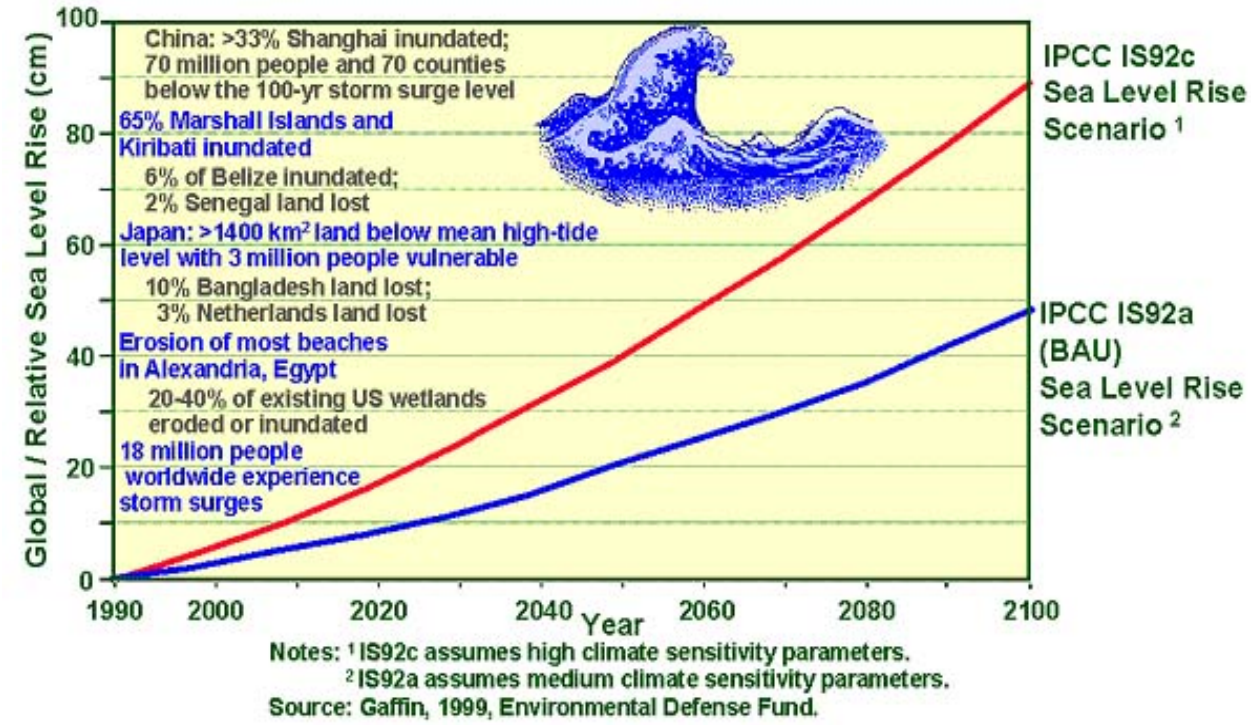

Figure 1. Impacts of Climate Change-Induced Sea Level Rise on Selected Coasts and Islands Worldwide

At least some of these harmful effects due to sea level rise and climatic change are already underway. The South Pacific Regional Environmental Programme (now known as the Pacific Regional Environment Programme), for example, reports that rising sea levels and coastal erosion have already swamped several small islets in Kiribati and Tuvalu, destroyed coastal roads and bridges, and caused traditional burial places to collapse into the ocean.

2. BPOA: CLIMATE CHANGE AND ENERGY

Under the BPOA (United Nations, 1994), Climate Change and Sea Level Rise is the first in a list of 15 priority issues considered to affect the sustainability of small island states. Energy Resources, also one of the 15 priority issues is set out as a separate concern. The BPOA recognizes the varying endowments of renewable energy resources in small island states and the need to develop them. It also identifies the connection between climate change and energy in the sustainable development of SIDS.

In addressing the issue of climate change, the BPOA focuses mainly on potential physical impacts and associated socio-economic effects of climate change on island societies, and the actions that need to be taken at national, regional and international levels to adapt to, and/or mitigate these impacts. Articulated in the action plan is the need for early action in such areas as research on sea level rise, development of adaptation and mitigation policies, assessment of

socio-economic impacts, promotion of public education and political understanding of the issue, and the need for assistance from the international community, among others (These are shown in Table 3).

The 1994 Action Plan clearly connects climate change and energy, stating that: "The development and use of renewable sources of energy and the dissemination of sound and efficient energy technologies are seen as having a central role in mitigating the adverse impacts of climate change." In this regard, it calls for national action in assessing the effects and the socio-economic impacts of climate change, climate variability and sea level rise on SIDS, and at the same time calls on the international community to provide access to energy efficient and environmentally sound technologies that would assist small islands states in conserving energy.

With specific reference to energy resources, the BPOA recognizes the heavy dependence of small island states on petroleum products and, to a lesser extent, on biomass largely for transport and electricity generation. It also notes that on average more than 12% of these resources are imported. In contrast, all small island states have substantial solar resources due to the characteristics of their geographical location. These, however, are still to be developed to their full potential. The availability and potential of other renewable energy sources such as wind, hydroelectric power and biomass are highly variable among island states, while research into geothermal, ocean thermal and wave energy are still continuing.

While it is generally recognized that a renewable energy system offers greater prospects of sustainability than continuation of the existing fossil fuel system, island countries are confronted with a number of constraints in making the switch to a renewable energy economy. These include limited access to technology, high investment costs and inadequate indigenous skills and management capabilities. Consequently, the BPOA spells out a set of actions needed at the national, regional and international levels to set SIDS on a course to a sustainable energy system (Table 4). Over the last decade, attempts have been made by SIDS to implement programs that focus on these priority areas and an assessment of these programs is provided in the following section.

Table 3. Elements of the BPOA Related to Climate Change and Sea Level Rise Program

A. Climate Change and Sea Level Rise	National	Regional	International
Policy Creation and Implementation	• Ensure early ratification of or accession to the UN FCCC, the Montreal Protocol on Substances that Deplete the Ozone Layer & other related legal instruments • Improve public & political understanding of the potential impacts of climate change • Formulate comprehensive strategies and measures (including the preparation, facilitation & collection of information) on adaptation to climate change that would contribute to a better understanding of the range of issues associated with the development of methodologies to facilitate adequate adaptation to climate change		• Implement immediately the prompt-start resolution agreed to by the Intergovernmental Negotiating Committee for the UN FCCC • Support SIDS in responding to the call by the IPCC for vulnerable coastal nations to develop integrated coastal zone management plans, including measures for responding adaptively to the impacts of climate change and sea level rise
Research and Analyses	• Formulate comprehensive adjustment & mitigation policies for sea level rise in the context of integrated coastal area management • Assess the effects and the socio-economic implications of the impact of climate change, climate variability & sea level rise on SIDS • Increase participation in the bilateral, regional & global research, assessment, monitoring & mapping of climate impacts, including the adoption of oceanographic and atmospheric measures and policies and	• Create &/or strengthen programmes & projects to monitor & improve predictive capacity for climate change, climate variability & sea level rise, & to assess the impacts of climate change on marine resources, freshwater & agricultural production, including pests	

	the development of response strategies • Map areas vulnerable to sea level rise & develop computer-based information systems covering the results of surveys, assessments & observations as part of the development of adequate response strategies, adaptation policies & measures to minimize the impact of climate change, climate variability & sea level rise		
Monitoring Plans	• Monitor, survey & collect data on climate change and sea level rise		

Climate Change and Sea Level Rise	National	Regional	International
Capacity Building		• Develop and/or strengthen mechanisms to facilitate the exchange of information and experiences among SIDS, & to promote technology transfer & training in those States in response to climate change, including preparedness response • Provide technical assistance for ratification or accession to the UN FCCC & assist those Parties that have ratified the FCCC in assuming their major responsibilities under it	• Provide improved access to financial & technical resources for monitoring variability & change of climate & sea level rise, for assessing the impacts of climate change, & for developing & implementing response adaptation strategies in a timely manner, recognizing the specific vulnerabilities & disproportionate cost borne by SIDS • Provide improved access to information from the activities carried out to reduce uncertainties of climate change & assist the inter-island exchange of this information • Provide access to environmentally sound & energy-efficient technology to assist SIDS in conserving energy. • Provide improved access to financial & technical resources to assist SIDS in meeting the costs associated with the development of national & regional strategies, measures &

			methodologies to facilitate adequate adaptation to climate change
Public Awareness and Assistance	• Promote a more efficient use of energy resources in development planning & use appropriate methods to minimize the adverse effects of climate change on the sustainable development of those resources	• Support national efforts aimed at developing strategies & measures on adaptation to climate change, as well as the development of technical guidelines & methodologies to facilitate adequate adaptation to climate change	• Support activities of intergovernmental, regional & sub-regional organizations assisting SIDS in coping effectively & creatively with climate change, climate variability & sea level rise, including providing systems for systematic & continuous research, monitoring, surveying & data collection, as well as assessment, in the areas of climate change, climate variability & sea level rise, coral reefs, the role of oceans in the world climate, tidal variations & salt water intrusion into freshwater resources

Table 4. Elements of the BPOA Related to the Energy Resources Program

B. Energy Resources	National	Regional	International
Policy Creation and Implementation	• Promote the efficient use of energy & the development of environmentally sound sources of energy & energy-efficient technologies, paying special attention to the possibilities of using, where appropriate, economic instruments &	• Assist, where appropriate, in the formulation of energy policies, standards & guidelines for the energy sector that are applicable to SIDS, & enhance national capacity to	• Formulate & ratify international agreements on energy-sector issues in relation to sustainable development in such areas as carbon emissions & the

	incentive structures & the increasing economic possibilities of renewable sources of energy	effectively plan, manage & monitor their energy	transportation of petroleum (for example, the use of double-hulled tankers)
Research and Analyses	• Strengthen research capabilities & develop technologies to encourage the efficient utilization of non-renewable sources of energy		• Support the research, development and utilization of renewable sources of energy & related technologies & improve the efficiency of existing technologies & end-use equipment based on conventional energy sources • Develop effective & efficient ways of utilizing, disposing of, recycling & reducing the by-products & waste of energy production
C. Monitoring Plans			
Capacity Building	• Establish &/or strengthen, where appropriate, research capabilities in the development & promotion of new & renewable sources of energy, including wind, solar, geothermal, hydroelectric, wave & biomass energy, & ocean thermal energy conversion	• Establish or strengthen research & policy capabilities in the development of new & renewable sources of energy, including wind, solar, geothermal, hydroelectric, wave & biomass energy	• Develop effective mechanisms for the transfer of energy technology & establish databases to disseminate information on experience in the use of new and renewable sources of energy, as well as on the efficient use of non-renewable energy sources
Public Awareness and Assistance	• Implement appropriate public education & awareness programmes, including	• Gather & disseminate information, and promote	• Encourage international institutions & agencies,

	consumer incentives to promote energy conservation	regional cooperation & technical exchanges among SIDS on energy-sector issues, including new & renewable sources of energy	including public international financial institutions, to incorporate environmental efficiency & conservation principles into energy-sector-related projects, training & technical assistance, &, where appropriate, to provide concessionary financing facilities for energy-sector reforms

3. BPOA IMPLEMENTATION STATUS: CLIMATE CHANGE and ENERGY RESOURCES

3.1. Climate Change and Sea Level Rise

A variety of activity at the regional, national, and international scales has occurred since the BPOA and areas of significant progress in response to its recommendations for national action on climate change and energy resources, but at the broader scale the responses have been highly uneven.

Noteworthy have been developments in the Caribbean arising out of the BPOA, such as the Caribbean Planning for Adaptation to Climate Change (CPACC) project. Funded by the Global Environment Facility (GEF), with additional support from the Canadian, French, and Dutch governments, this regional plan included installation of sea level and coral reef monitoring stations (18 stations in 12 countries), coastal vulnerability and risk assessment, and inventory and economic valuation of coastal resources.6 Implementation occurred through the Caribbean Community and Common Market countries (CARICOM) who supported the participating countries in preparing to cope with the adverse effects of global climate change.[7]

Table 5. Caribbean Planning for Adaptation to Climate Change Project Components

Components	Scope of work
1. Design and Establishment of Sea Level/ Climate Monitoring Network	• Regional – 12 countries
2. Establishment of Databases and Information Systems	• Regional – 12 countries
3. Inventory of Coastal Resources and Uses	• Regional – 12 countries
4. Formulation of a Policy Framework for Integrated Coastal and Marine Management	• Regional – 12 countries
5. Coral Reef Monitoring for Climate Change	• Jamaica, Belize and Bahamas
6. Coastal Vulnerability and Risk Assessment	• Barbados, Grenada and Guyana
7. Economic Valuation of Coastal and Marine Resources	• Commonwealth of Dominica, Trinidad and Tobago and St. Lucia
8. Formulation of Economic/ Regulatory Proposals	• Antigua and Barbuda, and St. Kitts and Nevis
9. Enabling the preparation of national Communication in Response to Commitments to the UN FCCC	• St. Vincent and the Grenadines

6 A overview of GEF activities in the SIDS is available from GEF (2005).

[7] Caribbean Planning for Adaptation to Global Climate Change Project. Information about this project is available from the website: http://www.cpacc.org.

The project consisted of nine components, which focused on adaptation planning, including regional sea/climate data collection and management, impact and vulnerability studies, and the assessment of policy options through a series of regional activities and pilot studies within selected countries of CARICOM (These are shown in Table 5). These enabling activities were complemented by selective capacity-building initiatives, aimed at creating or strengthening endogenous skills and institutions necessary to operate a long-term adaptation program.

When the CPACC concluded in 2001, it was followed by a second phase project in 2003, Mainstreaming Adaptation to Climate Change (MACC), the primary objective of which is to continue the work of CPACC, by integrating climate change and variability into the tourism, agriculture, fisheries and infrastructure sectors of Caribbean islands (OAS, 2002), (see Figure 2). In addition to integrating climate change planning into development planning and sector strategies, the project will continue promoting technical and institutional responses for adaptation, and monitoring and modeling regional climate change (OAS, 2002).

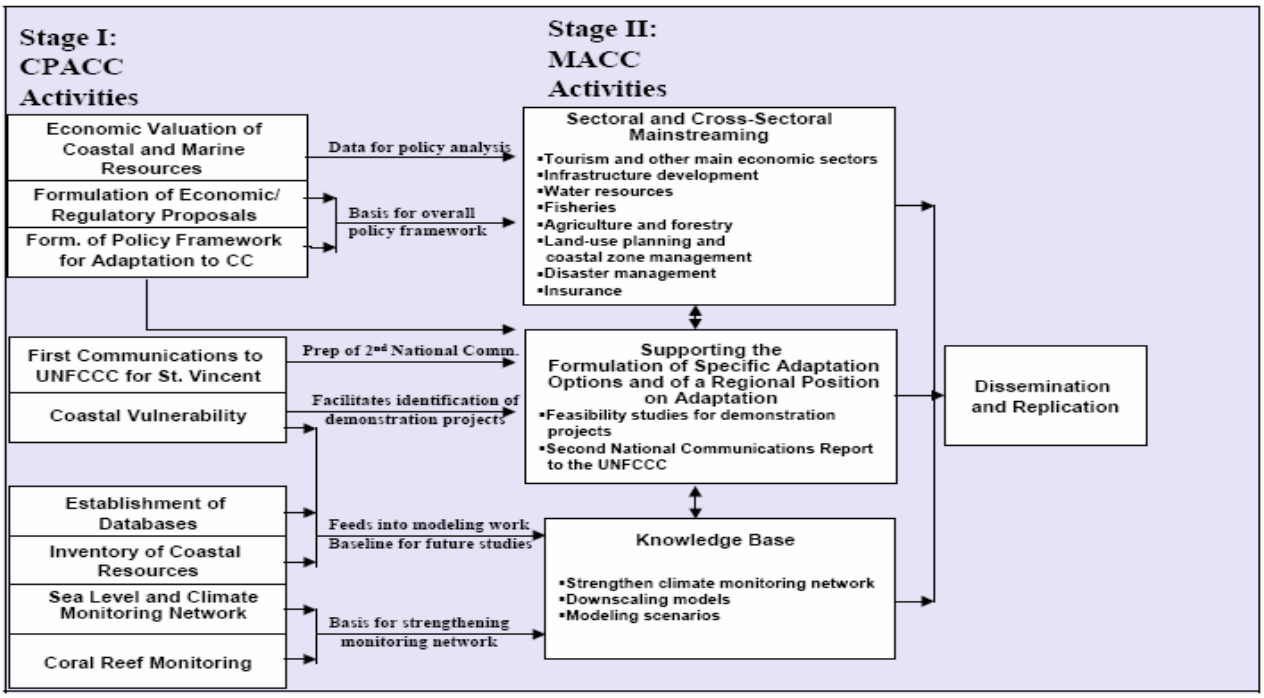

Figure 2. Linkage between the Caribbean Planning for Adaptation to Climate Change (CPACC) and Mainstreaming Adaptation to Climate Change (MACC) Projects

Source: OAS, 2002.

The main elements of the new phase include: expanding and strengthening the technical capacity to assess vulnerability and the risks associated with the global climate change; strengthening the supporting information infrastructure; building the capacity to formulate adaptation policy options to reduce vulnerability; supporting specific adaptation measures or (demonstration projects); and encouraging a regional approach to mainstreaming adaptation to climate change in

island development planning. This regional strategy will also be extended to public and private sector development planning.

Other developments in the Caribbean and Pacific since BPOA include the initiative to establish a permanent regional mechanism to address climate change in the form of the Caribbean Community Climate Change Centre; the establishment of the South Pacific Sea Level and Climate Monitoring Project (funded by AusAID which set up high resolution monitoring stations in eleven island countries to measure the relative motions of land and sea at each station); strengthening regional capacity and institutional frameworks for the management of natural disasters, and strengthening national capacity for the management of coastal zones.

In their efforts to respond to the BPOA's requirements for climate change and sea level rise, island countries face economic and political barriers. Climate change impacts threaten economic costs that may exceed the capacities of SIDS to meet, yet the costs of adaptation measures may also be beyond the economic capacities of SIDS. Since the relocation of physical structures and activities away from the coastal zone or into areas less vulnerable to climate and related changes is often not an option,[8] islands will be required to invest heavily in the construction of coastal defense infrastructure. The IPCC has estimated that, for developing countries in general, such costs could amount to less than 0.5% of their GDP. But for island countries — the Caribbean island countries in particular — some $1.1b will have to be spent on new construction to protect against sea level rise (UN/ECOSOC, 1999).

Caribbean SIDS could not undertake such investments without major economic disruption, which represents approximately seven per cent of their collective GDP.[9] Similar amounts for coastal protection will be required for Pacific Ocean SIDS. The GEF has provided $12m to 14 South Pacific States to assist in their climate change assistance programme. The Pacific Islands Climate Change Assistance Programme (PICCAP) has similar objectives to its Caribbean counterpart, CPACC, as it too seeks to conduct SIDS assessments and support capacity building for adaptation planning for climate change impacts (The status of the PICCAP activities are shown in Table 6).

[7] Continental nations can consider the relocation of farm belts and other climate-sensitive economic activities, but small islands cannot entertain such a strategy.

[8] The collective GDP for 14 AOSIS member countries in 1995 at constant prices (using 1987 as base year), was $16.02b.

Table 6. Status of PICCAP Implementation

PACIFIC ISLANDS	Adaptation and mitigation programs / initiatives	Disaster preparedness plans (relating to climate and sea level change)	Renewable energy plan / implementation	Climate and sea level data collection / monitoring	Public education on climate change and sea level rise	Assessment of the socio-economic impact of climate change and sea level rise
Cook Islands	Conducted a national vulnerability assessment	Established national office and plan. An early warning system in place	None	GHG inventory. Member of South Pacific Sea Level & Climate Monitoring Project (SPSLCMP)	None	Conducted a social vulnerability assessment
Federated States of Micronesia	Vulnerability & adaptation assessments for Yap (1992), Kosrae (1997), Chuuk (1999)	Information required	Information required	GHG inventory. Member of SPSLCMP.	Information required	Vulnerability & adaptation assessments for Yap (1992), Kosrae (1997), Chuuk (1999)
Fiji	Conducted a vulnerability & adaptation assessment (2000)	Established national office & plan. Early warning system in place	Major hydroelectric system in operation-serves a majority of population. Implemented projects involving solar,	GHG inventory. Conducted computer modeling to predict sea level rise effects	Conducted a pilot program in local communities	None

			geothermal, & bio-fuel energy. Assessed potential for wave, wind & hybrid energy			
Marshall Islands	Conducted mitigation workshops, a vulnerability index assessment, & an adaptation simulation	None	Established a solar energy program	GHG inventory. Member of SPSLCMP	Proposed but not implemented	None
Samoa	Climate change policy in final stage of preparation. Localized coastal management plans prepared (2002)	Established national office and plan. Early warning system exists. Disaster fund in place	Policy exists. No implementation	GHG inventory. Member of SPSLCMP	National climate awareness day. TV & radio programs. Included in primary school curricula	Conducted a community vulnerability & adaptation assessment (2003).
Tuvalu	Plan currently in preparation. Sea walls have been constructed	Established national office & plan. Early warning system exists. Annual national disaster day. Disaster equipment distributed to all	Some progress	Member of SPSLCMP	Included in primary school curricula	None

		islands				
Vanuatu	Information needed	Information needed	Initiative to make all energy production 100% renewable.	Member of SPSLCMP	Information needed	Information needed

At the political level, islands are facing an even larger challenge. At the outset, small island states recognized the potential danger to their sustainability, if not survival, posed by global climate change. They recognized that the problem would require international response, that much of their efforts would therefore have to be directed at persuading the international community to take the necessary steps to significantly reduce the level of CO_2 and other GHG emissions to the atmosphere, and that, since all islands faced a common plight in the case of global warming, their best strategy would be to adopt a coordinated approach to the negotiation of the proposed Climate Change Convention. This was the purpose for the formation of the Alliance of Small Island States (AOSIS), which has had the specific aim of presenting a strong, united position in the pending negotiations. Over the last decade AOSIS has attempted to raise the awareness of the international community to the particular vulnerability of small island states to sea level rise and to take effective measures to control, limit or reduce the emission of GHGs, and recommended that all coastal and island states take appropriate measures to protect the coastal environment against the adverse impacts of climate change.

However, in spite of the success of AOSIS in having the vulnerability issue of SIDS recognized in climate change treaty negotiations as is reflected in the UN FCCC (see Arts. 4.8a; 4.1e and 4.4), these concessions fall significantly short of meeting the central criterion for assuring the sustainability of islands in the face of global warming. Immediate and significant cuts in the emission by industrialized countries of carbon dioxide and other GHGs are needed if island sustainability is to be a realistic goal. The IPCC (1991 and 1996) has cautioned that a 60% reduction in world CO_2 emissions is necessary in order to avoid adverse consequences of global climate change, a target that provided a clear benchmark for the climate change negotiations. The lack of political clout in the international arena has worked heavily against SIDS, who have not been able to withstand the strong tide of resistance mounted by wealthy continental nations, to an environmentally significant climate regime. A critical fact is that island countries themselves can make little impact in a global program of CO_2 emissions reduction, since their per capita emissions of CO_2 are small compared to other countries. The average 1996 per capita emissions for 32 island states and territories that are members of the AOSIS was 0.9 metric tons of CO_2 equivalent (ORNL, 1999). By contrast, most developed countries exceed 6 tons of CO_2 per capita, with the US in excess of 19 tons per capita (see Byrne et al, 1998).

3.2. Energy Resources

Underdevelopment is often characterized by inadequate access to energy or the provision of energy services of poor quality (Farinelli, 1999; UNDP, 2002 and WCED, 1987). By definition, SIDS are lesser developed nations where relatively modest levels of energy are consumed, both in absolute and per capita terms (See, e.g., EIA 2004; United Nations, 2003) and many are without adequate energy services, especially in rural communities. Few SIDS have fossil fuel reserves or extensive fossil fuel development; Trinidad and Tobago is exceptional as an energy-exporting SID. Energy efficiency is also generally low in comparison to industrialized nations and there is a high dependence on imported fossil fuels. Imported fuel is often used to supply electricity generation and basic energy services as lighting, cooking, heating, water and sewage pumping for the domestic sector, primary industry processing and manufacturing, and service sector activity, including government services and tourism (Island Solar Summit, 1999).

This heavy dependence on fossil fuels brings with it high economic, environmental, and social costs. Most of the imported fuel is used for transport and electricity generation, both of which are essential for routine economic activity. A particular aspect of vulnerability is that many SIDS are totally reliant on fossil fuels for power generation (see Table 7). Economically, the costs of importing petroleum are a significant proportion of many SIDS total import accounts and often contribute to negative terms of trade (especially given the steady increases in world oil prices since 1999 and because many SIDS have no significant export industries (see, United Nations, 2003)). High fuel transport costs are passed onto consumers. Electricity prices, for example, can be four to 20 times that of adjacent continental nations (Island Solar Summit, 1999). Small domestic markets in most SIDS mean that diseconomies of small scale are often evident in conventional energy systems. SIDS reliance on imported fuel sources creates economic dependency and vulnerability to external economic and political impacts. As the price volatility and increases of the international spot market for oil in 2004 and 2005 have demonstrated, economic activity can be depressed by such a circumstance.

Table 7. Power Generation by Fossil Fuel for Selected SIDS

Country	Power Generation by Fossil Fuel (%)
Cook Islands	100
Kiribati	100
Marshall Islands	100
Nauru	100
Niue	100
Palau	100
Papua New Guinea	40
Samoa	49
Solomon Islands	100
Tonga	100
Tuvalu	100

Source: Weisser, 2004

Environmentally, petroleum is an undesirable fuel source for electricity generation as it creates emissions problems when combusted, and there are risks in its handling and storage. Socially, fossil fuel energy systems on SIDS are a relatively expensive source of energy, there is often competition for electricity between commercial and household customers, and energy agencies and corporations often have great influence in political decisions.

The BPOA recognized this energy problem and sought to redress the situation through the implementation of the Energy Resources program. In order to improve SIDS' energy services, an emphasis on renewable energy systems, energy conservation, and energy efficiency was proposed.

A significant energy initiative in the Caribbean has been the *Caribbean Renewable Energy Development Program* (CREDP) in 1998. CARICOM, in collaboration with the German Technical Cooperation GmbH, (Deutsche Gesellschaft für Technische Zusammenarbeit - GTZ) are managing the project on behalf of the United Nations Development Program (UNDP) and the GEF.[10] The program's main objective is to advance the implementation of renewable energy technologies in the Caribbean by removing barriers that hinder their use. The main barriers identified in the Caribbean are related to policy, finance, human and institutional capacities, awareness and information.[11] It is estimated that the share of renewable energy in the region will reach at least five percent by 2015 as a result of the program (currently, it is at about two percent) (CREDP, n.d.).

Achievements of the program include:

- Assessments of renewable energy resources of 16 Caribbean countries, fourteen of which are SIDS
- Development of financial mechanisms for the financing of renewable energy projects in the Caribbean, both on-grid and off-grid connected
- Establishment of criteria and mechanisms for the selection of renewable energy projects
- Establishment of a pipeline of renewable energy projects in the region
- Letters of government support for renewable energy projects within individual countries, and
- Feasibility studies of the renewable projects (Clarke, 2003).

Other key regional energy initiatives that have been undertaken over the past decade include:

- The establishment of the *Caribbean Energy Information System*, which disseminates information across the Caribbean and some Latin American countries
- Development of sustainable energy/ renewable energy plans (e.g., St. Lucia, Dominica and Grenada) under the Global Sustainable Energy Islands Initiative, which is a consortium of international non-governmental organizations (Climate Institute, Counterpart International, Winrock International, Energy and Security Group and International Network for Sustainable Energy) and multi-lateral institutions (Organization of American States), and
- Pre-feasibility study for a possible new project on energy efficiency in the Caribbean on behalf of GTZ (an earlier project initiated by the Latin American Energy Organization and supported by UNDP and GEF seems to have stalled).

[10] Those SIDS involved are Antigua and Barbuda, the Bahamas, Barbados, Belize, British Virgin Islands, Cuba, Dominica, Grenada, Guyana, Jamaica, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Suriname, Trinidad and Tobago, and Turks and Caicos

[11] Further information available from Projekt-Consult GMBH (2000). *Caribbean Renewable Energy Development Project*. Final Report – Volume II: Country Reports. March 23, 2000.

There is still capacity building to be undertaken by the project particularly in the area of renewable energy policy and training, but it is expected that this and other activities will be achieved by the completion of the program in 2007.

There are several regional energy policy initiatives underway in the Pacific, including the Committee of Regional Organisations of the Pacific's Energy Working Group's *Pacific Islands Energy Policy and Plan* (CROP, 2002). This plan contained the Rarotonga Declaration from the 2002 regional meeting, which among other things, calls for greater use and access to renewable energy and energy efficiency, and for affordable, reliable and environmentally sound energy for sustainable development. This effort links with the *Pacific Islands Energy Policy and Strategic Action Plan* being implemented by the South Pacific Applied Geoscience Commission and funded by the Danish government (Govt. of the Cook Islands et al, n.d.). Participating nations establish their own priorities, and these have included developing national energy plans, developing renewable energy plans, energy legislation reform, assistance in acquiring energy project funding, preparatory work for renewable energy projects and rural and urban electrification. A GEF-funded renewable energy program, the *Pacific Island Renewable Energy Project*, is also being undertaken for fourteen Pacific Islands[12] (GEF, 2005). This project began in 2003 and aims to remove barriers to the development and commercialization of renewable energy.

4. SIGNIFICANT TRENDS AND EMERGING OPPORTUNITIES FOR SIDS

The critical question for island states at this juncture is what can be done to advance the implementation of the BPOA for energy and climate change issues? There are strategies SIDS can employ to address energy needs in a climate-sensitive manner. Often, the economics and effectiveness of these strategies depend upon the availability of regional implementation mechanisms. These options (described below) have merit in their own right for SIDS, but the need for significant emission reductions by industrialized countries cannot be ignored. Without large reductions, the SIDS community cannot realize long-term sustainability goals.

The Kyoto Protocol is applauded (e.g., Kerr, 1997) and criticized (e.g., Byrne and Yun, 1999, Byrne and Glover, 2000, and Byrne et al, 2001) for its creation of so-called "flexibility mechanisms" for meeting CO_2 reduction targets — emissions trading, joint implementation and the clean development mechanism (CDM). These policies are believed by their advocates to provide least-cost means for meeting the goals set out in the Protocol and are expected to convince the largest emitters to agree to reduce their emissions. Critics argue that the mechanisms will enable countries to avoid making serious efforts to lower their GHG releases by paying other countries to do so instead (e.g., Byrne et al, 1998, 2001 and 2004). The first registered trade under the CDM has already been approved and it is anticipated that the frequency of trades will increase with the Treaty coming into force in early 2005.

The position of SIDS within this emerging global carbon-trading regime is particularly important. First, the regime is based on the principle of economic efficiency, which encourages

[12] Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Island, Tonga, Tuvalu and Vanuatu.

global actions that are focused on countries or sectors with the greatest potential to reduce emissions at least cost. This global least-cost strategy, determined by the use of cost-benefit analysis of policy options among countries, will direct actions on emission trades that are cheap to buyers (principally the wealthy OECD countries) and easily managed in national portfolios. Participation in the Kyoto flexibility mechanisms depends largely on the comparative advantage of states to trade emissions or, in the case of joint implementation and the CDM, to attract foreign investments for environmentally benign projects. This almost certainly will favor trades with large, continental nations who have infrastructure and bioresources that are well suited to embrace the technological and economic strategies of the OECD (as is the case with the first registered CDM project, Brazil's landfill gas to energy facility). By contrast, small island states offer very small-scale emissions reduction projects, often with special technical and economic needs. The transaction costs of implementing and monitoring these projects may eclipse the benefits of their GHG reduction credits. It is highly probable that the issue of small size will disadvantage island states under the Kyoto mechanisms (Byrne and Inniss, 2002).

Island countries will have to jostle with the rest of the world if they expect not merely to participate, but to negotiate terms of participation that are to their advantage. Beyond the Global Environmental Facility, the Kyoto mechanisms may constitute the best pathway to accessing much-needed funds for adaptation to climate change. This is doubly ironic. First, SIDS will be forced to hustle for the opportunity to reduce their emissions cheaply, even though their releases did not cause the problem. Second, SIDS, precisely because their emissions are small, will be unattractive candidates for trading (Byrne and Inniss, 2002). With regard to the latter, a synthesis report on Activities Implemented Jointly (AIJ) already has signaled the existence of a project distribution problem. The report reveals that of 122 projects funded by 11 investor Parties in 33 host countries (including 22 non-Annex I Parties), two-thirds of the projects are conducted between wealthy OECD countries and Economies in Transition (EITs); 54 projects took place in just three EITs, five in Africa and only four AOSIS countries are involved in AIJ activities (Foundation for International Environmental Law and Development, 1999). Thus, in taking the decision to continue the AIJ pilot phase, the Fifth FCCC Conference of the Parties requested that "… such continuation should address the issue of geographic imbalance, in particular the lack of projects in Africa and small island states" (Decision 13/CP.5, United Nations, 2000).

An additional concern are carbon 'sinks' and their use to offset GHG emissions.[13] From the island countries' perspective, innovative mitigation projects to reduce emissions, such as renewable energy technologies and energy efficiency, are ultimately preferable to sequestration. By definition, small islands have little ability to expand sink capacity and technological and economic commitments in this direction can delay much needed investment in renewable energy

[13] 'Carbon sinks' refer to that portion of the carbon cycle where carbon is sequestered in soils, vegetation, the deep ocean and similar sites. Such terrestrial carbon stores are counted in the national inventories of GHGs conducted by national parties to the UN FCCC, where they have the effect of 'offsetting' GHG emissions. Sequestration typically provides a temporary 'store' in the carbon cycle and does not offer the permanent effect on atmospheric concentrations as do reductions in GHG emissions.

and energy efficiency technologies, both of which offer far greater benefits to SIDS and to the global effort to reach a climate-stable future.[14]

What are the strategies that SIDS can employ to ensure that they are not either bypassed in global climate change negotiations or they attain sustainability in their energy regimes?

4.1 Opportunity for Island Impact Assessments

Clearly, the first priority for SIDS is to prevent or reduce the current and potential harmful impacts of climate change and sea level rise. In this vein, a new strategy for AOSIS to consider that is consistent with these overarching goals, might be to advocate an international policy of penalty assessments on OECD countries until they reach an agreed upon sustainability condition (such as the 3.3 tons of CO_2 equivalent found in Byrne et al (1998)). Islands states are the proverbial canaries in the mine when it comes to climate change and greater emphasis has to be placed on ensuring their survival, given the forecast impacts of climate change. As with projects with potential significant environmental impacts requiring impact assessments and identification of measures to mitigate these effects, as developed under environmental impact statements, the activities of developed countries with direct environmental implications for SIDS could be assessed using a 'climate change impact statement' scheme. Byrne and Inniss (2002) have proposed a climate change impact assessment requirement in implementing the Kyoto Protocol as a means of protecting island survivability. In the context of this assessment process, a substantial increase in international commitments would be expected to fund adaptation planning for the most vulnerable in the world community over the coming decades, namely, the coastal and small island developing states.

4.2 AOSIS Support for a Global Dematerialization Strategy

A second strategy for island countries is to join with others in supporting a global strategy to accelerate recent 'dematerialization' trends in technology development. Such a strategy would encourage a worldwide transition to new technology platforms that rely on zero/low-polluting and zero/low resource-consuming production and processing. Recent advances in computing and communications hold out promise for a different economy-environment-society relationship that uses intelligence, rather than cheap resources, to meet human needs. Island development policies should focus on ways to obtain a share of the new markets and technologies built on 'greener' energy systems and low-materials production and consumption. But the promise of such a future will depend greatly on new policy commitments that embody core commitments to equity and sustainability (Byrne et al, 1998). Without commitments to these principles, the new economy will look all too familiar.

Energy has a particular role to play in dematerialization of industrial economies. There is a global shift of world and national economies from energy- and materials-intensive development

[14] Yet, sequestration projects have attracted significant interest among industrialized countries and potentially represent a major diversion from reduction strategies that can actually lower climate risks for SIDS and other communities (Byrne et al, 2004).

to one where renewable energy and energy efficiency are ascendant in the energy sector and where dematerialization trends in production diminish the demand for natural resources generally. The transition to a global economic base which favors low-polluting and low-energy intensive production and consumption, offers all countries perhaps their greatest hope for a sustainable future (Byrne and Glover, 2002). SIDS can utilize their institutional voice as AOSIS to press for global agreement on such a strategy. Indeed, a new Plan of Action that sought island consensus on this goal would be consistent with AOSIS's historic role in urging global actions that would empower island sustainability (Byrne and Inniss, 2002).

4.3 Opportunity for a Regional CDM Project Approach

Small size is prejudicial to island states when competing on the global market for emissions reduction projects. Accordingly, it might be in the best interest of SIDS to seek CDM projects as a single trading block in which investments are negotiated at a regional scale, rather than as individual projects within single nations, as currently occurs. Such a regional approach, possibly using the Caribbean or the Pacific as regional groupings, can negotiate for a CDM project encompassing many or all of various small projects within the island states. Individual states could decide on their preferred project types, with the regional system operating according to rules or criteria set under a regional planning regime. This would ensure that preferable options for GHG emission reductions, such as renewable energy development or energy efficiency improvements, would be the first offering under a CDM scheme. An additional benefit of this approach could be offsetting the high transaction costs associated with separate small projects. Were negotiating parties to agree to the conditions set under a regional format, applicable to all islands within the region, industrialized countries would avoid having to negotiate the conditions for every project within a country.

4.4 Opportunity for a Regional Renewable Portfolio Standard Approach

A regional approach can also be applied to the promotion of renewable energy within island states. A key policy instrument that has been used to promote renewables around the world is the renewable portfolio standard (RPS) for electric utilities. An RPS requires a percentage of generating capacity by a utility to be generated from renewable energy sources by a certain date. (e.g., 10% of a utility's electric capacity must be from renewable energy by the year 2012). RPS policies stimulate minimum investments into RE technologies that eventually yield viable markets for this option.

Often, an RPS approach can be the most direct and effective way to bring renewables into widespread use, particularly as broad adoption of renewables will lower technology prices. It is also relatively easy to administer, since it only requires setting the level of renewables with modest subsequent oversight and enforcement. An RPS relies on market forces to bring down the costs of renewable technologies.

A regional RPS can be developed so that a generation target is set for the region and electric utilities or states can then decide the best technology mix given the particular climate and

environmental conditions in their individual territories. Thus, one island state can favor a particular type of renewable energy technology (such as wind, solar, biomass, micro-hydro or geothermal) and it will be preferable for that island to pursue a course of action which makes optimal use of its best resources, while another island state has the flexibility to contribute its share of the regional RPS via resources and technologies that are most competitive within its borders.

An additional benefit of the regional approach includes potential capital cost reduction in renewable energy projects, as bulk purchases of equipment can be made from suppliers. Project development costs can also be reduced, such as lower insurance premiums for certain renewable energy projects (e.g., wind farms) can be negotiated from a scale that warrants more favorable pricing. A regional approach also reinforces the benefits of a regional CDM strategy, as it can provide a lower cost, market-based implementation vehicle for realizing CDM obligations.

There is already a basis for a regional RPS as the Caribbean Electric Utility Service Corporation, an association of Caribbean utilities, has set up a task force to consider establishing a regional RPS for Caribbean utilities. A similar program can be established for other SIDS regions.

5. CONCLUSIONS

The BPOA has played a valuable role in providing a policy and planning foundation to enable SIDS to respond to the challenges of energy and climate change. Since the implementation of the BPOA, there have been important developments:

- Greater realization of the threats posed by climate change to SIDS
- The coming into force of the Kyoto Protocol of the UN FCCC
- Improvements in renewable energy technologies (especially reduced costs)
- Successful demonstration and application of renewable energy technologies in SIDS (including the establishment of wind farms)
- Further development of policy settings and innovative finance plans to promote renewable energy, and
- Establishment of regional strategies, policies and plans and increased capacity-building in energy and climate change.

The BPOA+10 provides an opportunity to build on these developments in order to respond strategically to the problems of climate change and energy demand/supply. This paper has identified specific opportunities for building on the BPOA and finding innovative ways to ensure that the goals of the BPOA can be realized. Four policy options are specifically recommended:

1. Advocate for the use of climate change impact statements when examining the impacts of activities of developed nations on SIDS.

2. Adopt, through AOSIS, a proposal to prioritize dematerialization and renewable energy-based development strategies.

3. Promote a regional CDM project approach that can improve the competitive position of SIDS within the global marketplace for emissions credits and thereby maximize the benefits to the islands community.

4. Extend the regional strategy to develop a RPS for SIDS that would include using the RPS as a CDM project.

Presently, SIDS are bellwethers of the adverse impacts of climate change on society and ecology. A more responsible global programme for action is needed that diminishes the present, serious threats to islands. Although in the *Mauritius Strategy* (United Nations, 2005), the international community affirms its commitment to the UN FCCC and seeks implementation of the Kyoto Protocol, stabilization of GHGs in the atmosphere will not be achieved sufficiently quickly under the Kyoto Protocol so as to reduce the extent of economic, social and environmental losses to SIDS that is likely to occur. Minimizing future climate change impacts on SIDS requires deeper cuts in GHG emissions by OECD countries and more rapid development of renewable energy options. The islands community, with appropriate support from developed nations and international agencies, can set an example for international action by embracing energy policy strategies consistent with a sustainable, climate-sensitive future.

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