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Energy and the environment in Asia-Pacific: Regional cooperation and market governance

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Energy use in Asia will grow dramatically over the next decade and for the foreseeable future. As a whole, the Asian region (South and East Asia) is expected to use 133 per cent more commercial energy in 2010 than it did in 1995 (Fesharaki, Clark, and Intaraprovich 1995, 2). In East Asia, commercial energy demand will double. Electricity generating capacity in China alone is expected to nearly quadruple (IEA 1996, 13).

If the future looks like the past, rising Asian energy use based on coal and oil will create severe, possibly irreversible, environmental and health problems, as well as heighten concerns about energy supply security. As in other parts of the world, sustainable energy development in Asia requires that dependence on fossil fuels be reduced. However, some of the leading alternatives, especially nuclear and hydro, pose their own environmental and security problems.

The explosive hunger for energy is prompting a move away from centralized state planning and towards greater reliance on markets to meet demand for energy supplies and capital for energy infrastructure. The transition towards markets will present governments with new roles, policy imperatives, and options. Given the increasing level of market interdependence, the most powerful policy instruments – those which shape market incentives – will be those undertaken collectively.

This chapter examines the role of regional cooperation in nudging markets toward an energy path which enhances both environmental and supply security. The first section profiles the trend towards markets and

describes the energy-security-environment nexus and the policy dilemmas it creates. The second section analyses energy-environmental market failures and develops a broad policy framework for regional energy cooperation . The third section describes and evaluates initiatives towards energy cooperation in Asia, both within regional institutions and on a project basis.

One hundred years of smoke and smog? The energy picture in Asia

Energy demand in Asia is driven primarily by rapid economic growth, which generates increases in energy use by industry, transport, and household sectors, including newly electrified rural areas. Demographic factors are also important: over 4 billion people will be living in Asia by 2010, an increasing number of them in cities. By 2025, over half of the Asian populace will be urban, up from only 35 per cent in l995 (WRI 1996, 150).

Energy demand projections are derived from projected GDP growth rates. Extrapolating from a decade-long economic boom, the International Energy Agency projected in 1996 that GDP in China would grow annually by 9 per cent between 1995 and 2005 and by 7 per cent between 2005 and 2010. For the rest of (developing) East Asia, the corresponding projections were 6.6 per cent and 5.9 per cent (Grollman 1996).

These projections were made before Asia's financial crisis, which, at least in the short term, will dampen economic growth, energy demand, and power sector investment. Nonetheless, the economic ''fundamentals'' point towards sustained industrialization, urbanization, growth in personal transport, and rural electrification – all of which add up to increased energy use. According to one ''post-crisis'' estimate, primary energy demand in Asia will increase at an annual rate of 4–5 per cent through to 2010 – double the global rate (Yergin, Eklof, and Edward 1998, 38). Moreover, environmental problems are already pressing even at current levels of demand. The slowdown in growth may even exacerbate environmental problems, as governments cut environmental budgets (Nautilus Institute 1997).

Moving towards markets

Throughout Asia, the trend at the macroeconomic level is towards liberalization and market opening. In the Asian countries hardest hit by the financial crisis – South Korea, Thailand, and Indonesia – this trend will accelerate as a result of the conditions for bail-out by the International

Monetary Fund. Financial markets in particular will get an overhaul. In the energy sector, the two crucial markets are those for energy supplies and power sector financing.

Besides stimulating economic growth and the overall demand for energy, macro-level liberalization will affect the energy sector in two broad ways. First, it will enhance the efficiency of energy use. Through more open markets, Asians will generally have access to more efficient producer and consumer goods. Secondly, a greater reliance on markets will encourage policies and forms of governance more appropriate to markets, including the energy sector. Better governance is important in both stimulating investment and integrating environmental objectives.

The investment demands of increased energy use are staggering. By one estimate, annual investments required to meet Asia's power demand over the next decade are projected to be some US$600 billion – over 62 per cent of the world's projected power sector investments (Bakthavatsalam 1995). By another estimate, in North-East Asia alone (China, Japan, Taiwan, and North and South Korea) the investment requirements of the power sector are projected to average US$72 billion per year for the next 15 years – a total of US$1.8 trillion (Razavi 1997, 1). By any estimate, the capital requirement is huge and has raised concerns about where the capital will come from.

In nearly all the developing countries of Asia, the power sector has historically been dominated by and financially dependent upon the central government. Domestic capital markets remain largely undeveloped, unable to tap domestic sources for large-scale investment. In the past, Asian governments looked to multilateral financing agencies such as the World Bank and the ADB as primary sources of power sector financing. However, given the scale of the required capital and the current ''cut government spending'' political climate, multilateral banks will at best play a brokering role.

The recognition of these constraints by Asian governments has triggered substantial changes in methods of financing to allow the private sector – both domestic and foreign – to invest in power generation. The increasing role of independent power producers (IPPs) means that the power sector, while still in large part a government monopoly, is moving towards being market-based (Razavi 1997). In China, for example, foreign investment accounted for 18 per cent of power sector investment in 1995, up from only 6.4 per cent in 1985 (Razavi 1997, 5). India, the Philippines, Japan, Thailand, and South Korea have all begun to open up their electric power industries.

The trend towards markets is also evident in energy supply strategies. While there are large reserves of coal in China, India, South-East Asia, and Australia, growing energy demand has created a new and growing

dependence on oil imports. Virtually all Asian countries either are already or will soon be net importers of oil. China, for example, traditionally a major oil exporter, has become since 1993 a net importer at the rate of 600,000 barrels per day and is projected to increase its oil imports fivefold by 2010 (Calder 1997, 24). Indonesia, long the largest oil exporter in South-East Asia, will probably become a net oil importer between 2000 and 2005 (Calder 1997, 24). The shortfall between India's domestic crude oil production and oil consumption is nearly 900,000 barrels per day (US EIA 1997). Overall, imports accounted for 59 per cent of Asia-Pacific oil supplies in 1995. By 2010, oil import dependence, primarily on the Middle East, will increase to 77 per cent (Fesharaki, Banaszak, and Kang 1997, 8).

Apart from oil, energy supplies in East Asia are met largely via intra-regional markets, including Australia (see Figure 14.1). There is a substantial intra-regional trade in coal and liquefied natural gas (LNG), as well as in oil. The primary exporters are Indonesia and Australia and the primary importers are Japan, South Korea, and Taiwan. The demand for natural gas, which accounted for 9 per cent of energy use in 1995, is met almost entirely within the region. Excluding China, about two-thirds of coal demand is met by imports and three-quarters of imports are supplied within the region (Grollman 1996, 14).

The trend towards greater reliance on markets to fulfil energy needs in Asia is evident not only at the lofty heights of the power sector but also at the level of the rural and urban poor. Processes of modernization and urbanization are increasingly replacing non-commodified, traditional energy sources such as biomass, animal, and human power with commodified, often fossil-fuel-based, forms of energy. The move up the ''energy ladder'' has implications for both environment and equity (UNDP 1997, 8–10).

The energy-security-environment nexus

The expected surge in energy demand in Asia – and the ways in which the demand is met – will have enormous implications not only within but beyond the region. On the one hand, increasing energy use will bring welfare benefits to millions of Asians, as well as to economies throughout the world, which will gain export markets. Job creation and rising standards of living are important aspects of sustainable development.

On the other hand, the region's growing hunger for energy resources will create new forms of insecurity and could potentially inflame relations between major powers within and beyond the region. Moreover, given Asia-Pacific's current dependence on fossil fuels, its highly inefficient and technologically backward power sector, and its weak environmental

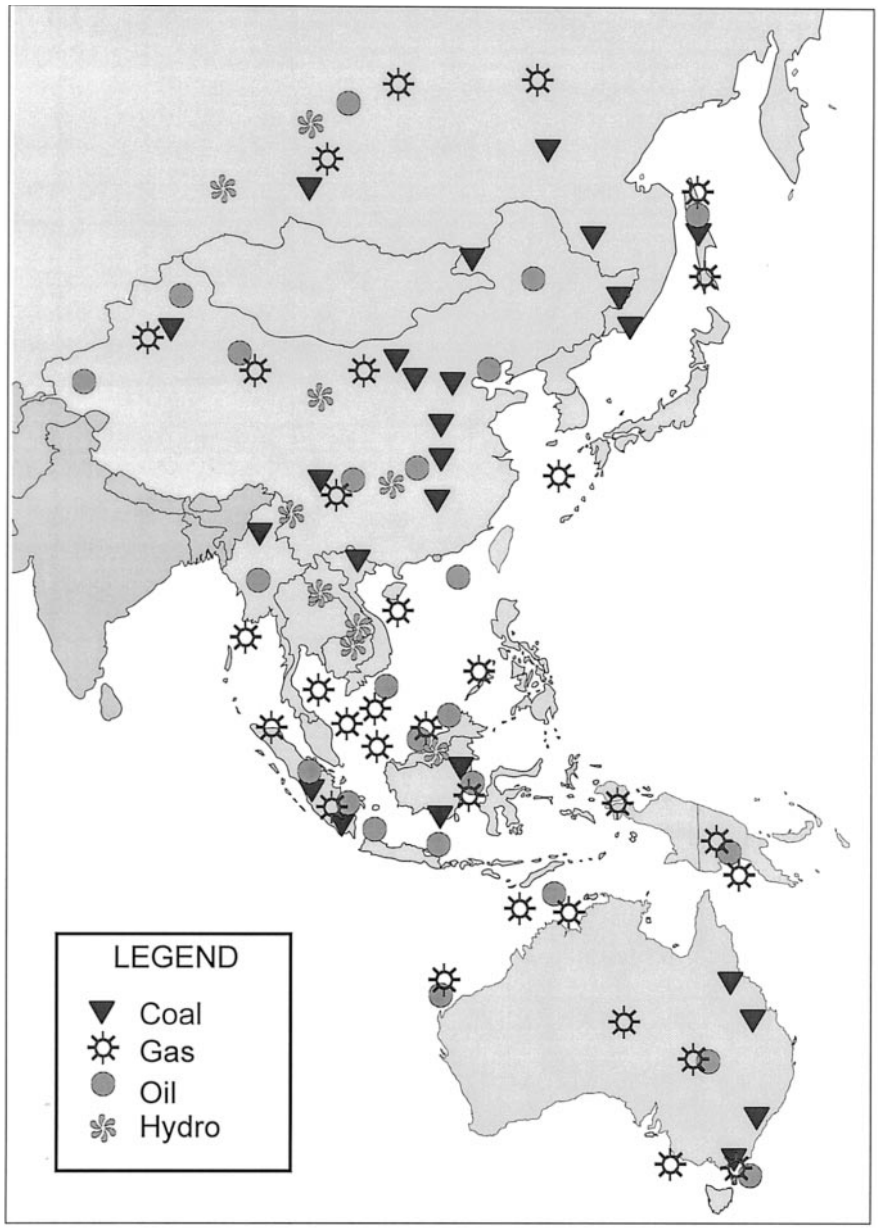

Figure 14.1. East Asia-Pacific region: Strategic energy resources

management capacities, a future which resembles the past will rain massive ecological damage on Asia, primarily through acid deposition, and globally through climate change.

Current energy demand in Asia-Pacific is met overwhelmingly by coal and oil. In 1995, coal and oil accounted for 46 and 38 per cent respectively of total primary commercial energy consumption. Natural gas accounts for 9 per cent of primary commercial energy consumption, and nuclear and hydro account for 5 and 2 per cent respectively. In India, domestic coal, which has a high ash content, accounts for over 55 per cent of energy consumption (US Department of Energy 1997). In China, the world's leading coal producer, coal accounts for 77 per cent of energy consumption, as shown in Figure 14.2 (Streets 1997, 10).

Emissions from coal-fired power plants, especially in China and India, have resulted in widespread acid deposition both within and beyond national borders. Acid deposition occurs when emissions of pollutants, including sulphur and nitrogen, interact with water and oxygen in the atmosphere to produce sulphur dioxide, which reacts in the atmosphere with hydroxyl radicals and then with water to become sulphuric acid (SO_3). Transported by air currents, the pollutants mix and are finally deposited back on the earth's surface. The chemical reactions and depositions may be fairly close to the source of emissions – or hundreds of kilometres downwind.

Acid deposition is an especially pressing problem in India and North-East Asia. In India, sulphur dioxide levels in nearly all cities greatly exceed international standards (US EIA 1997). In North-East Asia, according to the World Bank/ADB RAINS-Asia model, sulphur dioxide emissions totalled 14.7 million tonnes in 1990. Under a ''business-as-usual'' scenario, sulphur dioxide (SO_2) emissions will more than double by 2010 and nearly triple by 2020; emissions of nitrogen oxide (NO_x) will more than triple between 1990 and 2020 (Streets 1997, 12). Even under a ''higher efficiency forecast'' scenario, in which governments make targeted efforts to increase energy efficiency and institute reasonable fuel substitution measures, sulphur dioxide emissions would double in the next 30 years (US EIA 1997). Given that Europe and North America have taken strong measures to reduce acid rain, Asia will emerge as the dominant emitting continent.

The impacts of acid rain are not well understood, since ecological degradation is usually the result of multiple variables. Generally, acid deposition is believed to modify the rate of nutrient leaching from soils and biomass; diminish or destroy fish populations; affect soil bacteria and fungi; increase uptake of heavy metals such as cadmium; and exacerbate pre-existing stresses such as pesticide contamination. The increase in emissions of nitrogen oxide may be especially problematic. Initial studies

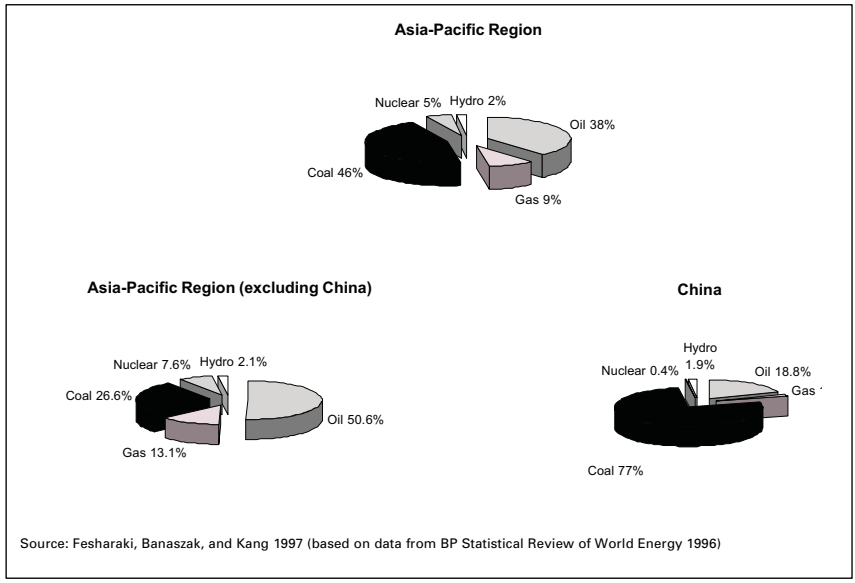

Figure 14.2. Primary commercial energy consumption by source, 1995

have suggested that the increase in NO_x emissions and fertilizer use in North-East Asia may lead to ozone levels sufficiently high to threaten rice, wheat, and corn production (Carmichael and Arndt 1997, 22).

The sensitivity of a particular ecosystem to the effects of acid deposition varies. North-East Asia is especially vulnerable due to the combination of high deposition and sensitive soils and vegetation (Bhatti and Streets 1992). Coal-related emissions also jeopardize human health by causing respiratory problems. By the end of the 1980s, the annual environmental and health cost of direct acid rain damage in the worst-affected areas of China was estimated to be 16 billion yuan (US$2 billion) (Sinton 1997, 2).

Acid rain is a problem not only within but also between countries in Asia. In North-East Asia, sulphur emissions emanating from China deposit acid in Japan, North Korea, South Korea, and the Sea of Japan. According to RAINS-Asia, China accounted for some 37 per cent of Japan's sulphur deposition and 34 per cent of North Korea's in 1990 (Carmichael and Arndt 1995, 33).

In addition to acid rain, Asia's future heavy reliance on coal and oil to fuel energy will produce a large volume of greenhouse gas emissions, especially carbon. In 1992, China was second only to the United States in total carbon dioxide emissions; India was the world's sixth largest emitter.[1] Cumulatively, the United States and the European Union are

responsible for the lion's share of the stock of carbon dioxide emissions in the atmosphere. The United States, for example, has generated four times more emissions than China and nearly 14 times more than India (WRI 1996, 319). In terms of the annual flow of emissions, however, China is the world's second largest emitter (WRI 1996, 318).

While a large increase in the use of fossil fuels, especially coal, will undermine environmental security, an increased thirst for oil presents another kind of security problem: vulnerability to supply disruption and price volatility. The primary source for crude oil imports is the Middle East. In 1997, 76 per cent of total Asia-Pacific crude imports came from that region. Given the large refining capacity throughout Asia, including in Japan, China, South Korea, India, and Singapore, oil requirements will continue to be met through imports of crude oil. By 2005, the Middle East's share is projected to rise to 90 per cent (Fesharaki, Banaszak, and Kang 1997, 9).

The growing dependence on Middle East oil may make Asian importers vulnerable to supply disruption and monopolistic pricing, as happened in the heyday of the OPEC cartel in the 1970s (Greene 1997, 18). Most Asian nations do not have well-developed strategic reserve stockpiles. Even if, as some analysts argue, market interdependence reduces vulnerability to supply disruption (Yergin, Eklof, and Edward 1998, 44), Asia's growing dependence on Middle East oil may have broad geopolitical repercussions, since it will generate a level of interdependence much higher than that prevailing between the Middle East and the West (Calder 1997, 25).

Concerns about environmental impacts and supply/price security have prompted interest in other cleaner fuels, especially natural gas, nuclear power, and hydro. While growing in absolute terms, the share of oil in electricity generation in Asia-Pacific will slip from about 15 per cent in 1993 to only about 5 per cent in 2010. The share of nuclear, on the other hand, is projected to increase from 12 to nearly 14 per cent, hydro from 15.5 to nearly 17 per cent, and natural gas from about 12 to about 14 per cent (Fesharaki, Clark, and Intaraprovich 1995, 1).

While they would help to reduce air pollution, both nuclear power and hydro generate their own security and environmental problems. For nuclear power, the overriding problems are safety and the potential proliferation of nuclear weapons, especially given the region's undeveloped capacities for spent-fuel management and the lack of a regional spent-fuel management regime (Von Hippel and Hayes 1997). In the absence of such a regime, the widespread adoption of nuclear power could accelerate a nuclear arms race.

Japan, China, Taiwan, India, Pakistan, South Korea, and North Korea all have nuclear power programmes; Indonesia and Thailand may join the

group soon. Moreover, proposals in Japan to move towards a ''plutonium economy'' based on closed-cycle plutonium reactors have generated widespread environmental and security concerns in Asia.

Large-scale hydro power, on the other hand, often entails substantial social and ecological costs. Social costs include displacement of communities, sometimes affecting millions of people, as well as loss of agricultural, fishing, tourism, and other resources. Ecological impacts can broadly be categorized as impoundment effects – deforestation, loss of vegetation, and other consequences of flooding large areas of land required for storage reservoirs – and barrier effects, especially loss of migratory fish species. There is also a health risk, since reservoirs often provide habitats suited to disease vectors. Moreover, large-scale hydro dams pose a risk of large-scale flooding should the dam crack or break (Hirsch 1997).

Given the nexus of source-related environment and security issues, the most attractive energy sources to fuel Asia's energy growth are natural gas – of which there are substantial reserves in the region – renewables (mini-hydro, wind, solar, photovoltaics, tidal, biomass, and geothermal), and energy efficiency. The widespread use of natural gas, however, will require a huge investment in infrastructure to transport and distribute – via either pipeline or transmission lines – gas (or gas-fired electricity) from fields in the northern regions of China, Central Asia, the Russian Far East, and South-East Asia (see Figure 14.1).

The role of renewables is still very small. However, four Asia-Pacific nations – India, Japan, China, and Australia – are pursuing renewable resources for electricity generation on a large scale (Fesharaki, Clark, and Intaraprovich 1995, 5). Moreover, small-scale renewable energy technologies can offer proven and environmentally benign alternatives to grid-based power. In India, fewer than 40 per cent of households are connected to the grid (Bakthavatsalam 1995).

Nonetheless, like a shift to natural gas, a major shift towards renewable energy sources is some way off into the future. In the short to medium term, that is the next 10–20 years, coal will continue to dominate the Asian region and short-term policy imperatives will revolve around ways to make the use of coal cleaner and more efficient, as well as to substitute cleaner fuels for coal and oil as much as possible.

There is also substantial room to improve energy efficiency. India uses 60 per cent more energy per dollar of GDP than the world average (US Department of Energy 1997). China uses 20 times as much primary energy to produce a dollar of economic product as does Japan. Only part of the difference stems from the different industrial structures of the two economies. The rest stems from inefficient equipment and outmoded practices (Sinton 1997, 8). The widespread embrace of the best available

technology – even if for only new plants – would provide a significant environmental benefit.

Regional environmental governance of energy markets

The anticipated explosion in energy demand in Asia poses dilemmas for policy-makers. It will be difficult simply to meet the demand at all – to mobilize the required finance and channel it into well-managed and efficient power projects. The deeper challenge is to meet the demand in ways which at once promote human health and environmental security, enhance supply security, and encourage (or at least do not undermine) prospects for inter-state peace and stability. In other words, if it is not to create new sets of intractable problems, energy planning must be based on integrating security and environmental, as well as economic, objectives. Given the past large investment in (dirty) coal and imported oil (and nuclear power, especially in Japan), and the long lead times required to develop and disseminate alternatives, this challenge can fully be met only over the long term – perhaps 20 to 50 years.

The central policy imperative is to develop the capacity for scenario-based strategic planning – in other words, to define overarching, integrated objectives for the development path of the energy sector. From environmental, security, and geopolitical points of view the heart of such a scenario should be to reduce dependence on fossil fuels.

Guided by a long-term ''fossil-free future'' scenario, an ensemble of policy initiatives can be designed which fulfil short- and medium-term energy sector objectives while at the same time promoting a transition to renewables.[2] Without a long-term strategy, policies and resultant energy choices will be skewed towards the status quo or towards crisis management. Crucial strategic investments in transition fuels like natural gas may be foregone.

In the short term, environmental security objectives should be to embrace demand-side management and enhance the efficiency of energy use throughout the economy; to make the use of coal as clean and efficient as possible; to invest in the development of natural gas and renewables; to substitute cleaner fuels for coal and oil wherever feasible; to reduce dependence on Middle East oil; and to phase out nuclear power and, in the interim, make its use as safe as possible.

Achieving these short- and long-term objectives will require new roles for the state in enabling and governing markets to achieve desired energy sector objectives. Governments will need to design market-oriented policy instruments, as well as mechanisms to gather and apply scientific

information and interface with business, communities, and other stakeholders. The key question for this chapter is what should or could be the scope of regional, as against national or global, approaches to integrated strategic energy planning.

Transborder resources and externalities

The most compelling rationale for regional energy cooperation arises when energy resources, markets, and/or energy-related environmental impacts are transboundary. In both South-East and North-East Asia, including Siberia and the Russian Far East, there are significant reserves of natural gas and oil. The primary markets, however, are in North-East Asia. Developing and distributing the gas is a cross-border undertaking (Paik 1995). In addition to primary resource development and management of regional commons, nations may also find economic advantage in integrating electricity grids on a regional basis.

Energy-related environmental pollution, including acid deposition, crosses national boundaries in Asia and requires regional cooperation to monitor emissions. In addition, pooling scientific efforts regionally can reduce the costs of mitigating the effects of acid rain and building management capacities where they are weakest. Most important, significant differences in the costs of reducing emissions in different countries provide scope and incentive for adopting regional as against purely national strategies.

Globalization and market failures

Geography-based incentives for regional cooperation exist regardless of the particular character of the economy. A new rationale emerges when economies are market-based and increasingly integrated. The growing openness of Asia's economies to trade and foreign investment – especially in the power sector itself – suggests that energy sector choices will be increasingly guided by domestic and global market forces. Without proper governance, however, markets have three major failings, all highly relevant to energy sustainability and security.

The first failing, now commonly understood, lies in the fact that market prices do not – and perhaps cannot fully – incorporate social costs. For fossil fuels, externalities include local air pollution, atmospheric pollution and the costs of climate change, marine pollution, and the costs of war in maintaining supply. The inclusion of these externalities in market prices, however partially and imperfectly, would change millions of energy production and consumption decisions every day.

The second problem with markets is that, to be efficient, market deci-

sions must be based on perfect information. When it comes to ecological and health impacts of production and consumption, the state of the art is that requisite information is imperfect or even inherently unknowable. Moreover, information often takes the character of a public good. Because the benefits of investing in information cannot be fully captured privately, private entities such as consumers or firms tend to underinvest in gathering it. Without public investment in information and policy instruments to incorporate it in market decisions, markets are flying blind when it comes to gauging the environmental and health costs and benefits of energy choices.

The third failing of markets is that they do not incorporate the future, and tend to guide production and consumption decisions according to a short-term rationality. However, many important and desirable economic outcomes, including technology development, are path-dependent: decisions taken today shape the options for tomorrow. Markets value the future only in terms of foregone consumption (net present value), but not in terms of foregone benefits due to today's consumption. From a long-term point of view, the optimal use of fossil fuels would be as a bridge towards non-fossil-fuel sources. Without policy intervention, markets will not chart such a course and may even foreclose options.

These three failings – in pricing, information, and strategic planning – generate a fundamental weakness of markets, which is that they are riddled with prisoner's-dilemma-type situations: what makes sense at the micro level of the individual does not add up to social rationality at the macro level. It is up to good governance, incorporating both formal and informal rules and norms, to create an institutional framework which can channel the enormous power of markets towards social goals, including a more ecologically sustainable future. In Asia, a framework for energy governance is probably the single most important component of a path towards sustainable development.

Developing such a framework is primarily the role of government. The unilateral policy-making capacities of national governments in governing energy supply and financial markets, however, are conditioned and constrained by global market forces. On the one hand, market openness means that local prices for goods, services, and financial assets are determined, or at least influenced, by international prices. On the other hand, pressures to be competitive in export markets and to attract foreign investment dampen policy initiatives which would impose significant costs on producers or investors. Purely domestic policy initiatives – such as a national carbon tax to improve energy pricing – become "stuck in the mud" of competitiveness concerns. Rules of market behaviour, including energy regulatory requirements and standards, are increasingly pushed by markets towards international convergence.[3]

Global markets, in short, like global ecosystems, require global governance. Global governance, however, is extremely complex. There are some 190 nations in the world, split along many divides. Negotiations are costly and difficult. Regional approaches to energy governance, as one analyst argues, ''encourage the break-up of the 'global cooperation' problem into smaller and more manageable pieces'' (Grollman 1997). Moreover, when markets – for primary energy supplies, electricity, or power sector financing – are themselves primarily regional, there is a strong rationale for regional approaches to governance.

Regional policy framework

A framework for regional environmental governance of energy in Asia would focus first on developing a broad regional consensus for energy policy; and secondly on generating the institutional and policy framework to implement it. In Europe, this two-part approach underlay the development of the European Energy Charter.

A regional institutional framework would incorporate at least five key policy targets: rational pricing; environmental guidelines for financial markets and innovative financing instruments for cleaner fuels and technologies; the convergence of energy regulations and standards, including energy efficiency standards; investment in scientific information, including mapping renewable resources; and the creation of a strong interface between government, the scientific community, environmental advocates, and the public.

Pricing

Rational pricing strategies entail policy instruments to internalize environmental externalities in energy prices. Currently, however, domestic Asian and global energy prices not only exclude externalities but include subsidies to fossil fuels. In China and India, for example, subsidies to electricity make consumer prices about 40 per cent below the world price; for fossil fuels, prices are about 25 per cent below world prices (World Bank 1995). Ending subsidies to the coal sector and promoting freer trade in coal would help to substitute low-sulphur coal imports, including from Australia, for high-sulphur domestic coal (Anderson 1993).

While embracing world fossil fuel prices would promote more rational energy choices, the deeper problem is that world prices are themselves skewed by direct and indirect financial and environmental subsidies. Both OECD countries and developing countries subsidize energy, including fossil fuels. According to one estimate, energy sector subsidies in the OECD are nearly US$150 billion per year (De Moor and Calamai 1997).

While there are broad domestic social and economic benefits to ending

fossil fuel subsidies, adjustment costs make subsidy reform politically difficult. Collective action at the regional level to reduce subsidies would ''level the playing field'' and help governments overcome domestic political opposition. As a recent OECD study concluded, ''Overcoming opposition to subsidy reform will be substantially easier if countries can be convinced to react *together*, rather than *separately*, in reducing subsidies/tax concessions to particular industries or sectors'' (Runge and Jones 1996).

The economic logic for the removal of subsidies to fossil fuels is unimpeachable. Subsidies for renewables, on the other hand, might be justified on the basis of social benefits (positive externalities). In India, a ''medium'' level of governmental support would increase the share of renewables in total power generation capacity to about 8 per cent by 2015, while a ''high'' level of support would increase the renewables share to about 12 per cent (Bakthavatsalam 1995, 1).

Financial markets

Perhaps more than any other single factor, the character of power sector investment will affect the environmental future of Asia. If capital markets can be structured so as to be environmentally sensitive, they will be a powerful channel for improving ecological and public health. If they remain environmentally blind, financial markets will be channels for ecological degradation.

According to the RAINS-Asia ''best available technology'' scenario, for example, sulphur emissions in North-East Asia could be cut by nearly 70 per cent between 1990 and 2020.[4] The key is in mobilizing capital markets to deliver the best available coal-burning technologies and cleaner fuels. One approach might be for governments collectively to set guidelines which require social and environmental impact assessments and mitigation strategies for power sector projects. They could also require public hearings or other avenues of public input into the design and construction of resource development projects and power plants.

Broad rules to govern investment are emerging at the global level. The OECD attempted to negotiate a Multilateral Agreement on Investment (MAI), which aimed to eliminate domestic barriers to foreign investors. However, environmental (and social) parameters were excluded from MAI obligations, sparking widespread criticism among environmental groups and leading ultimately to the collapse of the MAI effort. Governments in Asia could move the process forward by promoting their own environmental guidelines for investment.[5]

Creating innovative financial instruments is another way governments can channel capital markets towards environmental goals. The primary goal of such instruments is to find ways to capture ''public goods'' bene-

fits of investment in cleaner technologies when markets, governments, or multilateral development banks (MDBs) are reluctant to finance them. One innovative proposal currently being explored by the Nautilus Institute is a financial guarantee mechanism for technology risk in China (Razavi 1997).

Regulations and standards

Reflecting different histories and socio-economic conditions, energy regulations and standards vary widely in the Asian region. Market integration, however, creates pressures for standards to converge. The crucial policy issues are, first, how to nudge convergence upwards toward a higher (rather than a lower) level of environmental performance; and secondly, how to manage an upward-convergence process in a way which recognizes the region's diverse needs and capacities.

Information

Deepening and broadening the energy-environment information base in Asia is a crucial and immediate task for regional cooperation. One of the most pressing needs is to map the region's energy resources, especially renewable sources. There is also a need for more information about the sources, quantities, and effects of emissions, and for effective monitoring networks to be put in place.

A wise investment must extend beyond acquiring knowledge to learning to use it, especially for planning purposes. The embrace of common planning tools at a regional level would enhance medium- and long-term planning capabilities and could provide great benefits in terms of energy resource and product development, as well as policy design.

Scientific and stakeholder input

The integration of environmental with economic and security objectives in energy planning requires a much broader level of expertise than an economic- (or security-) driven approach alone. In particular, it is crucial to bring the judgement and knowledge of the scientific community into the policy debate. While scientists were the primary force in stimulating Asian awareness of acid rain, energy planning and policy decisions in Asia continue to be dominated by energy policy experts with little training or knowledge of ecological sciences.[6]

Other key contributors to the debate include environmental advocates, as well as consumer, community, and other citizen groups. Environmental groups are often a source of innovative policy ideas, as well as a transmission vehicle for information and communication flows between governments and communities (APEC SOM 1997). Moreover, a vibrant regional network outside the official lines of government can explore

politically sensitive issues and help to build popular support for a regional energy strategy. Without popular support, political will for a regional institutional energy framework – including public investment in information and energy price adjustments – may not materialize.

Regional energy initiatives

The Asia-Pacific region spans a large swathe of the world and the world's population. It is not a geographically determined entity. The parameters of ''Asia-Pacific'' tend to be drawn – and drawn differently – by researchers, depending on what they are trying to illuminate; or by regional organizations, depending on their political or economic goals and constraints. For the United Nations, the ''region'' is bounded by ESCAP (the Economic and Social Commission for Asia and the Pacific), which spans some 56 countries from East Asia and the South and West Pacific to South Asia and Turkey.[7] The extensive geographic span of ESCAP is reflected in its broad tasks, which focus primarily on information exchange and capacity-building, and its comprehensive issues areas, which sweep from poverty alleviation to human rights.

From the UN point of view, there are several ''subregions'' in Asia, which, largely through nurturing by ESCAP and the UNDP, have developed programmes for environmental, including energy, cooperation. These include the North-East Asian Regional Environment Programme and the South Asian Cooperative Environmental Programme of the South Asia Association for Regional Cooperation (SAARC).

Many of the environmental goals of energy market governance, however, may best be achieved by lodging them in the institutional context of regional economic organizations, especially those focused on trade and investment. Such institutions are already self-consciously developing rules of market behaviour. Although they are focused primarily on macroeconomic policy, energy-environment policies can parallel and gain momentum from the regional policy-creation effort. ''An ecologically sustainable regional energy strategy,'' concludes one analyst, ''would require an institutional framework comparable in scale and scope to agreements on commerce and trade'' (Grollman 1996, 5).

The leading economic organization in the region is the Asia-Pacific Economic Cooperation forum (APEC), which links 21 countries around the Pacific Rim spanning from East Asia and Australia to North and South America.[8] Within the trans-Pacific APEC region, some 70 per cent of trade and 65 per cent of investment is intra-regional. Led by the United States and its Western allies, APEC economies have embraced a vision of

''free and open trade and investment'' by 2010 for developed and 2020 for developing countries (Yamazawa 1994, 201–211).

In the aftermath of the financial crisis of 1997, APEC lost momentum and its future agenda and effectiveness are not clear. While trade and investment liberalization continue to be its primary focus, APEC also operated on a second ''track'' devoted to economic and technical cooperation. Dubbed the ''eco-tech'' track, this tranche of APEC work included in the early 1990s a strong focus on the environment, as well as on human resource development, small and medium-sized business development, and other issues of social concern. Moreover, in 1994 APEC embraced – at least rhetorically – the principle of integration of economy and environment and charged all 10 of APEC's working groups, including the Energy Working Group, to incorporate environmental concerns into their work agendas (Zarsky and Hunter 1997). Of all the groups, the Energy Working Group is the most active and broad-ranging on both liberalization and environmental issues.

Other regional organizations which are on a path to market integration include the 10-member ASEAN, which is pursuing the creation of an ASEAN Free Trade Area (AFTA); and SAARC, which agreed in 1993 to form a South Asia Preferential Trading Arrangement (Kalpage 1996).

Cooperation among two or more states in the region is also occurring outside the umbrella of regional institutions, and is aimed especially at the transborder development of energy resources. Consortia of companies and states are emerging to develop the huge natural gas reserves in South and Central Asia, as well as to explore offshore oil reserve in the Russian Far East, South China Sea, and elsewhere.

This section describes cooperative initiatives both within the region's institutional umbrellas and on a project basis.

APEC

Based on a consensus model of decision-making, APEC is a forum for building norms and encouraging common regional goals. It is not an arena in which formal agreements are negotiated but acts as a ''talk shop'' to promote broad policy shifts and stimulate Asian regionalism. However, as the only Asian regional organization to include North and South American countries, its agenda is strongly influenced by the United States and its process by an ''East-meets-West'' dynamic.

In APEC, the United States and its Western allies press hard for liberalization, while many East Asian countries, including Japan, emphasize eco-tech cooperation to promote economic development. Even when the Western economies embrace and/or lead an eco-tech initiative, such as

developing a regional programme of action on environmentally sustainable development, they do so in the context of opening markets.

Environmental and energy cooperation at APEC are encased within the discourse of ''public-private partnership,'' ''commercial technology transfer,'' and the removal of ''market distortions'' which stand in the way of efficiency. Japan's attempts to promote ''development cooperation'' based on non-market development assistance principles have largely faltered. Energy cooperation at APEC is thus primarily a product of the market-opening thrust of Western APEC countries generally, especially by suppliers of energy resources and energy technologies, in competition with Japanese suppliers for East Asian markets.[9] Secondly, it is a vehicle to promote learning, information exchange, and capacity-building, including on environmental management aspects of energy development.

Institutionally, APEC addresses energy issues via two vehicles: a regional Energy Cooperation Working Group (EWG), chaired by Australia and Japan; and ad hoc meetings of energy ministers. The EWG is assisted by five expert groups which concentrate on particular aspects of the EWG's agenda and which relate to its five strategic themes: energy data and outlook; clean fossil energy; energy efficiency and conservation; new and renewable energy technologies; and minerals and energy exploration and development. The expert groups and the EWG as a whole sponsor seminars, workshops, and other meetings to exchange information and promote common views. Between January and June 1998, for example, the EWG's calendar of events included 14 separate meetings, four of them relating to environmental dimensions of energy development (APEC Energy Working Group 1997).

The primary goal of the EWG is to promote freer trade in energy and greater access by foreign investors to the power sector. At the Energy Ministerial in August 1997, the Australian Chair of the EWG listed APEC's key challenges as improving market transparency and removing barriers to trade in energy products and services; mobilizing sufficient capital for power infrastructure demand; adjusting energy policies to reflect market dynamics and reduce business costs and investment risks; and ''mitigat[ing] any adverse environmental impacts'' (Higgins 1996, 1). Environmental cooperation, he suggested, was a ''prime example where regional cooperation can be beneficial,'' and he proposed initiatives such as adopting environmental impact mitigation criteria as a standard component for planning and energy project evaluation, and multilateral joint ventures for reducing greenhouse gas emissions. In conclusion, he suggested an ''accelerated programme of work'' on energy-environmental issues.

Acceleration is very much what the programme needs. Despite the adoption of 14 Energy Principles in 1996 (see Figure 14.3), environmental

1. Emphasize the need to ensure energy issues are addressed in a manner which gives full consideration to harmonization of economic development, security, and environmental factors.
2. Pursue policies for enhancing the efficient production, distribution, and consumption of energy.
3. Pursue open energy markets for achieving rational energy consumption, energy security, and environmental objectives, recommending action in the appropriate forum of APEC to remove impediments to the achievement of these ends.
4. Recognize that measures to facilitate the rational consumption of energy might involve a mix of market-based and regulatory policies, with the relative components of the mix being a matter for the judgement of individual economies.
5. Consider reducing energy subsidies progressively and promote implementation of pricing practices which reflect the economic cost of supplying and using energy across the full energy cycle, having regard to environmental costs.
6. Promote regular exchange of experience on the various policies being used by member economies to achieve a more rational energy consumption.
7. Ensure that a least-cost approach to the provision of energy services is considered.
8. Promote the adoption of policies to facilitate the transfer of efficient and environmentally sound energy technologies on a commercial and non-discriminatory basis.
9. Encourage the establishment of arrangements for the development of human resource skills relevant to the application and operation of improved technology.
10. Enhance energy information and management programmes to assist more rational energy decision-making.
11. Encourage energy research, development, and demonstration to pave the way for cost-effective application of new, more efficient, and environmentally sound energy technologies.
12. Promote capital flows through the progressive removal of impediments to the funding of the transfer and adoption of more energy-efficient and environmentally sound technologies and infrastructure.
13. Promote cost-effective measures which improve the efficiency with which energy is used but reduce greenhouse gases as part of a suggested regional response to greenhouse gas emissions.
14. Cooperate, to the extent consistent with each economy's development needs, in the joint implementation of projects to reduce greenhouse gas emissions consistent with the Climate Change convention.

Figure 14.3. APEC (non-binding) Energy Principles

issues have taken a back seat in the working group behind the active promotion of coal – albeit cleaner coal – and generally a supply-driven, fossil-fuel-based approach to energy (Grollman 1997). Although a host of workshops, seminars, and expert groups have pondered the relationship of environmental and economic costs and benefits, the working group has been slow to recognize the need for a long-term, integrated regional energy strategy.

One problem is that, like the rest of APEC, the Energy Working Group and the Energy Ministerials are dominated by diplomats and civil servants. There has been some success in expanding the involvement of the business community in the EWG and an Ad Hoc Business Forum has been established. One of the strengths of the EWG is the informal networking between and among business people and government, as this promotes business. However, scientists, environmental groups, and other stakeholders have no regular interface with either the EWG or the Ministerials. As a result, efforts in the early 1990s to propel a sustainable development agenda at APEC dissipated (Zarsky 1998).

Besides building a more robust regionalism, the involvement of NGOs provides a source of innovative ideas. In July 1997, for example, the International Institute for Energy Conservation, an NGO with a regional office in Bangkok, sponsored a forum on Asia Regional Cooperation on Energy Efficiency Standards and Labelling (IIEC 1997). The forum drew participants from 13 countries to explore the contentious and difficult issues involved in creating national, regional, and international energy efficiency standards regimes. The forum recommended regional cooperation in the development of an energy efficiency testing infrastructure, as well as on the alignment of energy efficiency testing methods between Asian and international procedures.

A new initiative spawned by (but independent of) the Energy Working Group is the Asia-Pacific Energy Research Centre. Based in Tokyo, the Centre will produce an annual ''regional energy outlook'' as well as specific research projects. The research will focus on medium- to long-term issues associated with energy supply security and the environmental consequences of energy use (APEC Energy Working Group 1997). If the Centre emerges as a dynamic and independent builder of information resources – and a vibrant vehicle for a broader public policy debate – it could make a significant contribution towards a regional energy strategy. However, if it is captured by supplier interests or bureaucrats, it will do little to build regional momentum.[10]

SAARC

The South Asian Association for Regional Cooperation encompasses seven countries south of the Himalayas: India, Pakistan, Bangladesh,

Bhutan, Nepal, Sri Lanka, and the Maldives. Established in 1985 at a summit held in Dhaka, Bangladesh, SAARC's main goal is ''to accelerate economic and social development'' through regional cooperation (SAARC 1997a).

A focus on the environment has threaded SAARC's history. Environment and Meteorology is one of 11 areas of cooperation in SAARC's Integrated Programme of Action, each of which has a technical committee. In 1991, the sixth SAARC summit approved a study on ''Causes and consequences of natural disasters and the protection and preservation of the environment.'' In 1992, designated as SAARC's Year of the Environment, a host of programmes were identified, including ones on energy and environment. In 1993, the Technical Committee on Environment included within its purview a focus on the ''Greenhouse effect and its impact on the region'' (SAARC 1997b).

Regional cooperation could go far towards meeting South Asian energy needs and enhancing environmental issues, as well as energy supply and security. The water resources of the Himalayas are enormous. The hydro power potential of Himalayan rivers flowing through Nepal alone has been estimated at 83,000 MW. The hydro power potential in India, Bangladesh, and Pakistan has been estimated to be 70,000 MW, 1,772 MW, and 21,000 MW respectively (Dash 1996, 9). The development of hydro power, especially in an environmentally and socially sensitive manner, will require states to cooperate in managing the water resource, amassing the requisite investment capital, and designing electricity distribution systems. In Bhutan, the Chukha hydro project was recently completed with assistance from India.

Another significant regional energy source is natural gas. Recent discoveries in Bangladesh suggest that current proven reserves are in the range of 283–340 billion cubic metres and could well be above 1,700 billion cubic metres (Mohan 1997). The gas would find a ready export market in India, which is eager to diversify its energy supply resources away from its dependence on Middle East oil. There could also be an integrated regional market encompassing the eastern and north-eastern states of India, Bangladesh, Bhutan, and Nepal.

Despite the lure of economic and environmental benefits, SAARC has not been effective in garnering regional cooperation for energy resource development – nor, indeed, on any component of its Integrated Action Programme. Stuck in the quagmire of Indo-Pakistani conflict, SAARC has avoided controversial issues, including the contentious ''upstream-downstream'' issues of water development. Lacking political will, as well as financial resources for implementation, programmes of action have remained stuck at the level of seminars and rhetoric. ''Since 1985,'' concludes Kishore Dash of the East-West Center, ''SAARC has evolved slowly but continuously both in terms of institutions and programmes.

However, it is true that most of the programmes and achievements of SAARC exist on paper'' (Dash 1996, 2).

Mahbub-al Haq, head of the Human Development Centre in Islamabad and author of the first ''Human Development Report in South Asia, 1997,'' is even more unceremonious: ''So far, SAARC has been a bureaucratic organisation with ceremonial summits that are expensive photo opportunity sessions for national leaders.'' However, he concludes, ''it can be the future'' (Pradhan 1997). Hope for SAARC is based on optimism for a new era of reduced conflict between India and Pakistan.

Moreover, the shift in macroeconomic policies towards market liberalization, especially in the context of growing energy requirements, will change incentives: the potential for commercial gains will raise the cost of conflict and increase the benefits of cooperation. The new discoveries of natural gas in Bangladesh, for example, along with economic liberalization and deregulation of the petroleum sector, generated a 10 fold increase in US investment in Bangladesh in 1997. After 25 years, cumulative US investment amounted to US$20 million. In 1997 alone, it jumped to US$200 million, primarily for oil and gas development (Mohan 1997).

Cooperation between India and Bangladesh to develop and utilize natural gas could create a new subregional ''eastern'' tilt to South Asian politics, which have previously been dominated by the ''western'' Indo-Pakistani axis. Energy cooperation could also breathe life into the South Asia Preferential Trading Agreement (SAPTA): intra-regional trade and investment has been modest and stagnant to date. The embrace of greater energy cooperation, in short, could be, in the near future, a driving force for wider South Asian subregional and even regional cooperation.

ASEAN

The Association of South-East Asian Nations is made up of 10 countries: Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam. Formed in the 1960s primarily to foster security cooperation, ASEAN emerged in the 1990s as an engine for regional economic cooperation. The proposed ASEAN Free Trade Area (AFTA) aims to create an integrated zone for foreign investment by minimizing internal barriers to trade and creating common external tariff and investment policies. Moreover, with its ''ASEAN-plus'' formula of regular consultations with its primary economic and security partners, including the United States, India, China, and the European Union, ASEAN plays an important political role in regional affairs. In recent years, the ASEAN Regional Forum has emerged as the region's overarching forum for discussion of security affairs in South-East and North-East Asia.

Regional energy cooperation is nothing new to ASEAN's agenda. In July 1997, ASEAN energy ministers, at their fifteenth meeting, approved a Medium-Term Programme of Action on Energy Cooperation, which extends from 1995 to 1999. The action plan has six objectives: to implement existing energy cooperation programmes; to develop indigenous, non-oil energy resources: to strengthen regional institutions through training and research; to establish an ASEAN policy framework; to synchronize ASEAN activities related to energy; and to promote sustainable self-supporting ASEAN cooperation on issues of common concern (ASEAN 1997).

The action plan identified seven sectors for enhanced energy cooperation, including electricity, coal, oil and gas, new and renewable sources of energy, energy conservation, energy and environment, and energy policy and planning. The energy ministers also declared 1998 as ASEAN Energy Efficiency and Conservation Year (ASEAN 1997).

For the countries of ASEAN, like the rest of Asia, key energy issues involve reducing supply dependence on the Middle East, developing new sources of energy, especially gas, and improving the access of poor and rural communities to energy resources. Indicating the high priority of energy issues, there is a focal point on energy within the ASEAN secretariat. In addition to cooperating in the exploration and development of new energy sources, the primary work of ASEAN to date has been on information exchange and capacity-building. Funded by the European Community, ASEAN has established the ASEAN-EC Energy Management Training and Research Centre. In a concerted effort to encourage business sector interest and investment, Malaysia hosted the first ASEAN Energy Business Forum in 1997, which drew some 230 public and private sector participants.

Like other regional organizations, ASEAN has had difficulty in moving workplans from design and agreement to implementation. The ambitious sweep of the workplans may be especially hard to implement in the current fiscally constrained post-financial-crisis era. Among the regional projects under way are the Trans-ASEAN Gas Pipeline and the ASEAN Power Grid Interconnection projects, both under the auspices of the heads of the ASEAN power utilities/authorities.

Outside of the ASEAN rubric, regional energy cooperation in South-East Asia has focused on cross-border development of energy resources, especially the Natuna gas project in the South China Sea. The Natuna gas fields, which lie within the disputed Spratley Island group, are estimated to contain reserves of 178 billion cubic metres of natural gas. The project is being developed by Indonesia's state-owned Pertamina oil and gas company, with Exxon, Mobil Oil, and several Japanese companies (*Straits Times* 1997).

Development of the Natuna gas fields, however, will probably be stymied by South-East Asia's financial crisis. In late 1997, for example, Thailand announced that it did not need the energy resources and withdrew from its purchasing agreement. Territorial disputes within the South China Sea could also put a drag on development. A part of the lucrative Natuna project lies in a disputed ''grey area'' claimed by both Indonesia and China. Despite Chinese assurances, Indonesia deploys reconnaissance aircraft and naval patrols to protect the project from military action by China.

North-East Asia

North-East Asia is the least institutionally developed region in Asia. Geographically, the region might be considered to encompass the north-eastern provinces of China, the far eastern provinces of Russia, Japan, North and South Korea, Mongolia, and Alaska. However, given that cooperation between states lies within the realm of the national, not provincial, governments, the region is usually considered to encompass simply China (and sometimes Taiwan as well), and, depending on the purpose of the description, Russia. Moreover, in UN terms, the United States is in North America. The fledgling North-East Asian Regional Environment Programme nurtured by the UNDP and ESCAP thus includes Japan, the two Koreas, Mongolia, China, and Russia.

Energy-related issues, most prominently the mitigation of acid deposition and the development of cross-border oil and natural gas reserves, top the list of regional priorities for environmental cooperation. The reduction of acid deposition would also reduce North-East Asia's greenhouse-related emissions.

The scale and cross-border nature of the acid deposition problem suggests that there are strong incentives for regional energy cooperation in North-East Asia. However, the political divides are deep. Until 1991, the region was split by the Cold War and economic opportunities languished. Moreover, North and South Korea remain technically in a state of war and historical animosities arising from Japan's occupation of Korea and China have not fully abated.

Most important in terms of solving collective action problems, regional institutions in North-East Asia are undeveloped. When Europe and North America encountered acid deposition problems, they were much richer institutionally than North-East Asia is today. In Europe, the European Union provided a forum, while the United States and Canada have a rich set of communication channels. Even research forums or networks are still lacking or in their infancy in North-East Asia.[11]

Nonetheless, the region is rapidly becoming more economically inte-

grated and the pace of economic integration is likely to accelerate. With increasing market openness, it is predicted that trade and investment flows within the region will boom. According to one estimate, the value of trade within North-East Asia will more than double between 1995 and 2000 and triple by 2010 (Kap-Young, Kubayashi, and Takahasi 1995). Economic integration has prompted greater interest in regional cooperation, and a kind of "soft regionalism" is emerging.

A number of energy-related regional initiatives have emerged since 1991. The North-East Asian Regional Environment Programme selected energy-related air pollution as the first of three priority areas, and has developed pilot demonstration clean coal projects. There are also a host of bilateral initiatives, primarily between Japan and China, involving the monitoring of acid deposition and, through Japanese official development assistance, financing of clean coal technology.

In Europe, acid rain was tackled in part via a regional convention to reduce emissions. China, however, is not open to a regional agreement at this time, although it is interested in other forms of regional cooperation (Sinton 1997). With the support of the Japanese government, a regional acid deposition monitoring network has been created. Another proposal is to establish a joint fund to cover the incremental cost of abatement technology in those facilities where the greatest benefit would be achieved (Streets 1997, 8).

Another approach is for the United States and Japan, as the dominant suppliers of energy technology and finance, to collaborate in establishing innovative regional financing mechanisms for clean coal and fuel substitution. Aimed primarily at China, such mechanisms could also be utilized to promote energy efficiency and reduce incentives for nuclear power in North Korea (ESENA 1997).

In addition to reducing acid rain, there are strong incentives for regional cooperation in developing the large reserves of natural gas and oil in China, Siberia, and the Russian Far East (see Figure 14.1). Located in remote regions of Russia and China, extracting these resources and getting them to the heavily populated coastal areas in China, Japan, and Korea will be highly capital-intensive. Regional cooperation is needed to manage not only the crossing of borders but also the garnering of large investment funds and the allocation of the resources.

The construction of a large-scale gas field and 4,100 km pipeline from Irkutsk in Siberia to Ulaanbaatar, Beijing, and Seoul, for example, will require an estimated investment of US$11 billion. Recently, South Korea, China, Russia, and Japan agreed to exchange letters of intent to develop the Siberian gas field. When completed, the gas field would provide 30 billion cubic metres of natural gas to China, Russia, and Korea annually for 30 years at a much lower price than liquefied petroleum gas. How-

ever, there is a long lead time: under the best scenario, the pipeline would not be ready until 2006 (*Korea Herald* 1997). Moreover, given the high level of requisite inter-state cooperation and the enormous financial requirement, some analysts consider the pipeline scheme to be a pipe dream and recommend transmission lines instead.

In addition to reserves in the interior, there are significant oil and gas resources offshore, especially near Sakhalin Island in the Sea of Okhotsk in the Russian Far East. To date, exploration has yielded discovery of 273 million tonnes of oil and 878 billion cubic metres of gas. Unexplored offshore reserves are estimated to contain an additional 450 million tonnes of oil and 700 billion cubic metres of gas.

Lacking the requisite capital and technology, the Russian Federation offered international tenders for the development of Sakhalin hydrocarbon resources. Sakhalin I is a US$15 billion consortium led by Exxon and including a group of Japanese firms led by the Japan National Oil Corporation, as well as two Russian partners. Sakhalin II, a US$10 billion consortium, is led by the US company Marathon and includes McDermott, Royal Dutch Shell, Mitsui, and Mitsubishi (Rosenthal and Mischenko 1998).

Regional cooperation will be needed not only to extract the resources but to ensure that their development does not generate an ecological catastrophe. To date, extraction has been constrained by severe climatic conditions, including an icing period of up to nine months a year and ice thickness reaching 1.5–2 metres. The depth of the sea in drilling areas can reach 30–50 metres. Moreover, the area is one of high seismic activity, and tsunamis and severe wind sheer are common in the summer months. Most important, fiscal resources for environmental protection are scarce in Russia and institutions for environmental governance rudimentary.

Conclusion

Regional cooperation could be an important vehicle to promote more sustainable and secure production and use of energy in Asia. The growing reliance on markets – for energy resources, electricity, and power sector financing – suggest that market governance is a crucial component of a regional energy strategy. The first step, however, is to develop a regional consensus about the goals and objectives of energy policy – in the long as well as the short term. Such a consensus should be built on the integration of environmental and security concerns with economic objectives in an energy strategy.

The development of a regional – or even subregional – consensus will not be easy. The region is wracked by political animosities, perhaps most strongly in South Asia, and a lack of common language. Significant gaps

in economic development and political power, along with historical memories of (Japanese) occupation and fears of (Chinese) expansionism create undercurrents of mistrust. In many countries in Asia, there is still little opportunity for critics and innovators – either inside or outside government – to have their say.

Nonetheless, perceptions of common good, as well as economic and financial incentives to cooperate, are becoming stronger. A new kind of social group is emerging: people born after the Second World War who have travelled in Asia, been educated in the West, speak English, and have a highly developed sense of social and environmental concerns. These people are beginning to wield influence in professional and governmental circles and may form the core for a new style of leadership and regionalism in Asia on environmental issues and beyond. Developing regional institutional mechanisms which enhance their voices in regional dialogue, both official and unofficial, is the most pressing need.

Notes

1. WRI (1996, 326–327). On a per capita basis, carbon dioxide emissions from the United States were more than seven times those from China.
2. For an excellent exposition of this argument, see Grollman (1997).
3. For a fuller exposition of the argument, see Zarsky (1997a).
4. The scenario assumes that all major point sources of emissions (existing and new, industrial and power) install state-of-the-art desulphurization systems and that all other users of fossil fuels switch to lower-sulphur fuels. Even under a somewhat less ambitious "advanced control technology" scenario, in which desulphurization technology is applied only to new power plants and there is a modest level of fuel switching, sulphur emissions could be cut or stabilized. See Streets (1997, 12–14).
5. A non-binding investment code adopted by APEC included a provision which eschewed the practice of lowering environmental standards in order to attract investment. See APEC (1995, Annex 3).
6. For an interesting look at the role of Asian scientists in creating an "epistemic community' on the issue of acid deposition, see Wilkening (1997).
7. A complete list of ESCAP's regional and associate members can be found on http://unescap.org/stat/statdata/apinfig.htm.
8. APEC's members are Australia, Brunei, Canada, Chile, China, Hong Kong, Indonesia, Japan, Malaysia. Mexico, New Zealand, Papua New Guinea, Peru, the Philippines, Russia, Singapore, South Korea, Taiwan, Thailand, Viet Nam, and the United States.
9. At the APEC Leaders' Summit and ministerial meetings in Vancouver in November. 1997, energy was one of nine sectors identified for "fast track liberalisation." *APEC Currents*, The Australian APEC Study Centre, http:/www.arts.monash.edu.au/ausapec/newsletter/Curr7.htm.
10. For an analysis of the problem of bureaucratic stagnation in the environmental cooperation side of APEC, see Zarsky (1997b).
11. One attempt is the Energy, Security, Environment in North-East Asia project (ESENA), which links scholars and policy-makers in Japan and the United States in an effort to develop joint regional policy initiatives. The project is directed by the Nautilus

Institute for Security and Sustainable Development and the Center for Global Communications in Tokyo. See http://www.nautilus.org/ESENA.

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