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Annex I-Non-Annex I Linkage Options Under a Kyoto Protocol

Below are options for linking commitments of Annex I Parties to agreement on crediting for Joint Implementation and on the adoption and implementation of commitments by other Parties. Two options are presented. Neither option would require non-Annex I Parties to adopt commitments on the same timetable or at the same levels as Annex I Parties.

Option I: The "Contingent Commitment" Option. Under this option, the commitments of Annex I Parties to limit and reduce their greenhouse gas emissions would be contingent on agreement on crediting for JI and/or on the adoption/implementation of commitments by other Parties. This Option could be undertaken either through a Declaration at Kyoto, or by actual Protocol text, e.g., building on the "Evolution" article in the U.S. Protocol Proposal. This Option would have the effect of leaving all Annex I commitments "up in the air" until the contingent issues are settled. Option I creates considerable tension with the Berlin Mandate, as it holds the commitments of all Annex I nations in abeyance until the issues of Joint Implementation and non-Annex I commitments are settled, and thus could be seen as stretching the limits of the Berlin Mandate's statement that the process leading up to COP-3 in 1997 "will...not introduce any new commitments for Parties not included in Annex I." Option I should therefore be avoided and preference given to Option II.

Option II: The "Reservation and Withdrawal" Option. Under this option, any Annex I Party that so chooses could sign the Kyoto Protocol with a reservation stating that in the event there was no agreement on JI, and/or non-Annex I nations fail to adopt and implement commitments by a date specified, the Annex I Party would withdraw from its emissions limitation and reduction commitments. This Option would put the political burden on the Annex I Party taking the reservation to deal with the community of nations in the event it decides to exercise its reservation. Option II would also serve the useful purpose of inviting a next round of negotiations, which would be needed in order to avoid a situation that gave any Annex I Party an incentive to leave the agreement. In addition, this Option would not automatically vitiate the commitments for all Annex I Parties, as would be the case under Option I. For these reasons, Option II is therefore preferable to Option I.

Option II is also preferable on legal and practical grounds. The likelihood of Option I being done as Protocol text is slim. Doing Option I as a declaration is legally problematic. If Option I were done as a declaration, it is likely that less than half of the Parties to the Treaty would sign it. Although the relevant international law, namely the Vienna Convention on the Law of Treaties, does not speak about declarations, the legal status of a declaration by a group of Parties constituting less than half of the Parties to the agreement, particularly a declaration that goes to the core of the agreement's obligations, is likely to be dubious. Therefore the legal and practical basis for Option I is somewhat shaky. By contrast, international law specifically provides a foundation for Option II. Under the Vienna Convention on the Law of Treaties, "a State may, when signing, ratifying, accepting, approving or acceding to a treaty, formulate a reservation unless the reservation is prohibited by the treaty; the treaty provides that only specified reservations, which do not include the reservation in question, may be made; or the reservation is incompatible with the object and purpose of the treaty." (Vienna Art. 19). Moreover, "a reservation expressly authorized by a treaty does not require any subsequent acceptance by the other contracting States unless the treaty so provides." (Vienna Art. 20.1). See also Vienna Conv. Arts. 20.2-20.5, and Arts. 21-23.

Option I: The Contingent Commitment Option

[[Could be stated as a Kyoto Declaration or as an amendment to the U.S. Article on Evolution]]

“The Parties to the United Nations Framework Convention on Climate Change, meeting in Kyoto, Japan, on December 12, 1997, declare and agree that the adoption and implementation of the Kyoto Protocol for Annex I Parties, and the entry into force of the legally binding emissions budget commitments under Article [*] of that Protocol for Annex I Parties, are contingent upon:

- (1) the agreement, not later than [[DATE - 2000?]] by the Parties to provide full crediting for emissions reduced or sequestered as a result of Joint Implementation Activities conducted between Annex I and non-Annex I nations, including such activities conducted between [[DATE - 2000?]] and [[DATE - start of the first budget period]]; ~~[[OR]]~~ ~~[[AND]]~~♦**
- (2) the adoption, not later than [[DATE - prior to the commencement of the first Annex I budget in the Protocol]], and entry into force, not later than [[DATE - prior to the conclusion of the first Annex I budget in the Protocol]] of common but differentiated legally binding emissions budget commitments, by non-Annex I Parties to the UNFCCC constituting [Y] percent of global greenhouse gas emissions in [year: 2000?], consistent with the objective of the Convention as stated in Article 2 of the Convention.**

The question under paragraph (2) of this Declaration as to what, in [the year 2000?], constitutes [Y] percent of global emissions, shall be determined by the Parties, based on [100-year global warming potentials for all greenhouse gases, sources and sinks], at the time of adoption of the commitments by non-Annex I Parties.”

♦Note: If “AND” is used, then agreement on both *JI* and developing country targets are necessary conditions in order for the Kyoto Agreement to take effect. If “OR” is used, then either agreement on *JI* or agreement on developing country targets is sufficient for the Kyoto Agreement to take effect.

Option II: The Reservation and Withdrawal Option

[[Could be included in the final clauses to the Kyoto Protocol]]

Any Annex I Party may make a reservation to the Kyoto Protocol stating that its emissions budget obligations under Article [*] of the Protocol shall cease and it may withdraw from its obligations under that Article if

- (1) the Parties fail to agree, at the nth meeting of the Conference of the Parties [[DATE - 2000?]], to provide full crediting for emissions reduced or sequestered as a result of Joint Implementation Activities conducted between Annex I and non-Annex I nations, including such activities conducted between [[DATE - 2000?]] and [[DATE - start of the first budget period]]; [[AND]] [[OR]] ♦ ♦**
- (2) Either of the following occurs:**
 - (a) by the oth meeting of the Conference of the Parties [[DATE - prior to the commencement of the first Annex I budget in the Protocol]], non-Annex I Parties to the UNFCCC constituting [Y] percent of global greenhouse gas emissions in that year fail to adopt common but differentiated legally binding emissions budget commitments, or**
 - (b) by the pth meeting of the Conference of the Parties [[DATE- prior to the conclusion of the first Annex I budget in the Protocol]], common but differentiated legally binding emissions budget commitments fail to enter into force for non-Annex I Parties to the UNFCCC constituting [Y] percent of global greenhouse gas emissions,**

consistent with the objective of the Convention as stated in Article 2 of the Convention.

The question under paragraph (2) of this Article, as to whether the emissions from non-Annex I Parties constitute [Y] percent of global emissions in [[DATE]], shall be determined by the Conference of the Parties for that year, based on [100-year global warming potentials for all greenhouse gases, sources and sinks].

♦ ♦ Note: If “AND” is used, then a failure both to agree on JI for credit and to adopt and implement developing country targets would be grounds for an Annex I Party to withdraw from its emissions budget obligations. If “OR” is used, then a failure either to agree on JI for credit or to adopt and implement developing country targets would be grounds for an Annex I Party to withdraw from its emissions budget obligations.

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Using A Border Adjustment To Take The Lead On Climate Change Without Encouraging Runaway Shops

By Frank Muller and Andrew Hoerner

Policy

Negotiations are currently underway through the Framework Convention on Climate Change (FCCC) for a new binding agreement by industrialized countries to reduce their emissions of greenhouse gases over the next few decades. The agreement is due to be signed in Kyoto, Japan, this December. It implements a key principle of the convention that was signed by President Bush in 1992 and ratified by the U.S. Senate: that developed countries should take the lead in combating climate change. Nevertheless, on July 25, in what has become known as the Byrd Resolution (after its chief sponsor), the Senate resolved that the United States should not sign the agreement unless it includes "new specific scheduled commitments to limit or reduce greenhouse gas emissions for Developing Country Parties within the same compliance period." Underlying this resolution are concerns that the Kyoto agreement will cause a loss of American jobs to China and other developing countries. Are these concerns justified? If so, does the Byrd resolution solve the problem? Is there a better solution?

Will the Kyoto agreement cause widespread loss of American jobs to developing countries?

No. An effective agreement will lead over time to lower employment in some industries, such as coal mining and higher employment in others, such as natural gas, energy efficiency and renewable energy technologies. But it will not cause widespread loss of American jobs to developing countries. Two-thirds of US carbon dioxide emissions come from energy used in transportation and buildings -- activities that by their nature cannot be exported. The remaining one third comes from manufacturing. In most of manufacturing, except for a few energy-intensive industries, energy is too small a cost factor for emissions limits to provide any real incentive for relocating overseas. Furthermore, American coal miners will not lose their jobs to China because emissions limits will apply equally to all coal consumed in the United States regardless of its origin.

Is there a risk of runaway shops in energy-intensive manufacturing?

Yes. It is widely recognized that to achieve long-term reductions in US carbon dioxide emissions at least cost will require an economy-wide incentive as well as incentives and other measures targeted to individual sectors. The two main options are a carbon tax or a system of tradable carbon emission permits. Either would raise the cost of energy from fossil fuels. Energy is a significant cost factor in a small number of industries including aluminum, pulp and paper, iron and steel, and basic chemicals (see attached table). Energy costs have always influenced where investments are made in these industries. Following the fuel price increases of the 1970s, for example, aluminum production was relocated from Japan and (to some extent) Europe to countries with cheaper electricity, such as Australia. Similarly, future investments might be redirected from countries where energy costs are expected to rise due to carbon dioxide emissions limits to countries with lower emissions constraints or no limits at all. In total, the industries facing this risk account at most for about 1 percent of US employment. In other words, critics have vastly exaggerated the magnitude of the runaway shop problem. Nevertheless, these

industries provide good jobs that form an important part of the economic base of some regions of the country.

Does relocation overseas of energy-intensive production help protect the climate?

No. Carbon dioxide has the same impact on the global climate system wherever emitted. In some cases, a marginal reduction in global emissions may be achieved, if efficient new greenfield plants overseas displace aging US production capacity. But, in other cases, displacement may involve greater utilization of existing inefficient power plants or manufacturing capacity in a developing or transition country, resulting in a net increase in global emissions. More importantly, though, the relocation option greatly weakens the economic incentive for developing more efficient production technologies and substitute low-emission products. The climate change convention's goal of stabilizing atmospheric greenhouse gas concentrations can only be achieved through a transition to sustainable production and consumption patterns. Simply shifting emissions around the world puts off the task of undertaking this transition. And from a political perspective, the threat of job displacement is used by special interests to undermine climate protection efforts, not only in the United States but also in every other developed country.

Does the Byrd resolution solve the runaway shop problem?

No. Even if developing countries agree at Kyoto to accept specific scheduled commitments on the same timetable as developed countries, this would not greatly diminish the risk of runaway shops. Senator Byrd himself has accepted that commitments will need to vary among countries according to level of development. Whereas industrial countries will be required to reduce emissions below current levels, developing countries at most will face limits to future growth. An American steel corporation, for example, could still move production and emissions to Mexico or Indonesia and export steel back to the United States without either country breaching its treaty commitments. Countries like China, India, and Indonesia with relatively low per-capita emissions (one-tenth of US levels or lower) would likely have considerable room within their emissions "budgets" to accommodate expansion in energy-intensive manufacturing for export to industrial countries. The Byrd resolution fails to address this problem, yet threatens to undermine the negotiations by reneging on earlier agreements by the United States.

Do joint implementation and international emissions trading solve the runaway shop problem?

No. US negotiators have proposed that the Kyoto agreement allow joint implementation (JI) between industrial and developing countries and emissions trading among industrial countries. Some proponents of JI and international trading have argued that these schemes address jobs concerns by promoting emissions reductions in developing countries and enabling affected US firms to reduce their compliance costs. Under JI, a firm could invest in a low-cost emission reduction project in a developing country and gain a credit for a share of the reductions against its own domestic emissions. Under international trading, a firm would purchase emission rights (directly or indirectly) from another industrial country with lower emission reduction costs that is able to do better than its treaty commitments. Whatever the merits of JI and international trading

in enhancing flexibility and lowering costs, though, they do not necessarily solve the runaway shop problem.

At best, JI and international trading would reduce, but not eliminate, the cost disadvantage imposed on US-based energy-intensive manufacturers by an effective emission-reduction agreement. Under such an agreement and a JI regime that provides real and verifiable emission reductions in developing countries, not just paper reductions, emission credits would be unlikely to cost less than around \$20 per ton of carbon. The purchase of such credits would still impose a significant cost disadvantage on energy-intensive plants selling into highly competitive global markets.

At worst, the expansive JI and trading schemes advanced by some proponents within the Administration and environmental community could actually promote footloose corporate behavior. For example, in the JI case, a US steel firm could invest in improving the efficiency of a steel plant in Brazil (or alternatively Mexico or Indonesia) as part of a joint venture deal that also included construction of a new steel plant. The firm could use the emission reduction at the upgraded plant to gain a credit under JI against its US emissions while also importing steel from the new plant to displace its highest-cost US capacity. Similarly, in the case of tradable permits, an aluminum major facing high electricity costs for its eastern US plants (or the coal-based utility which supplies it) might invest in Russia's inefficient and underutilized power supply and aluminum industries and close its oldest US plants. As Russia is expected to easily meet its treaty commitments, the deal could be partly financed through the sale of internationally tradable emission rights to the US utility. In these cases, JI and international trading form an integral element of the financing of deals that shift American jobs overseas.

Why not simply exempt energy-intensive industries from emission limits?

The manufacturing sector or particular energy-intensive industries could be exempted from a carbon tax or permit scheme. However, this would increase the cost to the economy as a whole by requiring a greater emission reduction effort in other sectors. It also would greatly diminish the incentive to improve production technologies in the exempted industries, develop substitute low-emission products and generally shift to more sustainable consumption patterns. Moreover, as the BTU tax debate demonstrated, exempting heavy industry would undermine broader support for the tax or permit scheme.

What is a border tax adjustment?

Under the "destination system" of border tax adjustments (BTAs), traded goods are subject to the taxes of the importing ("destination") country and exempted from the taxes of the exporting ("origin") country. For instance, gasoline trucked from Toronto to Buffalo is exempted from paying gasoline tax in Canada and subject to gasoline tax in New York, at the combined New York/federal tax rate. BTAs are a necessary part of a tax on national or in-state consumption, and are a nearly universal feature of sales, excise, value added and other taxes. Because BTAs are required for consistent treatment of a consumption tax base they are regarded as a normal part of the tax and not as a form of local favoritism.

How can a border tax adjustment solve the runaway shop problem?

BTAs are the most straightforward way to prevent firms in low-tax jurisdictions from preying on energy-intensive industries in high tax jurisdictions. A BTA system would rebate the tax on fuels used to produce energy-intensive exports (such as metal ingot and certain bulk chemicals), thus maintaining the competitiveness of exports. A comparable tax would be imposed on imports of energy-intensive basic materials to put foreign firms on a level playing field in the home market. This BTA system is a natural part of a tax on fuels used to produce goods consumed domestically.

BTAs should be distinguished from tariffs and other forms of industry protection. Energy-intensive manufacturers (e.g. basic chemicals, aluminum) already undertake large investments in developing countries that sometimes displace American production and jobs. Various factors make such investments attractive including lower resource costs and the prospect of winning large new markets. A BTA ensures that job displacement is not accelerated by the FCCC, but does not favor domestic over foreign production or otherwise alter underlying market conditions. Aluminum or ethylene production that already would have been shifted overseas, for example, will still be shifted. But it won't be shifted because of climate protection policies.

Why are border tax adjustments controversial?

Some advocates of unbridled free trade argue that BTAs for taxes on carbon embodied in energy-intensive traded goods are or should be barred by the General Agreement on Tariffs and Trade (GATT). (BTAs on the fuels themselves are universally accepted.) There are three major arguments for this position:

The basic policy argument. Many GATT experts take seriously the conclusion of the never-adopted Tuna-Dolphin decision that trade measures can be based only on taxes on *products*, and not on taxes on *processes*.

The practicality argument. Some administrators have argued that such BTAs would be *hard to enforce or easy to abuse*.

The technical legal argument. Some legal scholars argue that the rebate of taxes on embodied fuels is barred by the GATT Subsidies Code's ban on rebating *prior stage cumulative indirect taxes*.

Does the GATT forbid border tax adjustments on "process" taxes?

No. The GATT allows BTAs on taxes that fall "directly or indirectly" on like products. It was the intent of the original GATT negotiators that process as well as product charges be border adjustable. This language was first introduced in 1946 by U.S. negotiator Oscar B. Ryder at the London Preparatory Committee as part of the process of drafting the Havana Charter, the precursor to GATT. The Brazilian delegate, Mr. Rodrigues, demanded to know what was meant by the addition of the term "or indirectly." Mr. Ryder replied that the language was to allow border adjustments on "a tax, not a tax on a product as such, but on the processing of a product, which are covered by the word 'indirectly' here." The process/product distinction proposed by the Tuna-Dolphin Panel, like the Tuna-Dolphin decision itself has never been adopted by the GATT contracting parties or by the World Trade Organization (WTO).

Can border tax adjustments be administered effectively?

Yes. A BTA system for carbon taxes would be no more complicated than the BTA systems already in place for many other taxes. For instance, the U.S. administers border tax adjustments on hundreds of chemicals under the Superfund toxic chemical excise tax. BTAs apply to all taxed chemicals, and to all products manufactured primarily from a taxed chemical. If the producer documents the amount of taxed chemical used in the manufacture, the tax is based on the documented amount. Otherwise, it is taxed at a rate set by Treasury regulation, based on the amount of the taxed chemical that is used to manufacture the same product in the U.S. under the predominant method of production. This tax was held by the GATT to be consistent with international trade rules. The Ozone-Depleting Chemicals (ODC) Tax has similar BTA provisions, except that it is a "process" tax, in that it applies to products manufactured with taxed substances but not physically incorporating them, such as electronic parts cleaned with ODCs.

BTAs on the embodied carbon in energy-intensive goods would be administratively identical to the BTAs on these existing taxes. For plausible carbon tax rates, only a handful of energy-intensive basic materials — fewer than are covered under the existing Superfund chemical excise — would have price increases great enough to justify border adjustment.

Are border tax adjustments on taxes on embodied carbon barred as "prior stage cumulative indirect" (PSCI) taxes.

No. Border adjustment of carbon taxes is clearly not barred by the ban on PSCI taxes, for two reasons. First, the Uruguay Round Amendments to the GATT specifically excluded taxes on fossil fuels from the scope of the PSCI tax ban. Second, energy taxes are not PSCI taxes because they are not "cumulative." Although energy is used in every phase of the manufacturing process, each unit of fuel is taxed only once. This contrasts with the standard example of a PSCI tax, the cascade tax. A cascade tax is a tax on the value of all products sold, including goods used as materials in the manufacture of other goods. Cascade taxes cumulate, because the tax on, for example, sheet steel used to make an automobile, becomes part of the cost of manufacturing the automobile and the tax is *itself taxed again* when the automobile is sold. Cascade taxes were once common in Europe, but are now extinct in all but a few developing nations, having been replaced by VATs (which, like energy taxes, are not cumulative).

If the United States chooses a domestic emission trading scheme rather than a carbon/energy tax, could such a scheme include a border adjustment?

The Clinton Administration has not proposed specific domestic policies to implement the proposed Kyoto agreement. Current thinking within the Administration, however, favors a domestic tradable permit scheme over a carbon/energy tax. Such permits either would be auctioned by the government (most likely to coal, oil and gas companies at the point where carbon fuels enter the economy) or given away under "grandfathering" rules (most likely to utilities and other major industrial emitters). In principle, a border adjustment (at the current market price of permits) could be levied on imports and

rebated on exports of energy-intensive products as part of such a scheme. Doing so, however, would raise different and more difficult international legal and policy issues than in the case of a tax.

Whereas border adjustments on consumption taxes have long been used and accepted under international trade rules, this is not true for environmental requirements like emissions permits. In implementing a border-adjusted permit scheme, the United States could not rely on the above mentioned BTA provisions of Article III of the GATT, except by analogy, and therefore probably would have to claim an environmental exemption under Article XX from GATT trade rules otherwise prohibiting import charges and export subsidies. Such a scheme, therefore, would be more vulnerable than a BTA to a challenge through the WTO by a country seeking to exploit the climate change convention for competitive advantage. GATT and WTO dispute panels have not looked favorably on claims for environmental exemptions. Indeed, to date, no country has successfully defended the use of Article XX to justify an environmental policy measure that runs foul of GATT provisions. Given this history, the availability of border adjustments for tradable permits cannot be guaranteed without a multilateral agreement specifically allowing them as part of the Kyoto accord.

Although elements of the trade community might object to including such provisions in the Kyoto accord, there are precedents for including even stronger trade provisions in multilateral environmental agreements (e.g., Montreal Protocol, Convention on International Trade in Endangered Species). Article 5.3 of the FCCC states "Measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade." The earlier discussion makes clear that BTAs do not constitute "arbitrary or unjustifiable discrimination" within the meaning of this article. Although legally different, the trade policy arguments for allowing border adjustments for auctioned emission permits are virtually identical. However, in the case of grandfathered permits, the trade community might legitimately argue that border adjustments at the market price of the permit unjustifiably discriminate in favor of domestic producers by overcompensating them for the actual costs imposed by the emission permit scheme. In summary, the runaway-shop problem can be avoided with a border-adjusted carbon tax but achieving the same goal with tradable permits may require a specific provision in the Kyoto agreement overriding GATT trade rules.

Frank Muller is Director and Andrew Hoerner is Research Director of the Environmental Tax Program. For a more detailed discussion of border tax adjustments, see J. Andrew Hoerner and Frank Muller, "Carbon Taxes for Climate Protection in a Competitive World," Center for Global Change, University of Maryland, June 1996 (available from the authors, and also published in an abbreviated form by the Swiss Federal Office for Foreign Economic Affairs in E. Staehelin-Witt and H. Blöchliger, "Ökologisch orientierte Steuerreformen," Verlag Paul Haupt, Bern, Switzerland, 1997.)

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Direct Cost Impact of a \$50 per ton Carbon/Energy Tax for the 24 Most-Affected Manufacturing Industries				
Industry Groups and Industries	Energy Tax (% of Shipments)	Employment (1,000s)	Cumulative Employment (% of manufacturing)	Cumulative Value of Shipments (% of manufacturing)
Lime	23.9%	4	0%	0%
Primary Aluminum	15.0%	20	0%	0%
Cement Hydraulic	13.7%	16	0%	0%
Alkalies and Chlorine	9.9%	8	0%	0%
Industrial Gases	8.4%	9	0%	1%
Nitrogenous Fertilizers	8.0%	7	0%	1%
Paper Mills	7.4%	30	1%	1%
Electrometallurgical Products	7.2%	5	1%	1%
Paperboard Mills	6.2%	51	1%	2%
Blast Furnaces and Steel Mills	5.9%	177	3%	3%
Industrial Inorganic Chemicals nec	3.9%	79	3%	4%
Beet Sugar	3.7%	8	3%	4%
Synthetic Rubber	3.7%	12	3%	4%
Cellulosic Manmade Fibers	3.7%	11	3%	4%
Pulp Mills	3.5%	17	3%	4%
Wet Corn Milling	2.8%	10	3%	4%
Flat Glass	2.7%	13	3%	4%
Industrial Organic Chemicals nec	2.4%	101	4%	6%
Glass Containers	2.3%	35	4%	6%
Primary Nonferrous Metals nec	2.3%	11	4%	7%
Mineral Wool	2.2%	18	4%	7%
Gray and Ductile Iron Foundries	2.1%	76	5%	7%
Petroleum Refining	2.0%	74	5%	12%
Pressed and Blown Glass nec.	2.0%	33	5%	12%

Source: Analysis by J. Andrew Hoerner using energy consumption estimates from the U.S. Department of Energy's Manufacturing Energy Consumption Survey. Employment and value of shipment data is from the National Bureau of Economic Research's Productivity Database. Manufacturing industries are defined at the four digit SIC level. All data is for 1991.

Notes: The tax would apply to all fossil fuels at a rate of \$50 per ton of carbon and to large-scale hydro and nuclear electricity at the national average rate for utility fossil-fired generation. Such a tax is at the high end of proposals by advocates of stronger climate change policy, and ideally would be phased in over 5-10 years. It translates into 13 cents per gallon on gasoline, and measured in terms of its impact on electricity is about three times President Clinton's 1993 Btu tax proposal. Due to high transportation costs and other factors, some of the above industries (e.g., cement) face limited international competition, and therefore little risk of job exports. All manufacturing accounted for 15.3 percent of U.S. non-farm employment in 1996.

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Trading

U.S. Views: International Greenhouse Gas Trading System

The U.S. has proposed an international greenhouse gas (GHG) trading system as a mechanism to achieve greenhouse gas emission reductions cost effectively.

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Effective policies for slowing and eventually halting global climate change must minimize the cost of achieving substantial reductions in global emissions. The key to lowering costs is to allow maximum flexibility in reducing emissions, while ensuring the strict accountability of all parties involved. Such flexibility and accountability can best be attained through a system of binding emissions budgets, with international trading. Allowing trading between nations with low and high marginal costs of abatement could reduce the costs of achieving significant emission reductions by as much as 50 percent. The ultimate effectiveness of a trading system in lowering the costs of reducing emissions will depend on its ability to keep transaction costs low, and its success in creating and maintaining the credibility of the commodity being traded.

Creating an international emission trading system requires three initial conditions: a legally-binding allocation of emission authorizations (or starting emission budgets); a standardized and verifiable system of measurement and reporting that enables actual emissions to be matched to authorized amounts; and an effective mechanism to ensure that all Parties are complying with their obligations.

Preconditions for Participation in International Greenhouse Gas Trading System

Legally Binding Emissions Limit. Legally binding emission limits or budgets are a necessary precondition for any international greenhouse gas emissions trading system. The U.S. expects that an international agreement will identify a comprehensive list of greenhouse gas sources and sinks, and establish the legal limit as a uniform percentage of those emissions from 1990. According to the U.S. proposed protocol, the budgets would cover a fixed period of "x" years (where x would be at least 3 years, but no greater than 10 years). Under this approach, each Party would receive its initial budget allocation for the budget period in "tonnes of carbon equivalent emissions allowed", hereafter referred to as "tonnes-allowed".

Measurement and Reporting Systems. Verifiable measurement and annual reporting of emissions is a critical precondition to any international trading system. Adequate mechanisms for measuring and reporting actual emissions of greenhouse gases must exist so that compliance with legally binding emission limits can be verified. The current IPCC guidelines allow a wide range of options for emissions measurement; therefore, standardized methods would be needed to ensure a consistent, minimum level of accuracy for all Parties. Each Party would provide annual emissions and budget adjustment reports to the FCCC Secretariat, which would record, track, and publish annual emissions inventories and budget balances.

Compliance Mechanisms. All Parties must be able to credibly demonstrate compliance with their emission targets. In addition to international mechanisms to assure compliance with budget commitments, parties should be encouraged to build mechanisms domestically. Before participating in emissions trading, a Party must meet certain requirements. First, the Party must have an adequate monitoring and reporting system for tracking its emissions of greenhouse gases; and second, the Party must establish a certification and verification mechanism (which could mean identifying a government person as the "authorizing official") for budget adjustments. Further guidelines must be developed to specify these minimum standards, including evaluation requirements for in-depth review teams.

Elements of the International GHG Trading System

Tradeable Units. The tradeable unit would be established as a "tonne of carbon equivalent emissions allowed" (tonne-allowed). The FCCC Secretariat would record the initial budget of tonnes-allowed for each Party (the Secretariat would likely use an electronic database, with an "account" for each Party), together with the identifying information necessary to track trades of specific tonnes-allowed, including country-of-origin and budget period of issuance.

Standardized Reporting by Parties. All Parties must provide annual emissions reports to the FCCC Secretariat. To facilitate the accounting process, the Secretariat would likely use a standard electronic reporting format which Parties would be required to use in order to minimize administrative costs and reduce errors. In addition to the annual reports on emissions to be required of all Parties, those Parties participating in an international trading system would have to report annually on the status of their budget. Specifically, the Party would identify any tonnes-allowed traded and would identify sufficient tonnes-allowed to account for its annual emissions. The Secretariat would likely use a simple form to capture the needed tracking information.

Centralized Recordkeeping and Accounting. The FCCC Secretariat already records, tracks, and publishes emissions inventory reports based on the data submitted by each Party in its national communications. Under the proposed protocol, the Secretariat would be authorized to administer budget transactions for Parties which meet the monitoring, reporting, verification, and compliance requirements established by the Parties. At least annually, the Secretariat would record any transfers of tonnes-allowed. The Secretariat would officially record a transfer by deducting the specified number of tonnes-allowed from the selling Party's account and adding that quantity to the buying Party's account. After all the transfers have been officially recorded by the end of each year, the Secretariat would retire enough tonnes-allowed from each Party to account for its annual emissions, as specified by each Party's annual report.

At the end of the budget period: The FCCC Secretariat would complete a final accounting of each Party's emissions and budget adjustments. If a Party held more than enough tonnes-allowed to match its actual emissions, the Secretariat would automatically transfer the unused tonnes-allowed into that Party's account for use during the next budget period. If a Party did not have sufficient tonnes-allowed to cover all of its emissions during the budget period, the Party would be permitted to buy tonnes-allowed from other Parties to make up the difference. A Party could also have a limited number of tonnes-allowed automatically deducted from its subsequent budget in order to remain in compliance. A predetermined penalty would be associated with this type of "borrowing." For example, the Party would have its subsequent budget reduced by 12 tonnes-allowed in order to transfer 10 tonnes-allowed into the current budget period. (The two "penalty" tonnes would be immediately retired by the Secretariat.)

Emissions Trading Restrictions for Parties Not in Compliance. Parties must meet initial and ongoing minimum measurement, verification, and reporting requirements in order to maintain eligibility to participate in trading. In-depth review teams would periodically assess a Party's compliance according to minimum standards established by the Parties. The trading system is designed to foster and facilitate compliance with Parties' emissions budget by providing a mechanism which encourages low cost emission reductions but requires significant, automatic consequences for failure to achieve the required budget levels. Specifically, the FCCC Secretariat would be authorized to implement any emissions trading restrictions established by the Parties. Emissions trading restrictions would include preventing a non-complying Party from selling tonnes-allowed, or allowing the sale of such tonnes-allowed, but restricting their use by another Party until the question of

compliance is resolved. In addition, Parties will have the discretion to take any further action deemed necessary to address non-compliance.

Party Authorization Required for Trades Initiated by Domestic Entities. Although any Party could permit private entities to take actions that would lead to international trades of tonnes-allowed, the Party would have to provide official authorization before the tonnes-allowed could be transferred to the purchaser (or acquired by the buyer). Such verification would be necessary because the Party is legally responsible for meeting its commitments, and transfers modify a Party's compliance obligation.

National Mechanisms for Meeting Budget Requirements.

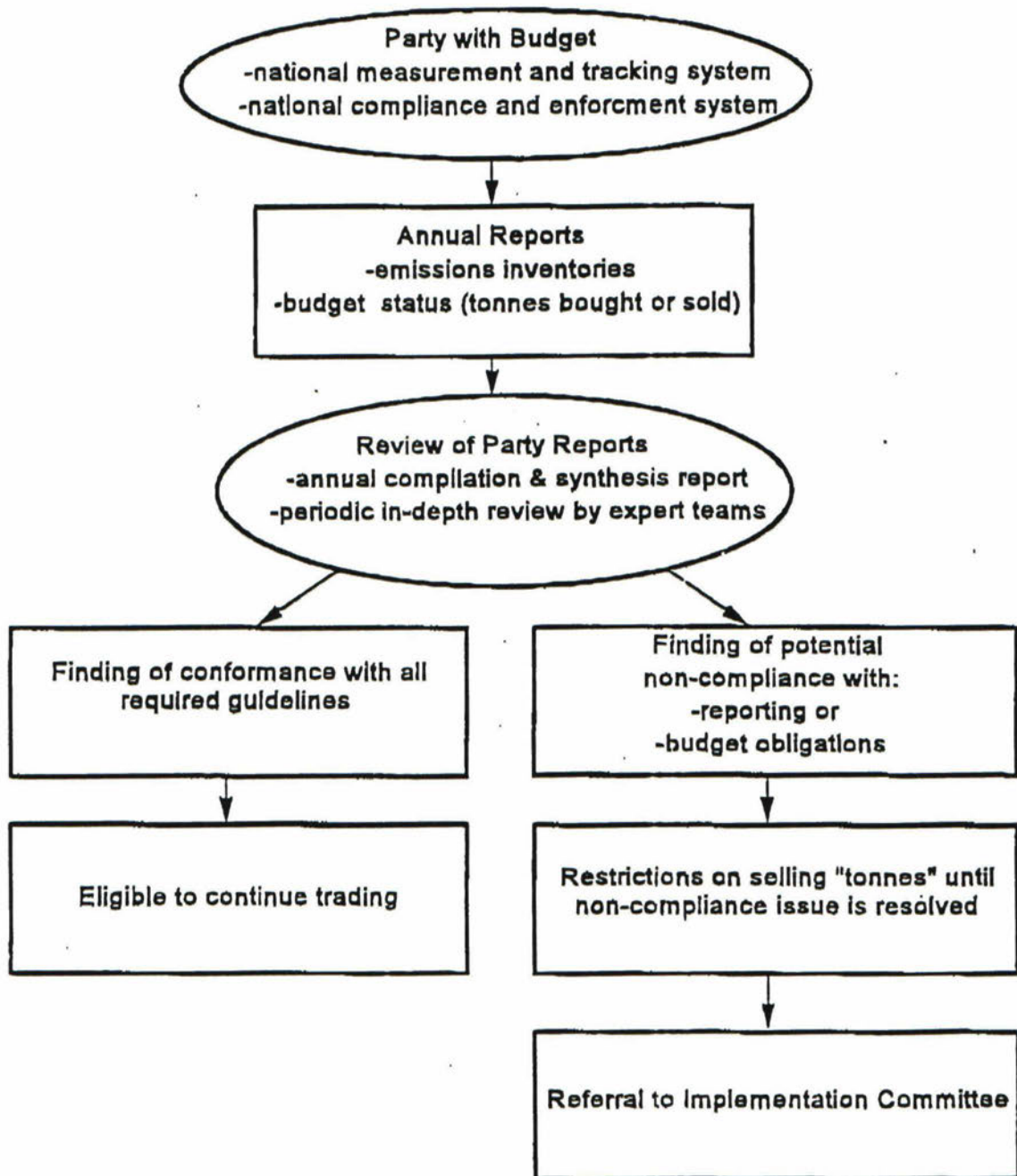
Parties with legally binding targets would not be required to have a domestic trading system to participate in the international greenhouse gas trading system. For example:

1. Party "A" could adopt a policies and measures approach (e.g. carbon taxes, efficiency standards) to reduce greenhouse gas emissions, while also trading tonnes-allowed internationally in order to reduce the cost of meeting its obligations.
2. Party "B" could adopt a domestic emissions trading program to control its emissions. It might allocate its entire budget of tonnes-allowed to an appropriate set of private entities which are responsible for greenhouse gas emissions. These private entities would monitor and report their emissions to the Party, and the Party would have domestic enforcement mechanisms to hold each source accountable for its emissions. Then, a domestic entity could choose its own compliance strategy. For example, a domestic entity could reduce its own emissions and sell its "extra" tonnes-allowed on the domestic market or internationally, with approval from its own Party. Another domestic entity could choose to purchase tonnes-allowed from the international market (with approval from the appropriate Parties).
3. Party "C" could adopt a combination of approaches to reduce its emissions. For example, it could use policies and measures for some sectors and an emissions trading system for other sectors. Under this approach, domestic entities in those sectors which are assigned tonnes-allowed in a domestic emissions trading system could participate as described above for Party B. At the same time, the government could choose to purchase or sell tonnes-allowed to account for emissions from those sectors being addressed by policies and measures.

Conclusion

If the Agreement establishes a clear environmental goal with legally binding targets, Parties must meet certain minimum standards for monitoring, verification, compliance, and reporting in order to demonstrate compliance. These minimum standards are also necessary for an international greenhouse gas emissions trading system. Such a trading system will be an extremely valuable tool, providing Parties with the flexibility to achieve their commitments at the lowest possible cost.

International Trading Reporting & Verification Process



*Legally binding budgets established in the International Agreement

International Emissions Trading: Commonly Asked Questions

- 1. Why does the U.S. believe that emissions trading programs are cost effective tools to achieve emissions reductions?**

The U.S. view is based on the experience with the U.S. sulfur dioxide (SO₂) trading program to reduce the emissions from electric utilities which cause acid rain. When the authorizing legislation was developed in 1990, a typical policies and measures program (which would have required each electric utility boiler to install standard pollution control technology) was estimated to cost about \$5 billion annually. To achieve the same level of emissions reductions using an emissions trading program (which would allow electric utilities to choose the most cost effective approach for each boiler) was estimated in 1990 to cost about \$4 billion annually. Once the program actually became effective, pollution control costs dropped dramatically, and with trading, the U.S. Government Accounting Office has since estimated that the SO₂ program is costing about \$2 billion annually. The U.S. has already experienced significant emission reductions under the first phase of the control program: by 1995, the U.S. experienced a 30% drop in national SO₂ emissions from 1980 (and the monitoring results show that the 263 Phase 1 units reduced their emissions by 3 million tons from 1994 to 1995 - a 40% reduction attributed to the first year of the SO₂ trading program).

- 2. Why is the cost of compliance with the U.S. SO₂ trading program so much lower than anticipated when the program was first designed?**

The cost of reducing a ton of SO₂ from the utility sector has dropped dramatically from the initial estimates. Recent studies have highlighted the innovation and efficiency improvements in pollution controls which have developed since the SO₂ trading program was implemented. In the past, policies and measures in the United States prescribed the specific scrubber technology required to meet a required removal efficiency. Scrubber costs have dropped significantly in the last six years, and their sulfur removal efficiencies have improved. In addition, there have been innovations in the blending of high-sulfur and low-sulfur coals, while expected increases in cost associated with the increased use of low sulfur coal have not materialized. The market mechanism provides an incentive to spur the efficiency and innovation which lowers costs.

- 3. How would Party "A", using policies and measures, participate in an international emissions trading system?**

Party "A" has imposed various policies and measures on its domestic entities in various emission sectors. Assume that by the last year of the budget period, its national policies and measures have been extremely effective, and Party "A" will have 50 million "tonnes-allowed" left over after deducting all of its emissions. If Party "B" has estimated that it will need an additional 30 million "tonnes-allowed" to meet its budget, then Party "A" could sell 30 million tonnes-allowed to Party "B" at a negotiated price that would be acceptable to both Parties (presumably, at a total price less than the cost for Party B to reduce 30 million tonnes domestically).

4. How would a Party "B" using a domestic trading system, participate in an international emissions trading system?

Party "B" could develop a domestic trading system which is designed to transparently delegate its tonnes-allowed to its domestic entities. Domestic entities would then try to make emission reduction choices based on both domestic and international costs of compliance. Because Party B would presumably have a compliance system which requires its domestic entities to retain enough "tonnes-allowed" to account for their emission reductions, Party B may be willing to approve its domestic entities' request to purchase or sell tonnes-allowed with fairly minimal government involvement in the details leading to the transaction. Nevertheless, the official transfer of tonnes-allowed cannot take place without official review and authorization of the transaction by Party B.

Detailed example of a Trade Initiated by a Private Company:

Party B allocates tonnes-allowed to Company X, requiring Company X to hold enough tonnes-allowed to account for its emissions. Company X installs energy efficient technology which reduces its emissions. Company X determines that it now has extra tonnes-allowed, which it could choose to sell either domestically or on the international market. Company X could choose to sell its extra tonnes-allowed to Party A (at a mutually agreeable price). However, Party B would have to authorize the transaction before the FCCC Secretariat could officially record the transfer, deducting the specified number of tonnes-allowed from Party B's account and adding that quantity to Party A's account.

Summary of Scenarios:

Government to Government trades
(domestic trading system is not necessary for either country)

Company X request, approved by its Government, trades with another Government
(Government of Company X has delegated tonnes-allowed to its company in a transparent domestic trading system; trading system is not necessary for the other government)

Company X request, approved by X's Government, trades with Company Y, approved by Y's Government
(Assumes domestic trading systems in both countries)

5. What is the Accounting Role of the FCCC Secretariat?

The FCCC Secretariat serves as the "bookkeeper" for tracking emissions inventories and budget adjustments. The FCCC Secretariat would create a simple computerized database and with the approval of the SBSTA/SBI develop standardized forms to make tracking easier to implement. The Secretariat would set up an account for each Party containing the initial allocations set in the Agreement. The Secretariat would then record emissions and budgets based on the annual reports submitted by Parties in their national communications. After determining that all necessary information was properly included, the Secretariat would implement budget transfers reported by the Parties by adjusting each Party's account to add any "tonnes-allowed" purchased and subtract any "tonnes-allowed" sold by the Party. The Secretariat would then permanently deduct (retire) enough "tonnes-allowed" to account for each Party's annual emissions. At the end of the budget period, the Secretariat would automatically record any budget adjustments required by banking and borrowing provisions.

6. What is the Role of the Private Sector?

Although a trade does not officially take place until the Secretariat records the transfer at the end of the year based on each Party's annual submission, there is a role for the private sector to facilitate the private transactions which lead to the official transfer. Indeed, private brokers may negotiate trades among Parties at any time during the year. "Tonnes-allowed" might be informally exchanged several times through various Parties during the year, with only certain transfers being officially recorded by the Secretariat. The Secretariat might facilitate the role of brokers by creating a "market account" (separate from the accounts created for each Party) where parties could transfer their tonnes-allowed to be held until the broker eventually finds another Party to purchase those tonnes-allowed for compliance. It might be possible to allow brokers and other various nongovernmental organizations to participate directly in official transfers recorded by the Secretariat, although there is some concern about the level of resources which would be required.

7. What happens at the end of the budget, if a Party does not have enough tonnes allowed to account for all of its emissions?

If there are cases where a Party does not have enough tonnes-allowed to cover all of its emissions during the budget period, the Party would be permitted to buy enough tonnes-allowed from other Parties to make up the difference. However, if the Party still does not have enough tonnes-allowed to account for its emissions, then the Secretariat would automatically transfer a sufficient quantity of "borrowed" tonnes-allowed from the Party's subsequent budget period into the Party's current account. The Secretariat would simultaneously deduct the appropriate number of "penalty" tonnes-allowed from the Party's subsequent budget period and immediately transfer those tonnes-allowed into a permanent "retirement" account. In addition, a Party would be restricted from selling any additional tonnes-allowed until the question of compliance was resolved.

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Planetary Roulette: Gambling with the Climate

by Robert Repetto & Jonathan Lash

Because of human actions, the Earth's climate is changing more rapidly than it has at any time in human history. This December, the 167 nations that ratified the 1992 United Nations Framework Convention on Climate Change (FCCC) will meet in Kyoto, Japan, to negotiate over how to prevent climate from moving outside the range of human experience. Among the issues they will have to confront are a global environment facing unprecedented risks, reduced dependence on the fossil fuels that have powered the world economy since the Industrial Revolution, new economic and political relations between the world's developed North and developing South, and potentially burdensome restrictions on nations' economic sovereignty. Rarely have the mechanisms for national decision-making and international cooperation been subjected to comparable strains. In short, what happens in Kyoto will signal the prospects for managing what could prove to be the most momentous environmental problem in human history.

Driving these negotiations is the certainty that rising greenhouse gas emissions, if left unchecked, will cause ever more serious climate change. Fossil fuel burning, agriculture, and deforestation are putting

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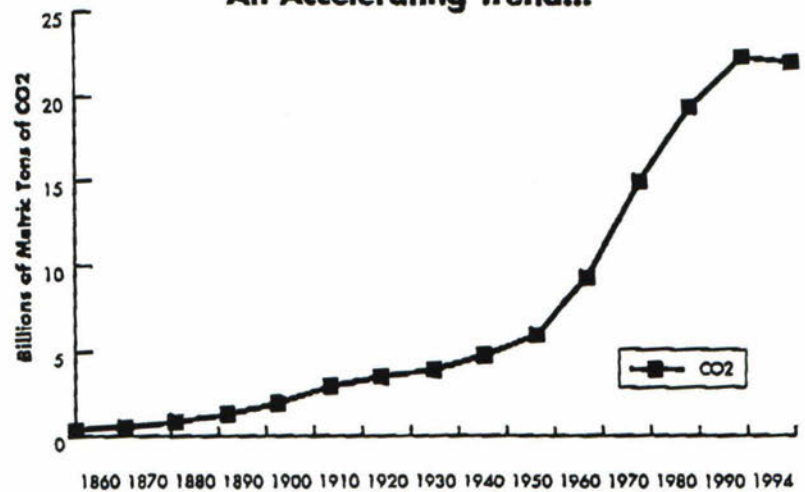
carbon dioxide, methane, nitrous oxides, and other greenhouse gases into the atmosphere faster than natural processes remove them. Carbon dioxide (CO₂) concentrations have risen by 30 percent and methane concentrations have doubled since preindustrial times. These gases raise the Earth's surface temperature by letting solar radiation through while blocking the reflection of infrared radiation back into space, as a greenhouse does. The existence of the greenhouse effect is indisputable: Without it, the Earth would be too cold to inhabit. The latest assessment by the Intergovernmental Panel on Climate Change (IPCC), a scientific body set up to coordinate and assess climate research, concludes that accumulating greenhouse gases have already produced a discernible effect on today's climate.

*Rain and snowfall, wind
and ocean currents,
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change drastically.*

Since some greenhouse gases stay aloft for long periods and because the oceans store a huge amount of heat, warming will continue and persist irreversibly for centuries even after accumulation stops. Consequently, the observable change in the climate, at any time before equilibrium is restored, will be much less than what emissions up to that point have made inevitable. Put simply, the climate problem will always be worse than it appears to be.

Unfortunately, climate change implies much more than gradually rising temperatures. Rain and snowfall, wind and ocean currents, evaporation rates, water runoff into rivers and lakes, and other aspects of climate are likely to change drastically. Heavy rains and snowstorms in higher latitudes—like those that caused devastating flooding in the upper midwestern United States last spring, and in Poland and the Czech Republic last summer—may become more common. Intense hurricanes and cyclones like those that hit Florida and the Caribbean during this decade may occur more frequently. These possibilities have alarmed property insurance and reinsurance providers about their exposure to catastrophic loss claims of \$50 billion or more for single events. Farming regions in the interiors of Africa, Asia, and North America may experience drought and punishing heat waves. Paradoxically, shifts

An Accelerating Trend...



Global Carbon Emissions from Fossil Fuels, 1860-1994

Source: "Trends '93, A Compendium of Data on Global Change," Carbon Dioxide Information Center, Oak Ridge National Laboratory

in the Gulf Stream could make northern Europe much colder. The disintegration of the Antarctic ice cap would raise sea levels. No country is exempt from the risks of climate change.

The biological consequences of climate change are pervasive but uncertain. The range and lifecycle of organisms from trees to coral reefs to mosquitoes are sensitive to climatic changes. In agriculture, wetter weather, a longer growing season, and more carbon dioxide in the air would be good for crops; but increased evaporation of moisture from the soil, destructive rainfall in heavy storms, and weather more hospitable to pests would not.

The only way to avoid these risks is to stabilize the atmospheric concentrations of greenhouse gases. That would ultimately require reducing current global emissions by 50 to 60 percent over the next century, even as population and economic output grow. No small task, this means using natural gas, a low-carbon fuel, instead of coal and oil in most applications. Noncarbon energy sources such as hydroelectric, solar, and nuclear energy will have to provide much more of the total supply. Buildings, transport systems, and industrial processes will have to be redesigned to use energy much more efficiently.

Since it takes decades to replace existing capital stock and technologies, a gradual transformation is the only option. The efficient way to start this transformation is by raising fossil energy prices persistently,

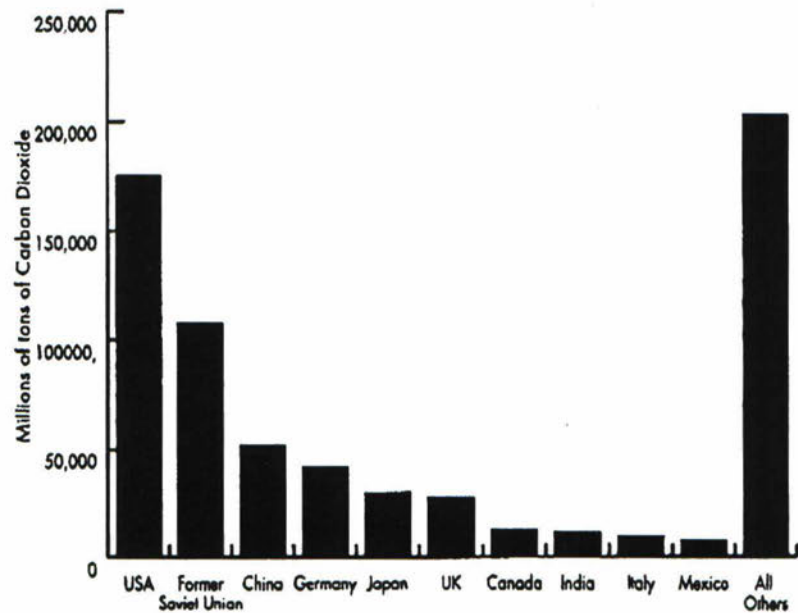
preferably by imposing carbon taxes. Even if phased in over decades, the necessary rise in fossil energy prices would affect economies profoundly: Energy-intensive industries would face higher costs; coal, the most carbon-intensive fuel, would be virtually phased out; coal- and oil-exporting countries would lose markets, and consumers' costs of living would rise. Inevitably, the adjustments would create economic losers in entire industries, regions, and nations.

WINNERS AND LOSERS

Although the fear of loss, and not the hope of gain, has dominated industrial strategies, there would also be winners. Higher fossil fuel prices would provide attractive incentives for producers of alternative energy and of energy-saving products and technologies. As nations are forced to restructure their tax systems by using energy tax revenues to replace other business and consumer taxes, firms and households that use energy more efficiently would come out ahead. High-tech industries would probably gain, on balance. Moreover, reduced coal and oil combustion would cut back on health and environmental damages caused by ordinary air pollution, even without the need for additional pollution-control equipment. Balancing these costs and benefits, economic models predict that achieving interim emissions-reduction targets of the magnitude likely to be discussed at Kyoto would have modest macroeconomic impacts—but that provides scant comfort to potential losers.

International political conflicts also create roadblocks: Although no one country or region can unilaterally prevent climate change, industrialized and developing nations assess responsibilities for the problem differently. The United States, the largest source of current and prior emissions, now contributes only about 22 percent of global carbon dioxide emissions, so even a total shutdown of the American economy would not solve the problem. Emissions from developing countries are rising rapidly, although they are still minuscule in per capita terms. Merely to hold global emissions stable over the next 10 years in the face of probable increases in developing country emissions would require a 35 percent reduction among Organization for Economic Cooperation and Development countries from current levels—and an even greater reduction if expected trends continue. Many U.S. policymakers oppose any cuts unless developing countries also limit emissions. Developing countries, however, say that they should not be held responsible for

Top Ten Polluters



Cumulative Emission of Carbon Dioxide, 1950-94

Source: The World Resources Report, 1996-97.

solving a problem that is almost entirely due to the cumulative effect of prior emissions from wealthy nations. Now, they argue, rich countries can afford to cut back on lavish energy consumption, but the developing world needs more energy in order to eliminate widespread poverty.

Although international cooperation is essential, countries' interests differ depending on whether they have coal, oil, gas, hydro-, or nuclear energy resources, or none; whether their industries are energy-, labor-, or technology-intensive; and whether geography, current climate, and economic structure make them more or less vulnerable to the foreseeable effects of climate change. Canada and Russia might actually benefit from warmer nights, warmer winters, and longer growing seasons. Globalized postindustrial economies, like that of the United States, can adapt to the direct effects of climate change. Underdeveloped deltaic regions such as Bangladesh and low-lying island nations may lose much of their territories to flood surges and rising seas.

China, India, and other developing countries with meager per capita energy consumption, substantial coal reserves, and pressing economic growth imperatives will oppose limitations on their energy use.

Fuel-exporting Australia and Organization of Petroleum Exporting Countries (OPEC) members will oppose a potential loss of markets and foreign exchange earnings. Japan, which uses energy much more efficiently and has much lower per capita emissions than the United States, is reluctant to make equivalent percentage reductions. France and Norway, which already rely little on coal and oil and so have relatively fewer emissions to reduce, also argue for special consideration. Britain, which phased out an inefficient coal industry in the early 1990s, supports sharp reductions but only if they are measured from a 1990 base line.

Public opinion, although strongly supportive of environmental protection, has exerted little political force on the climate issue. People mobilize much more readily around immediate and tangible environmental problems, such as water pollution and acid rain, than around an uncertain threat that will mainly affect succeeding generations. In the absence of any defining event comparable to the discovery of the Antarctic "ozone hole," scientific uncertainties remain paralyzing. The extraordinary weather events of the last several years may be a consequence of climate change, but they also may not. Scientific models that factor in the effect of clouds, air pollution, and ocean temperature can now track large-scale climate patterns and trends more accurately, but they still cannot predict confidently how the climate will change in specific locations—and that is what concerns people most.

Against these odds, the international community has already begun to build new institutional mechanisms for cooperative action. The FCCC signed at the 1992 Earth Summit in Rio de Janeiro, Brazil, laid the groundwork for subsequent negotiations. The IPCC, instituted in 1988, is one of the largest international scientific collaborations ever. Its work has helped to shift the debate from scientific uncertainty to policy responses. The Global Environmental Facility (GEF), created in 1991 with the participation of the United Nations Development Programme, the United Nations Environment Programme, and the World Bank, along with financial contributions from many nations, is a new multilateral vehicle for financial transfers to help resolve global environmental issues. It is the interim funding mechanism for the FCCC and supports the incremental costs of projects that seek to curtail greenhouse gas emissions.

Even so, mechanisms to negotiate national commitments, to coordinate policy approaches, to monitor and enforce implementation, to

A Climate of Disagreement

When and how will the climate change?

Scientists agree that greenhouse gases warm the Earth but debate how clouds, oceans, and other factors affect this trend, how soon warming will occur, and how regional climate and overall weather patterns will change.

Will the effects of climate change be benign, adverse, or catastrophic?

Some predict tempests, floods, and pestilence. Others suggest an outcome of milder winters, longer growing seasons, and more fertile farmland.

How much will it cost to control climate change?

Economic models can demonstrate that limiting carbon dioxide emissions may result in either severe economic costs or net economic benefits. The results depend heavily on the assumptions used to construct the models.

Do we need to act now, or can we wait?

Some argue that waiting for better knowledge and technology makes sense. Others insist that waiting will only make the problem worse.

What countries should be responsible for reducing emissions?

Developing countries say the rich countries created the problem, have the resources to solve it, and should focus on such long-term environmental issues. Developed countries argue that it makes no sense for them to reduce emissions if developing countries continue to increase their own.

How should countries reduce their emissions?

Americans argue in favor of market mechanisms such as energy taxes and international carbon-trading but maintain that countries should choose their own approaches. Europeans argue for a coordinated policy approach but against market mechanisms. Developing countries resist commitments to initiate any particular measures but have already raised energy prices and reduced energy subsidies considerably.

What should serve as the base line for measuring emissions reductions?

Developed countries favor using 1990 emissions, which would reflect historical patterns of energy use. However, they have reservations about applying that base line to the former Soviet Union, whose heavy industries collapsed shortly thereafter. Developing countries favor a base line reflecting equal per capita energy use (i.e., one person equals one ton of coal).

Should all developed nations cut emissions by an equal percentage?

Most countries agree on an across-the-board figure in principle but assert that their special circumstances should be given exceptional consideration.

bring about large-scale international transfers of financial and technical resources, and to adapt these actions to evolving scientific understanding have yet to be developed. Few people believe that existing international organizations are adequate to meet the challenge or that the required institutional mechanisms could be easily created, even if nations shared a common purpose. The widely different priorities nations and interest groups assign to the climate problem make progress doubly difficult. Failure by most industrialized nations to meet the stabilization targets voluntarily assumed at the Rio Conference does not bode well for their willingness to assume and implement binding commitments at Kyoto.

Few people believe that existing international organizations are adequate to meet the challenge or that the required institutional mechanisms could be easily created.

Nonetheless, tangible, consistent progress in overcoming these obstacles is crucial. Continuing to emit greenhouse gases even at today's levels will produce atmospheric concentrations double their preindustrial levels by 2060. The longer cuts are delayed and emissions are allowed to continue increasing, the steeper will be the reductions required to stabilize atmospheric concentrations, and the higher will be the atmospheric concentrations when stabilization is achieved.

If action is delayed, the stock of investments embodying carbon-rich technologies will grow, making the adjustment more painful when it finally occurs. By contrast, with appropriate policies and economic incentives in place, new and replacement investments would be planned for the carbon-limited world to come. New power plants built in Asia and Latin America—China alone is building 50 large power plants a year—would be designed for gas instead of coal or for easy conversion between them. If planned carefully, the transition can be made more gradual and the dislocations milder.

If the world is to avoid the worst effects of climate change, nations must not only cut emissions but adopt new policies toward infrastructure and the use of natural resources. Economies could be made less vulnerable to climate change by placing infrastructure and new construction away from flood and storm-prone areas. Agricultural research can develop more

adaptable crop varieties. Reforestation can convert carbon dioxide into useful trees through photosynthesis. However, without a definite shift in policy, coastal regions will become more damage-prone; agriculture will become more genetically specialized; and forests and other ecosystems will continue to shrink. The potential for calamity will increase.

Confronted with other serious risks, whether from military threats or from the spread of epidemic diseases, governments usually defend against worst-case eventualities. Responding to this new threat to global security, the FCCC foreshadowed such a stance, proclaiming that a buildup of greenhouse gases to potentially dangerous levels should be avoided. The Kyoto meetings will test nations' commitment to follow through on that policy with action.

EMISSIONS REDUCTIONS FOR BEGINNERS

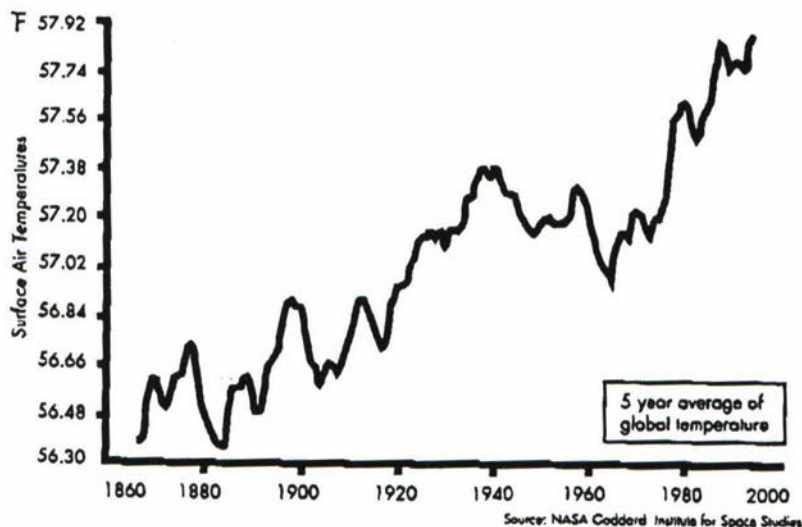
Although a prompt start is essential, the climate problem is too complex to deal with all at once. A solution will have to be built in successive steps, as uncertainties, political conflicts, and institutional deficiencies are resolved. Fortunately, the initial steps are relatively easy. In almost all countries, some greenhouse gas emissions can be reduced at little or no cost. For example, many countries are still venting large amounts of methane from coal mines, oil fields, pipelines, and landfills into the atmosphere. These emissions can be stopped or captured for energy, often at substantial cost-savings. In most countries, upgrading equipment, appliances, and buildings to meet higher energy efficiency standards can pay back the investment costs within a year or two through lower energy bills, and yield attractive returns thereafter. In nations emerging from state-dominated economic regimes, including China, India, Mexico, and the former Soviet Union, the scope for reducing energy use through profitable investments is enormous. Throughout the world, wherever natural gas is available, modern gas turbine power plants can generate electricity at lower cost than older model coal-fired power plants, reducing CO₂ emissions and improving air quality.

Other low-cost options include reforestation of degraded land, which helps to take carbon dioxide out of the air even as it relieves the scarcity of wood products, protects watersheds, and provides ecological and recreational benefits. As in international trade negotiations, most countries could table a range of "no-regrets" policies that would be in their own interests to carry out, even without corresponding actions by other nations.

National governments can also use economic incentives to reduce emissions and raise productivity. Although many countries, for purely economic and fiscal reasons, have already eliminated energy subsidies and have reformed their energy industries to improve efficiency, others have not. Some European countries have considered a further step—raising energy taxes and using the revenues to lower payroll taxes. This kind of “tax shift” could reduce CO₂ emissions as well as Europe’s high unemployment rate. The U.S. government is wary of proposing any new tax, but the United States would benefit if energy taxes were raised and taxes on investment incomes were correspondingly lowered. This would curtail America’s lavish energy consumption and raise its low savings rate. The overall effects on economic growth and environmental quality would be positive.

Once national policies are in place it will be essential to create an international market for emissions reductions. Such a mechanism would enable nations that can cut emissions at low costs to “trade” emissions reductions for the foreign financial and technological investments that generate more efficient growth. This mechanism, called “joint implementation,” allows a private or public entity in one country to meet an emissions-reduction target by contracting

A Warmer World



An Industrialist's Response

The following opposing viewpoint is an abridged version of an op-ed by Chrysler chairman Robert Eaton from the July 17, 1997, edition of the Washington Post.

In response to uncertain science and pressure from environmental activists and from countries eager for our jobs and our living standards, the Clinton administration seems poised to agree to a United Nations global warming treaty next December in Kyoto that would compel us—probably unilaterally—to curtail our fossil-fuel energy use in the next dozen years by more than 20 percent, one certain consequence of which would be a decline in the country's economic growth by a similar amount.

It would be an unwise and unnecessary move even if scientists could agree that the Earth's atmosphere is getting warmer because of man-made carbon dioxide and other gases. It becomes more so given the fact that they can't

The Kyoto document, as currently being drafted, would bind the United States and other developed nations to use no more fossil fuel energy in 2010 than they did in 1990. But the 130 developing countries—such as China, India, Indonesia and all of Africa and Latin America—would be exempt from the mandate on the theory that we've used more energy on a per capita basis for a long time, and now we should back off and give them a turn.

Of course, without that higher energy use in the past, we would not be a "developed" nation in the first place, and without it in the future, we're not likely to remain so.

Theoretically, the rest of the First World would share our sacrifice and our fate, but I don't believe that for a minute. For one thing, who's going to police it? Our unique court system would guarantee our compliance, but I don't believe any other people would allow their feet to be held to the fire as we would

This has become a trade, economic and foreign-aid issue disguised as environmentalism, and we're moving toward a solution involving a massive

and paying for the reduction to be engineered by a counterparty in another country. A multinational company headquartered in the United States, for example, could meet its obligation to cut overall U.S. emissions in part by improving energy efficiency in its plant in Brazil or by converting someone else's plant in Poland from coal to natural gas. Since abatement costs vary widely from country to country, joint implementation can substantially lower the global costs of

transfer of American wealth that won't do a thing to keep the polar ice caps from melting, but would severely undermine this country's international competitiveness.

If, in fact, we are in a period of global warming, and if man is contributing to it, and if there's something we can do to slow it down, then we should act. And it may be prudent to assume the worst until we know better. But we should act intelligently.

One model for action is the Partnership for a New Generation of Vehicles (PNGV), also called the "Supercar" project. It combines the research capabilities of the Big Three automakers, our suppliers and some key national laboratories like Argonne and Sandia to produce a car some time early in the next century that will get about 80 miles per gallon and produce less than half the CO₂ of today's vehicles, but with roughly the same cost, performance and comfort of a midsize family sedan of today. . . .

Cars are part of the mix, but only a small part. The Supercar project will address that part, and it can serve as a model for a much broader joint research effort involving all the major industries in the country and all the research resources of the federal government.

But this effort would dwarf the Manhattan Project and the space program in scope and cost. It would have to be a global program to be feasible, with everybody taking his fair share of the responsibility, sacrifice and cost.

This is the sensible approach to global warming, not an international treaty based on inconclusive science that would have no chance of solving the problem (if we have one) but which would have disastrous economic consequences for all Americans. It is sensible because only new technology will allow us to continue to grow our economy while managing the level of CO₂ output.

. . . Science may eventually tell us that dimming the lights, turning off the air conditioning, sacrificing some of our industrial competitiveness and curtailing economic growth is the responsible thing to do. If so, we should do it. But if so, it should be the last thing we do, not the first.

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attaining emissions reductions, just as international trade lowers production costs by "sourcing" production where costs are cheapest.

The G-77 group of developing countries has opposed joint implementation, fearing that the rich countries will buy their way out of the problem by restricting energy supplies in the developing world and paying poor countries not to grow. In fact, joint implementation would generate large private-sector capital and technology flows to developing

countries, including many that now receive little foreign investment and dwindling foreign aid.

A few emerging-market countries do see large potential benefits from joint implementation and may now be willing to accept binding emissions limits and effective monitoring and enforcement mechanisms in order to participate. Central Europe and Russia can improve energy efficiency while modernizing their economies; they can also replace coal with gas, provided the necessary investment funds are available. Colombia and Costa Rica see opportunities to finance the protection of their remaining tropical forests as carbon storehouses through joint implementation, which should evolve as a key mechanism for efficiently and equitably distributing international burdens.

THE BEGINNINGS OF A SOLUTION

Faced with formidable political constraints, negotiations at Kyoto are likely to focus on modest interim abatement targets for advanced industrial countries. Stabilizing national emissions at 1990 levels by the year 2010 is the leading U.S. proposal under consideration, although congressional approval of even such a modest step is not assured if developing countries do not follow suit. Europeans have proposed cuts 15 percent below 1990 levels. Developing countries are likely to resist any such commitments in the Kyoto round of negotiations.

Even a modest beginning such as the U.S. proposal would be useful if ratified and supported by implementing legislation that provides clear economic and policy signals. Unless the United States accepts and implements binding emissions-reduction targets and timetables, no other country will do so. Kyoto will be a failure.

However, this limited success would still leave the long-term climate problem largely untouched. More significant progress would require an agreement that includes the following three elements:

A Long-Term Goal

A stabilization target for atmospheric greenhouse gas concentrations implies limits both on the amount of climate change in store and on the cumulative total of global greenhouse gases that can be emitted. A doubling from preindustrial concentrations is about as little as can realistically be expected, although scientists predict that even this would force the average global temperature 1.5–3.5 degrees centigrade above its long-term mean. Setting a prudent limit on concentrations would clear-

ly indicate the magnitude of emissions reductions that eventually will be necessary and thus would shape future negotiations.

A Fair Allocation of Responsibility

Because the industrialized nations cannot stabilize greenhouse gas concentrations unless developing nations cooperate, developing countries have considerable leverage to insist that the final agreement acknowledge their smaller cumulative contribution to the problem and their need for economic growth. The terms of the FCCC and the mandate agreed to by the parties in Berlin three years later specify that the developed countries should take the lead in reducing emissions and that developing countries need not adopt binding targets and timetables at Kyoto. It is reasonable that industrialized countries take the first step this December by committing to reduce emissions to, or below, 1990 levels by 2010, and to implement potential further reductions thereafter. For their part, developing countries should pledge to enact no-regrets policies that would be in their own self-interest regardless of climate impacts and agree to adopt binding emissions limits in a later round of negotiations. If developing countries quickly adopted all of their no-regrets policy options, the resulting reduction of their greenhouse gas emissions would be very substantial. For example, developing countries could pledge at Kyoto to eliminate energy subsidies, maintain fuel prices at world levels or above, eliminate barriers to the use of gas or renewable energy sources in electricity generation, restructure their energy sectors to promote greater efficiency, and eliminate policies that promote deforestation. Many developing countries are already well embarked on such policy reforms. The World Bank could have a role in monitoring these policy commitments, since it already maintains an active dialogue about them with borrowing countries.

Efficient Implementation

Developed countries should reach an agreement on the use of joint implementation among themselves and work to construct institutional arrangements for certifying, monitoring, and enforcing such transactions. The GEF could have a useful role in brokering and certifying these arrangements. Developing and transitional countries that wish to participate in joint implementation should be able to do so by agreeing to binding emissions-reduction targets and timetables based on the implementation of no-regrets policies. Incorporating the permanent protection of forests as

carbon storches in joint implementation agreements would conserve biodiversity as well as climate.

Without an agreement that embodies these essential elements, the countries of the world are embarked on an unprecedented gamble, irreversibly changing the climate within which human civilization has evolved. For much of humanity, including many of the world's least well-off people, the results could be disastrous. Nations have cooperated to promote military and economic security and to forestall ecological crises as diverse as the depletion of ocean fisheries, the destruction of stratospheric ozone, and the extinction of endangered species. Although climate change is the most complex threat the global environment has ever faced, the technical, economic, and policy measures to prevent it are available. The world's future need not be risked.

WANT TO KNOW MORE?

For good short overviews of climate science, see John Houghton's *Global Warming, the Complete Briefing* (Oxford: Lion Press, 1994) and Thomas Graedel & Paul Crutzen's *Atmosphere, Climate, and Change* (New York: W.H. Freeman and Company, 1995), a Scientific American book. A skeptical view of climate change can be found in *Are Human Activities Causing Global Warming?* (Washington, D.C.: George C. Marshall Institute, 1996). *Energy Innovations: A Prosperous Path to a Clean Environment* (Washington, D.C.: Alliance to Save Energy, 1997) explores the technological options for reducing CO₂ emissions. Issues related to joint implementation and carbon trading are discussed in *Controlling Carbon Dioxide Emissions: The Tradeable Permit System* (Geneva: U.N. Conference on Trade and Development, 1995). For more details on the economic impacts of controlling emissions and a guide to the economic modeling literature on this topic, see *The Costs of Climate Projection: a Guide for the Perplexed* (Washington, D.C.: World Resources Institute, 1997). Readers may find useful a summary of the Conference of the Parties' most recent meeting in Geneva in the October 2, 1996, issue of *International Environment Reporter*.

Finally, many online resources exist for researchers. The reports of the Intergovernmental Panel on Climate Change contain the most comprehensive data on climate change and can be ordered via their Web site. Likewise, the electronic edition of *Global Change* provides up-to-date information on climate and ozone depletion. Both sites, as well as others, can be accessed via our Web site at www.foreignpolicy.com.

5

GLOBAL CLIMATE CHANGE:

U.S. Policy Directions

Dirk Forrister

Chairman

White House Climate Change Task Force

U.S. CLIMATE CHANGE POLICY

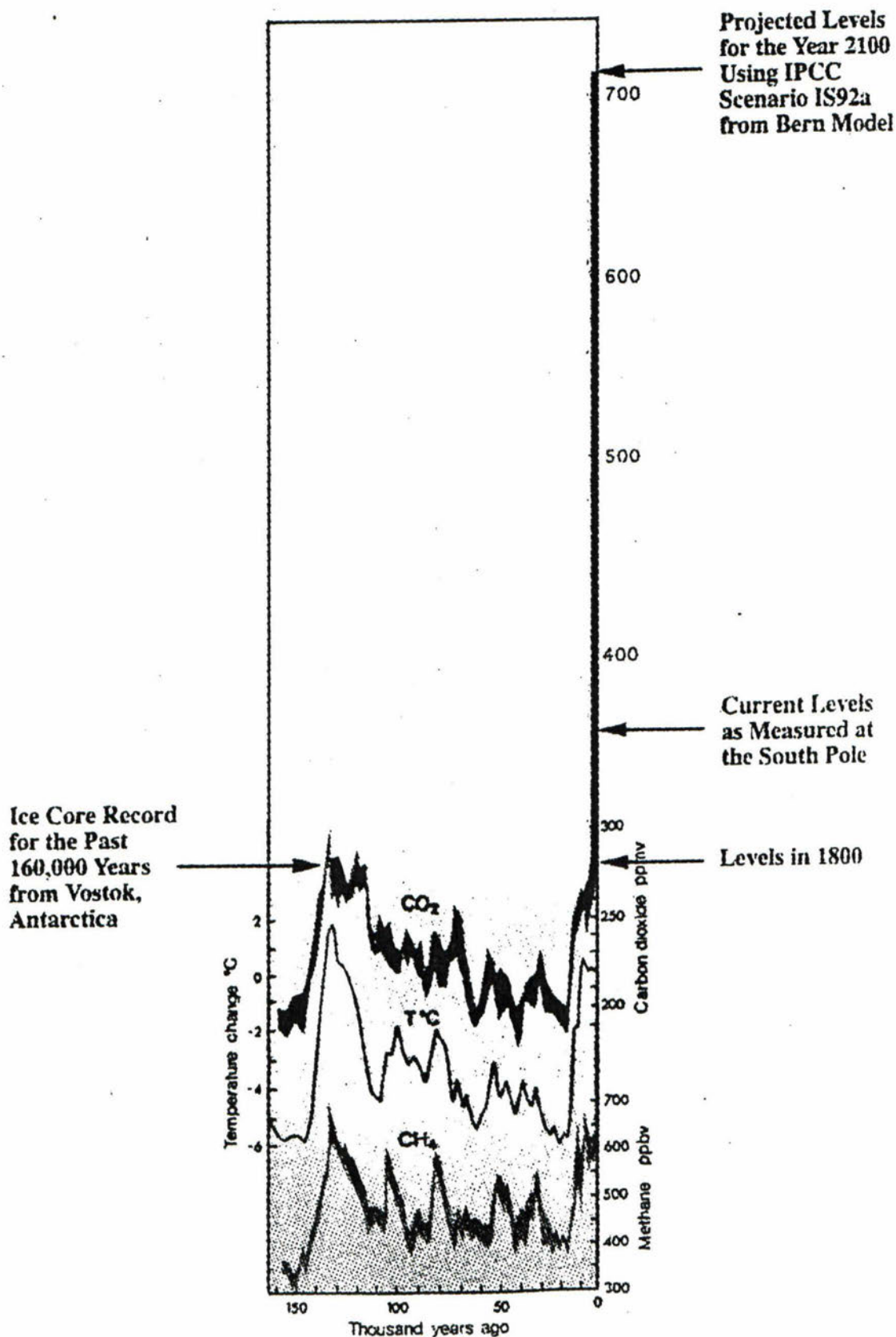
2,000 WORLD SCIENTISTS

- **Earth's Climate is Changing**
- **Discernable Human Interference**
- **Concentrations Are Rising**
- **Justifies Actions Beyond “No Regrets”**

Atmospheric Carbon Dioxide Concentrations

-- Comparing Past Interglacial Ice Core Records with IPCC Projections for the Next 100 Years --

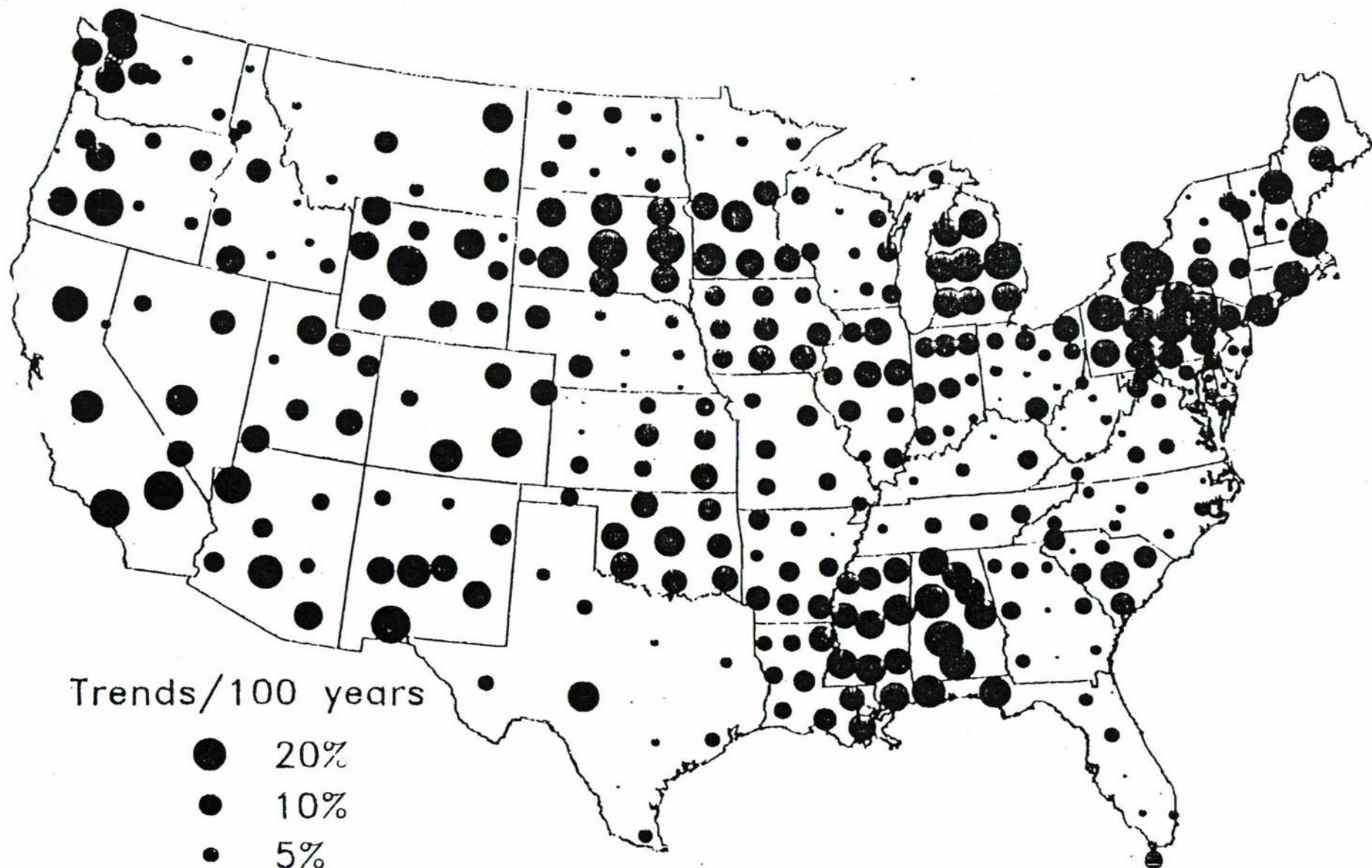
Source: "Radiative Forcing of Climate Change" Climate Change 1994, IPCC Record, Cambridge University Press, 1995



U.S. CLIMATE CHANGE POLICY

RISKS OF INACTION

- **More Extreme Weather Events**
- **Floods & Droughts**
- **Sea Level Rise**
- **Vector-Borne Disease**



Precipitation trends (1900-present, in percent of normal annual precipitation) within state climatic divisions. The diameter of the circle centered within each climatic division reflects the magnitude of the trend. Larger circles have the greater trends. Red reflects increasing precipitation and blue decreasing.

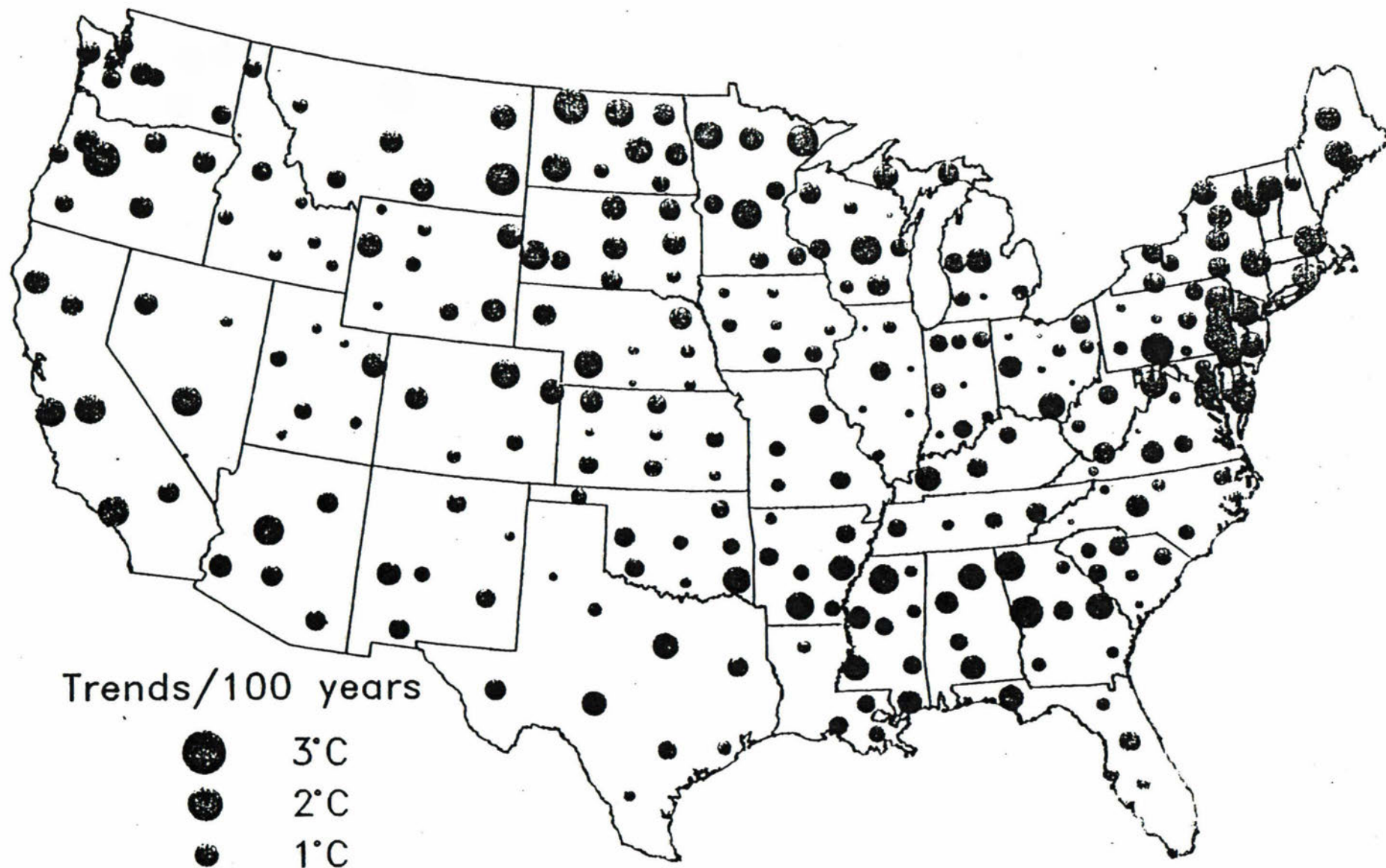
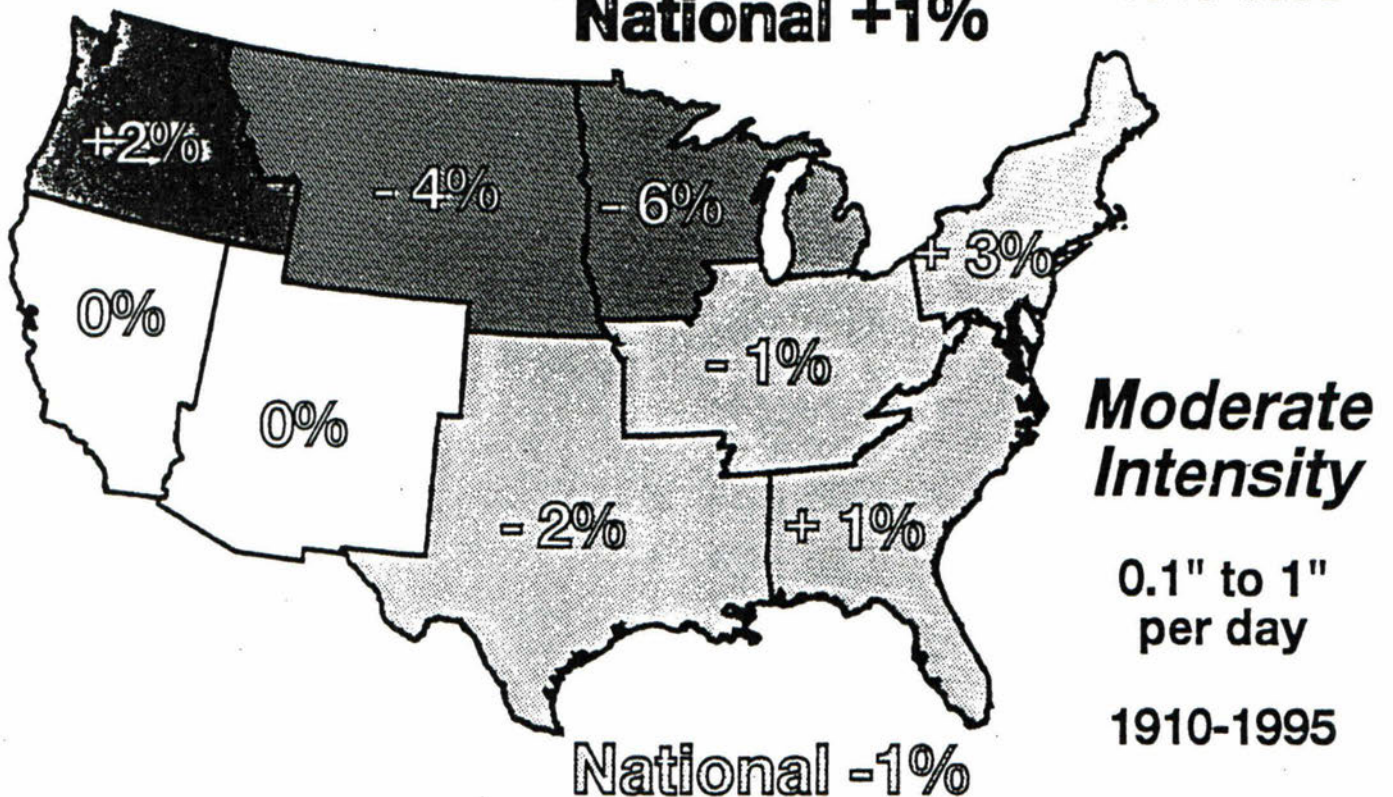
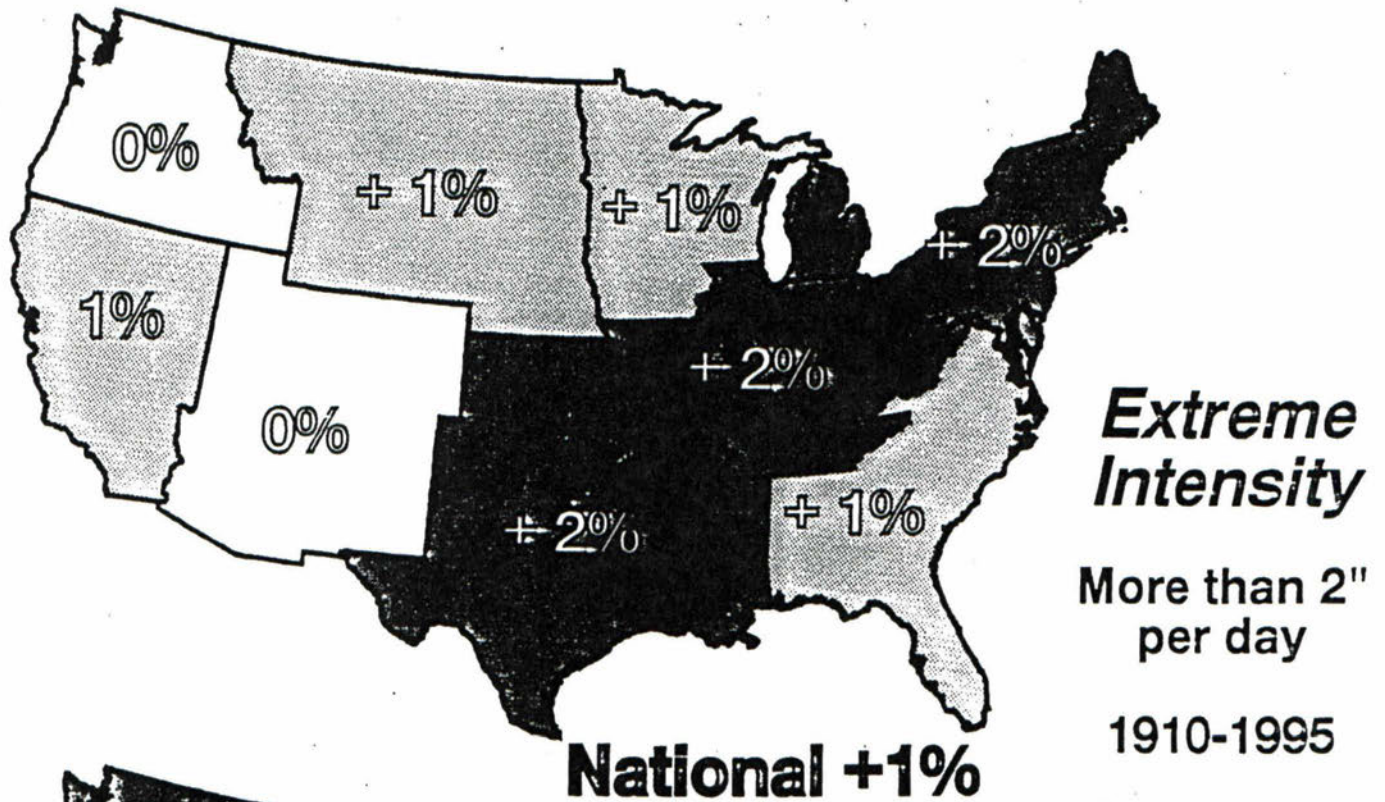
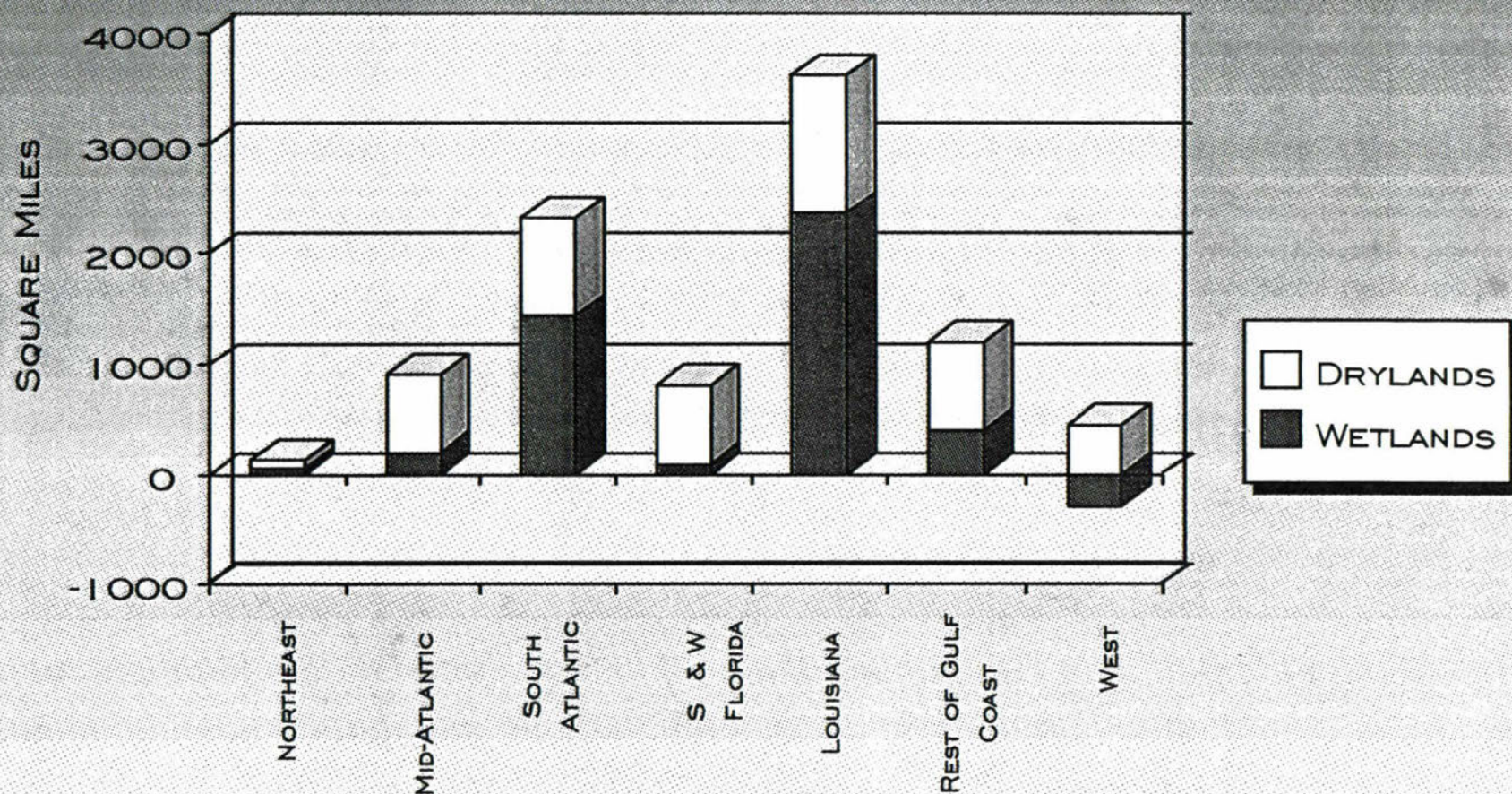


Figure 4. Temperature trends (1900-1994 converted to degrees C per century) within state climatic divisions are reflected by the diameter of the circle centered within each climatic division. Red circles represent warming and blue circles cooling.

Changes in the Proportion of Total Annual Precipitation Intensity

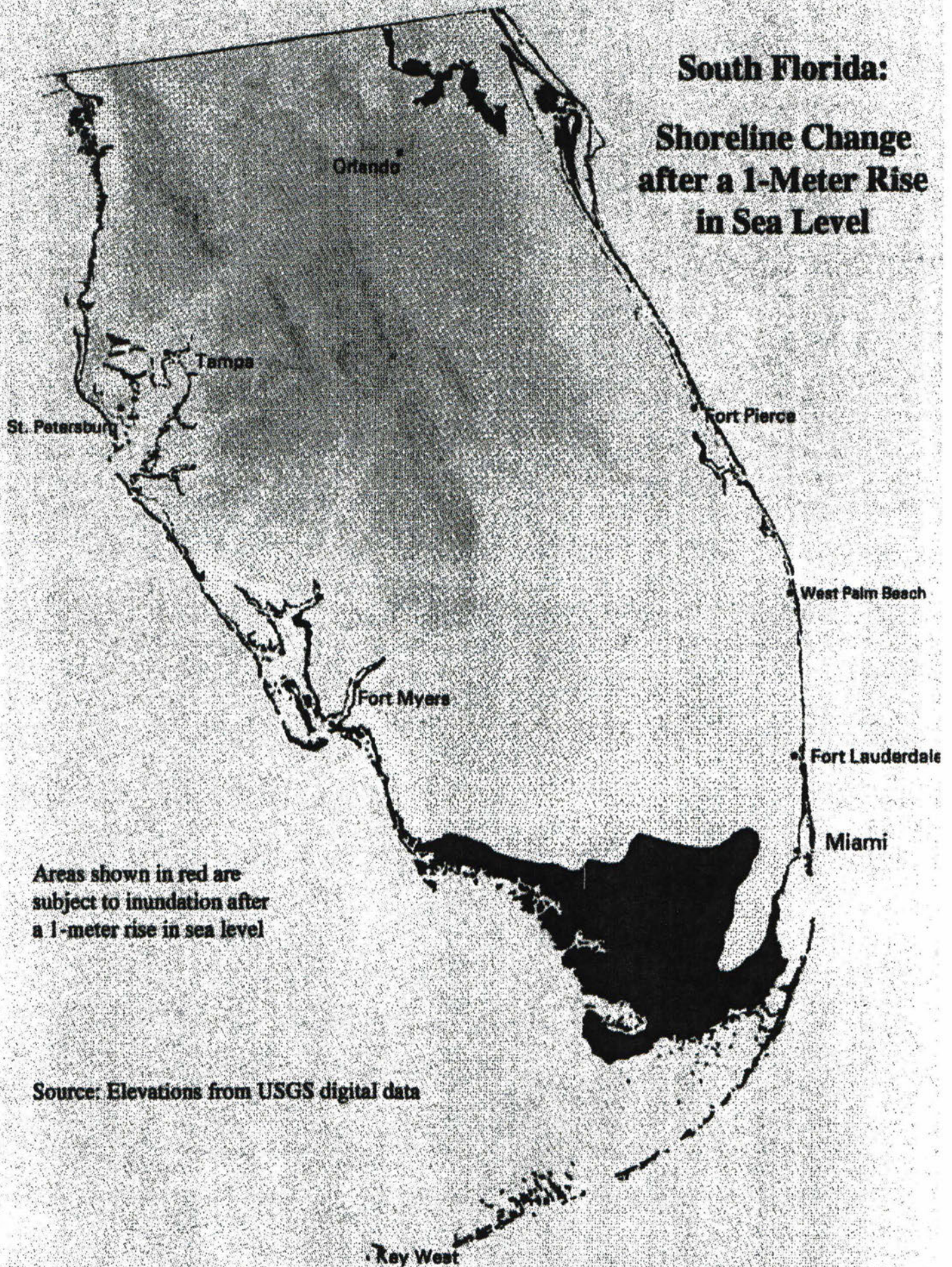


U.S. COASTAL LANDS AT RISK FROM A 20-INCH SEA LEVEL RISE IN 2100



SOURCE: U.S. EPA (1989).

**South Florida:
Shoreline Change
after a 1-Meter Rise
in Sea Level**



Areas shown in red are
subject to inundation after
a 1-meter rise in sea level

Source: Elevations from USGS digital data

U.S. CLIMATE CHANGE POLICY

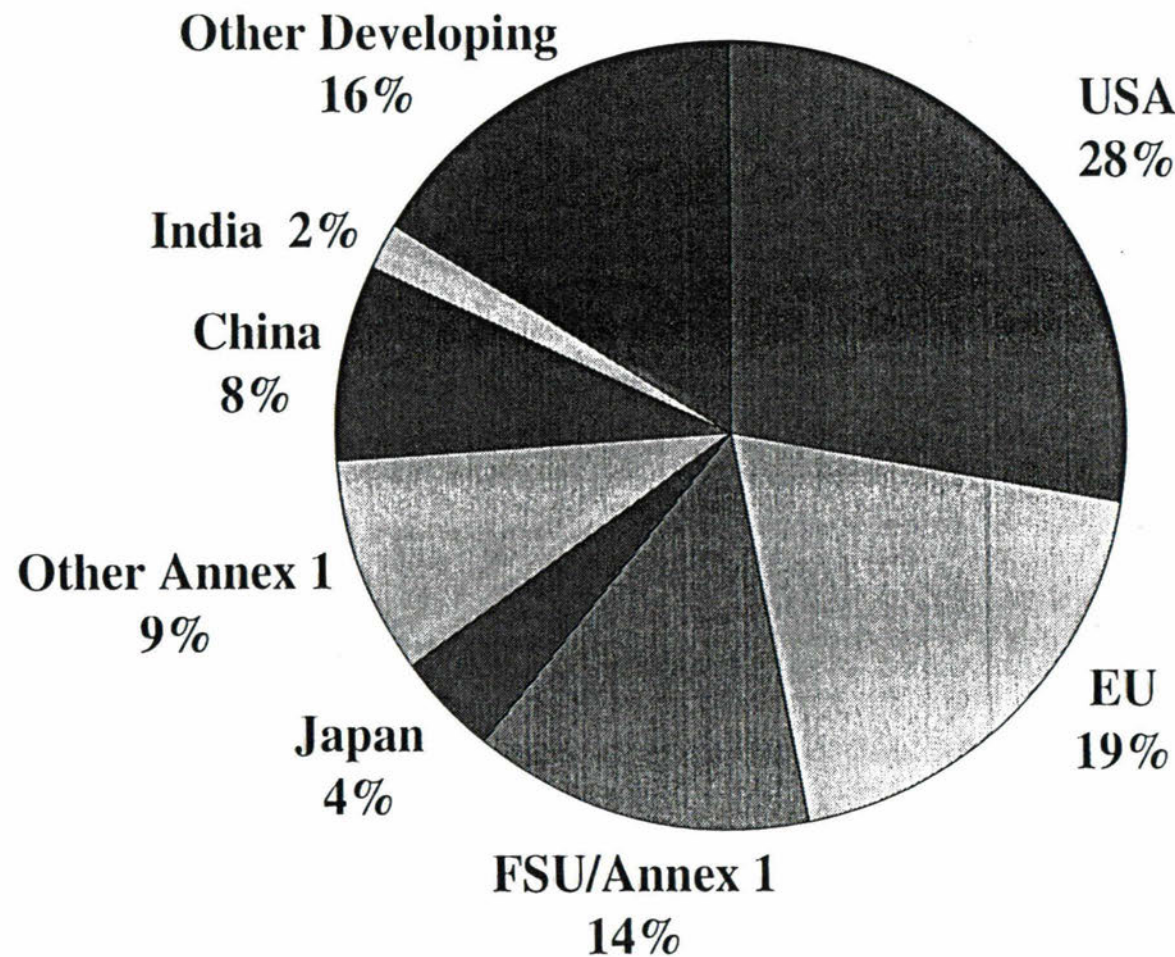
2,000 ECONOMISTS

- **Risks Justify Preventive Steps**
- **Policies**
 - **Not Harm American Living Standards**
 - **May Improve U.S. Productivity**
- **Market Based Policies = Most Efficient**
 - **International Emissions Trading**

U.S. CLIMATE CHANGE POLICY

CUMULATIVE GLOBAL EMISSIONS OF CO₂ 1950-92

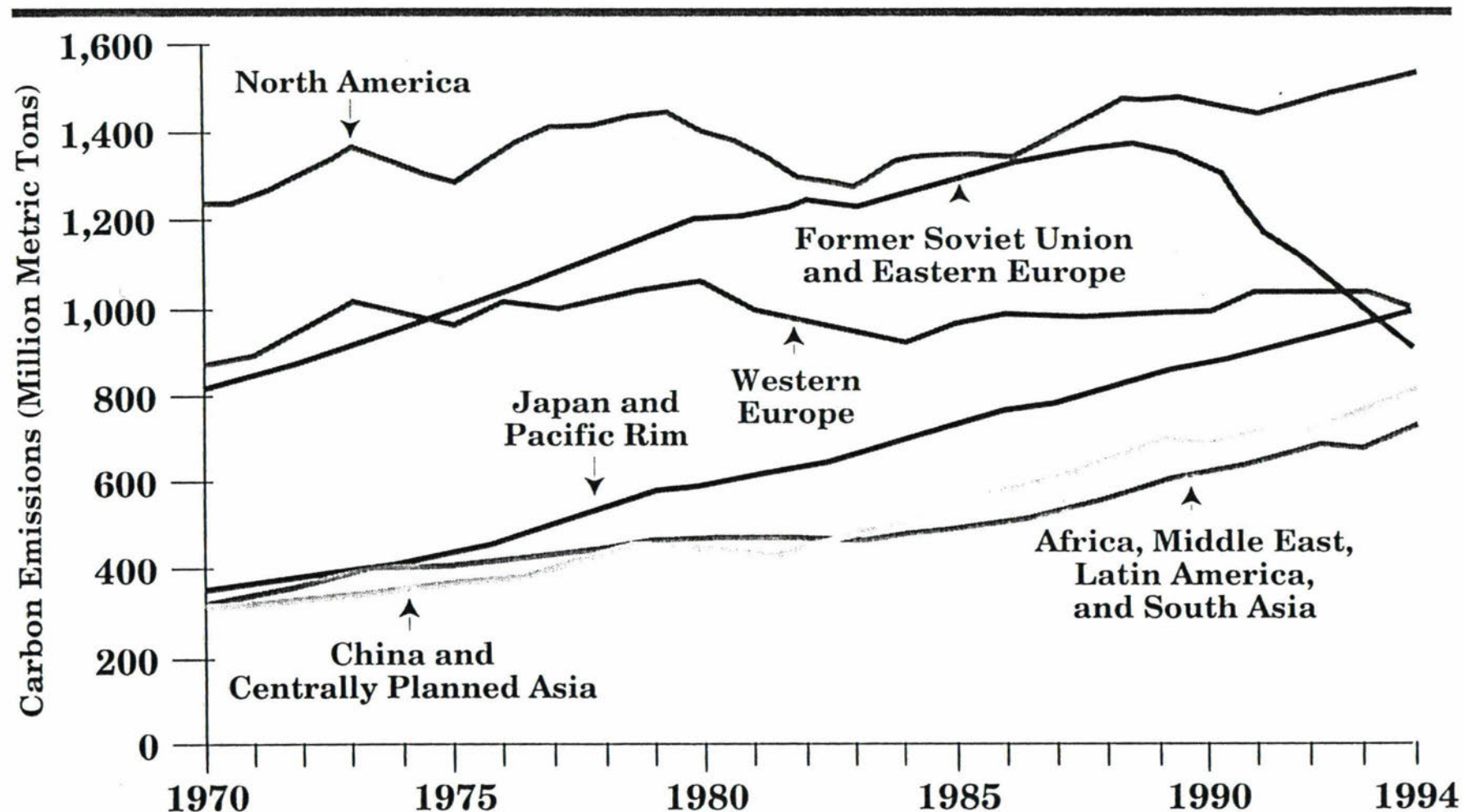
Fossil Fuel and Cement Sources Only



Annex 1 = 74%

U.S. CLIMATE CHANGE POLICY

ENERGY-RELATED CO₂ EMISSIONS BY REGION, 1970-94

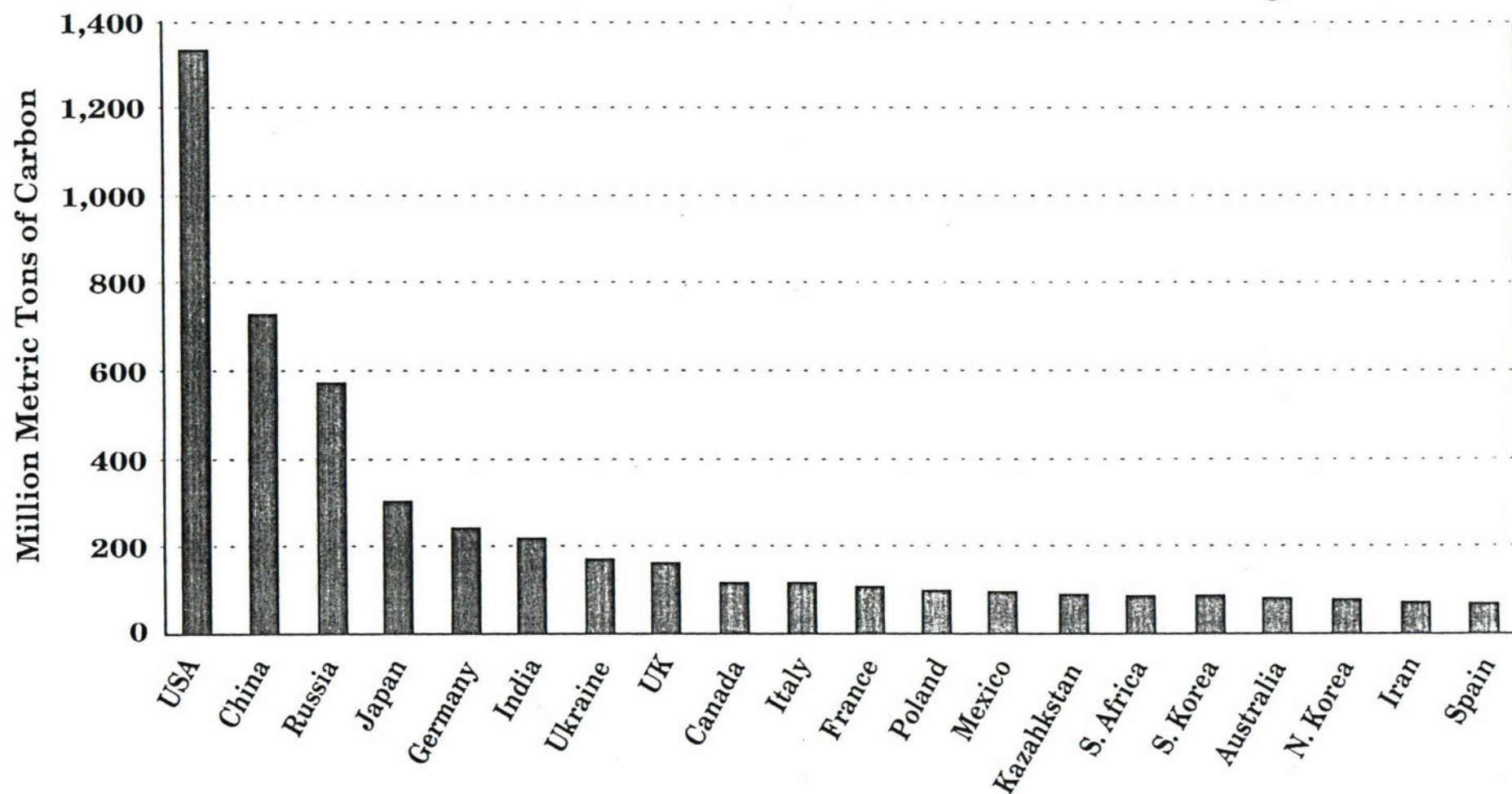


Source: EIA, Emissions of Greenhouse Gases in the US 1995

U.S. CLIMATE CHANGE POLICY

TOP 20 CO₂ EMITTERS – 1992

Fossil Fuel and Cement Sources Only

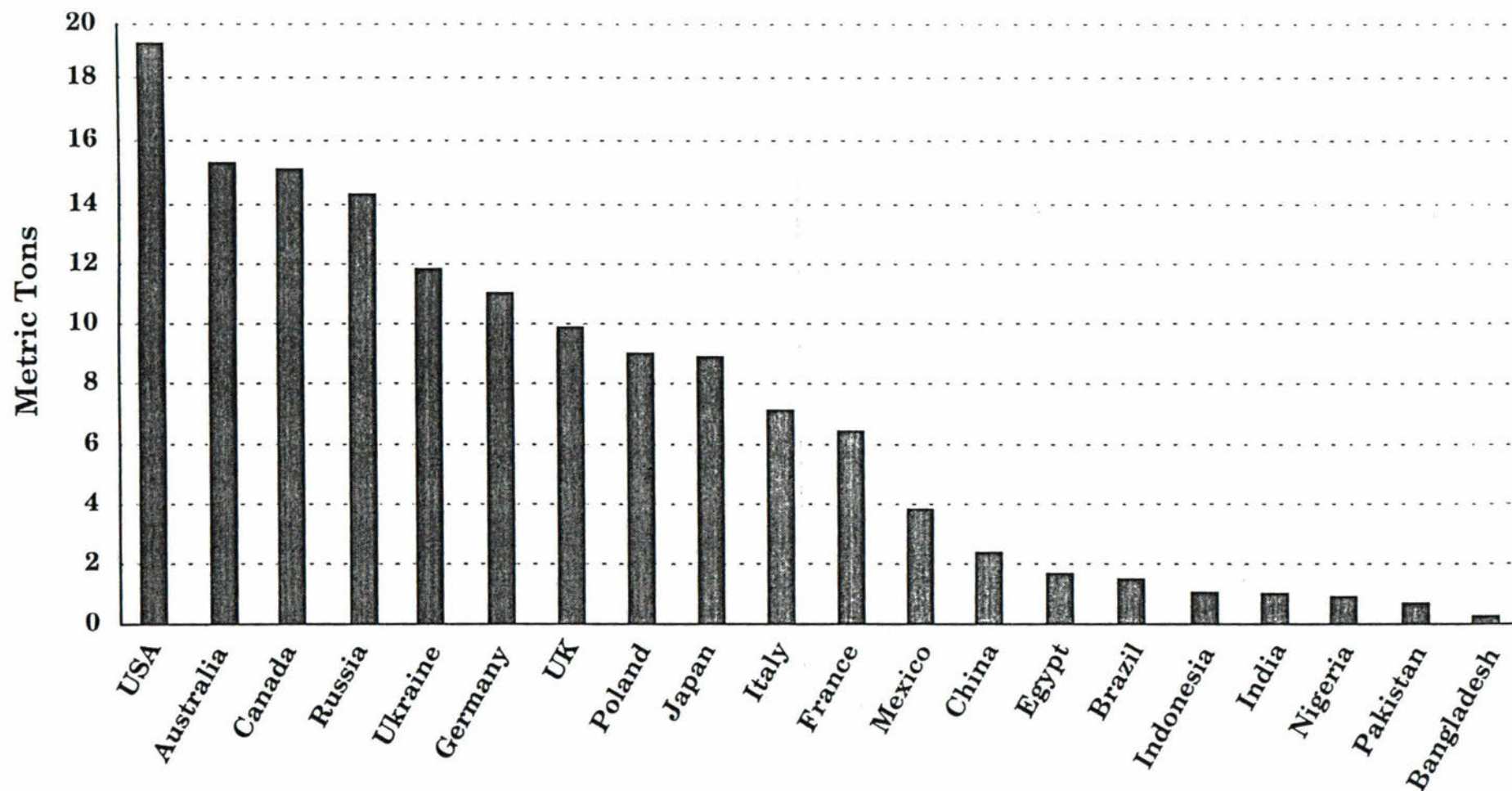


Source: Oak Ridge National Laboratory

U.S. CLIMATE CHANGE POLICY

PER CAPITA CO₂ EMISSIONS – 1992

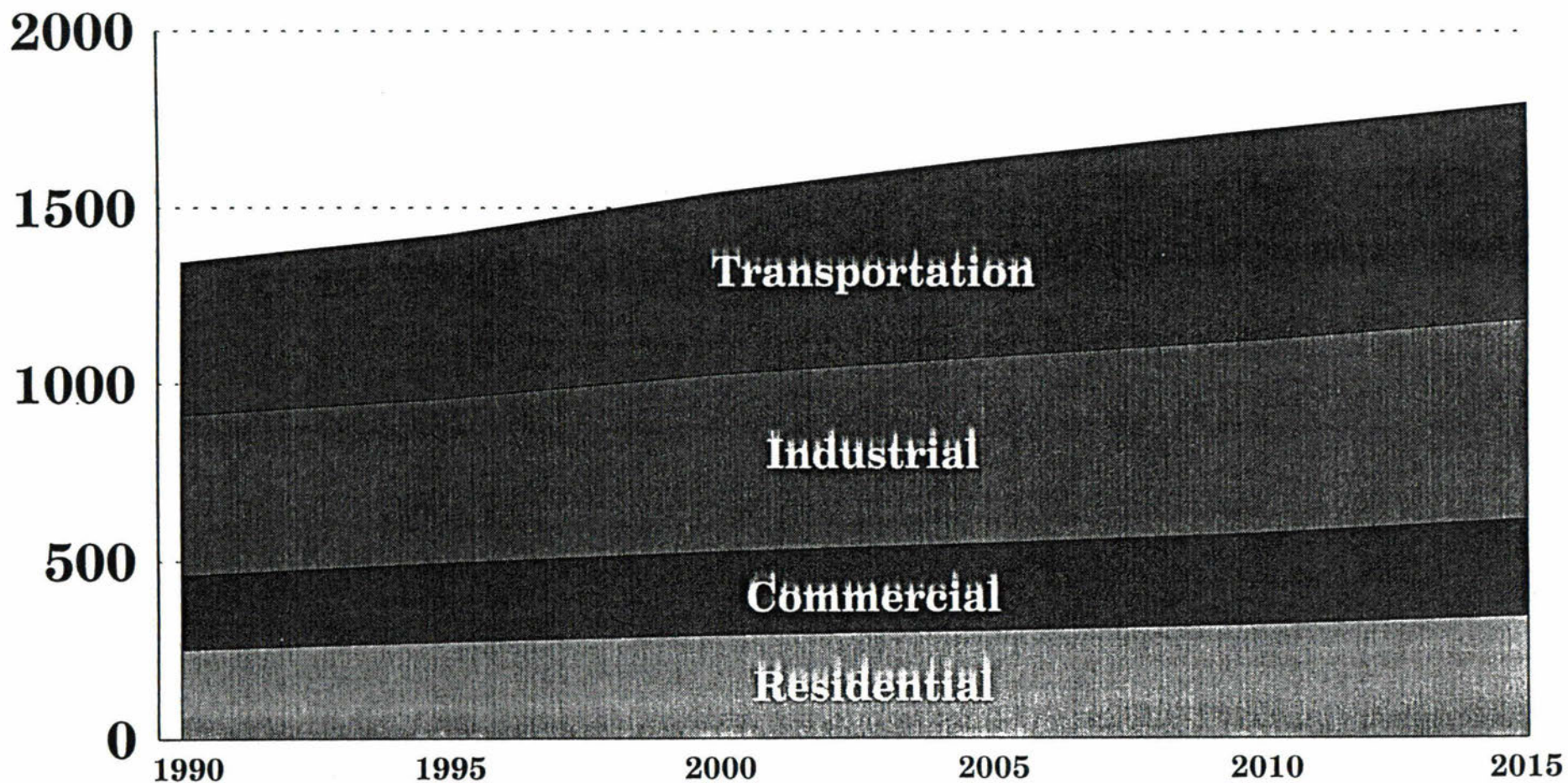
Fossil Fuel and Cement Sources Only



Source: World Resources Institute, 1996-97

U.S. CLIMATE CHANGE POLICY

PROJECTIONS OF ENERGY-RELATED CARBON EMISSIONS BY SECTOR, 1990-2015

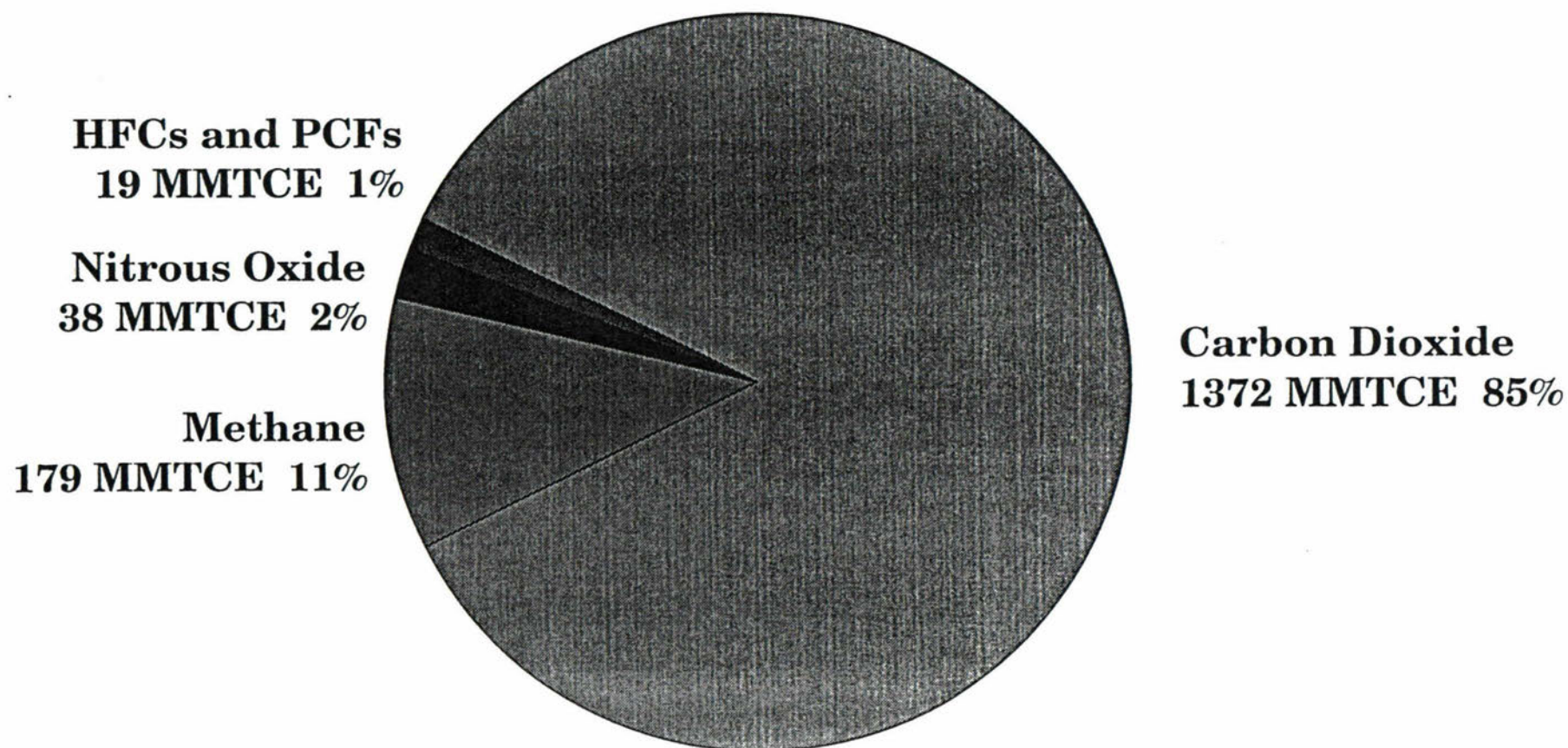


Source: 1997 Annual Energy Outlook

U.S. CLIMATE CHANGE POLICY

1990 U.S. GREENHOUSE GAS EMISSIONS

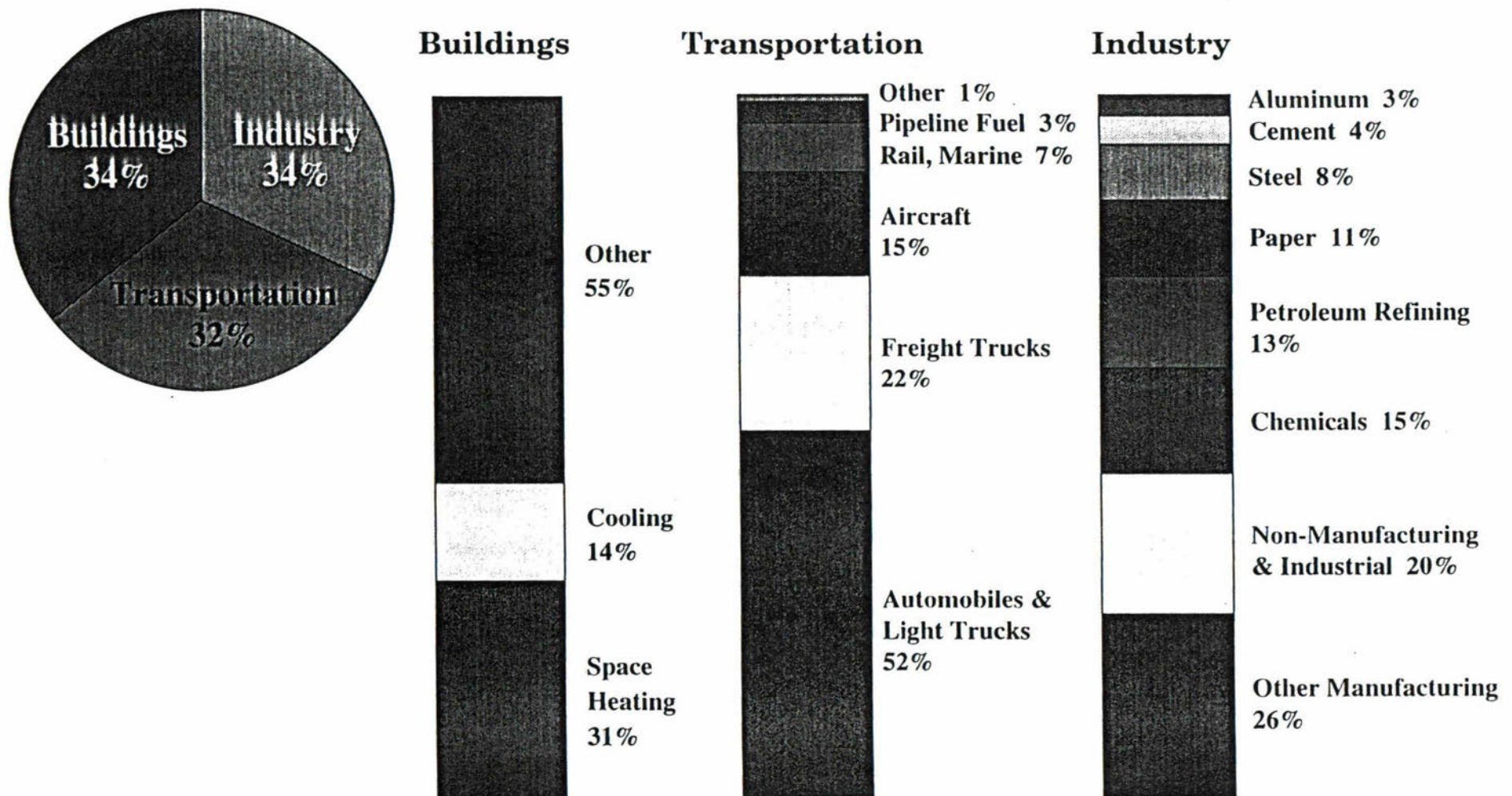
Total 1608 MMTCE



Source: Emissions of Greenhouse Gases in the U.S., 1995

U.S. CLIMATE CHANGE POLICY

1990 U.S. CO₂ EMISSIONS BY SECTOR



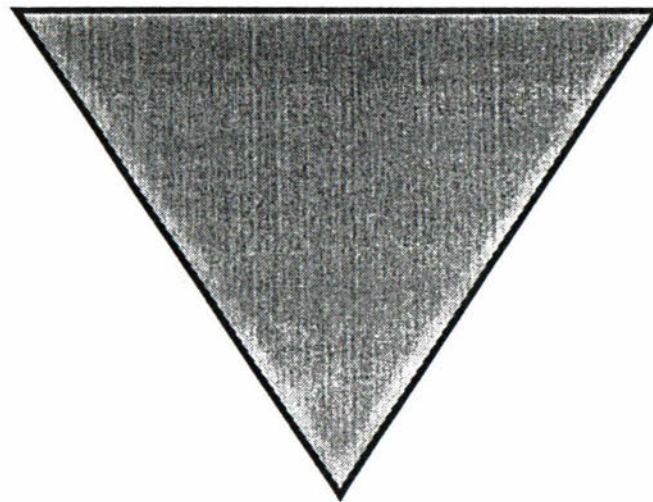
Source: EIA Annual Energy Outlook, 1992; EIA Emissions from Greenhouse Gases in US 1987-94

U.S. CLIMATE CHANGE POLICY

PRINCIPLES FOR KYOTO LEADERSHIP

Compliance With Binding Targets

**Maximum
Flexibility**



**National
Implementation**

Realistic & Achievable

+ Steps Towards a Longer Term Solution

U.S. CLIMATE CHANGE POLICY

EMISSIONS BUDGETS

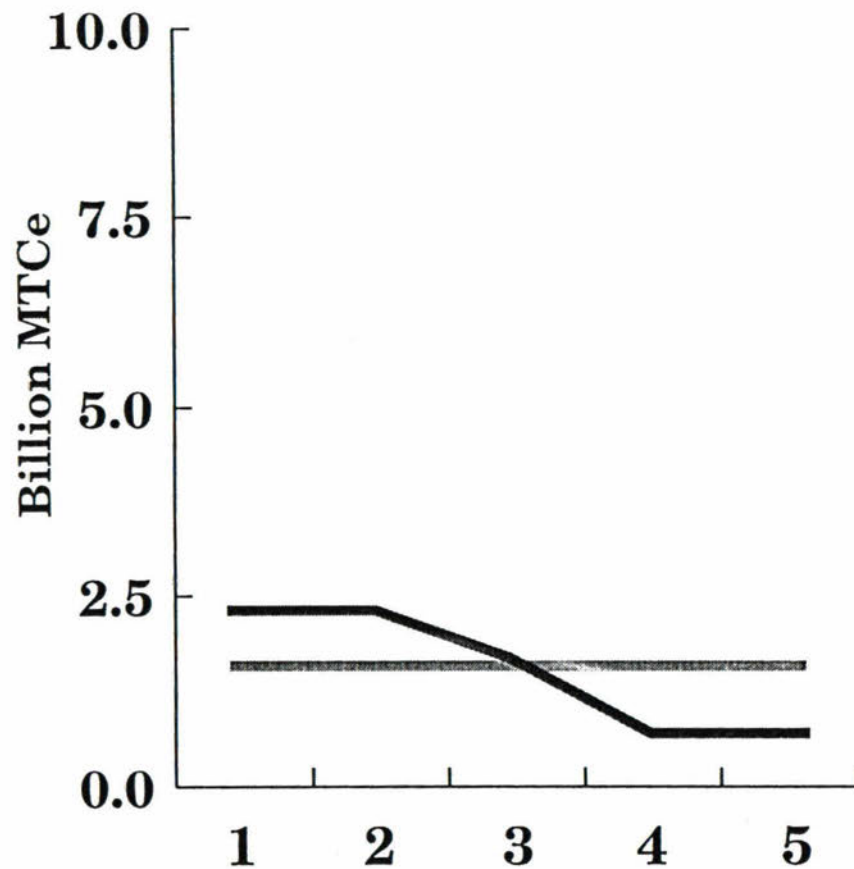
A Party's Emissions Budget Equals:

- The Party's Initial Allocation
 - *Plus* Any Amounts Banked
 - *Plus* Any Amounts Borrowed
 - *Plus* Any Amounts Acquired Through International Emissions Trading or JI
 - *Minus* Any Amounts Transferred to Other Parties Through International Emissions Trading

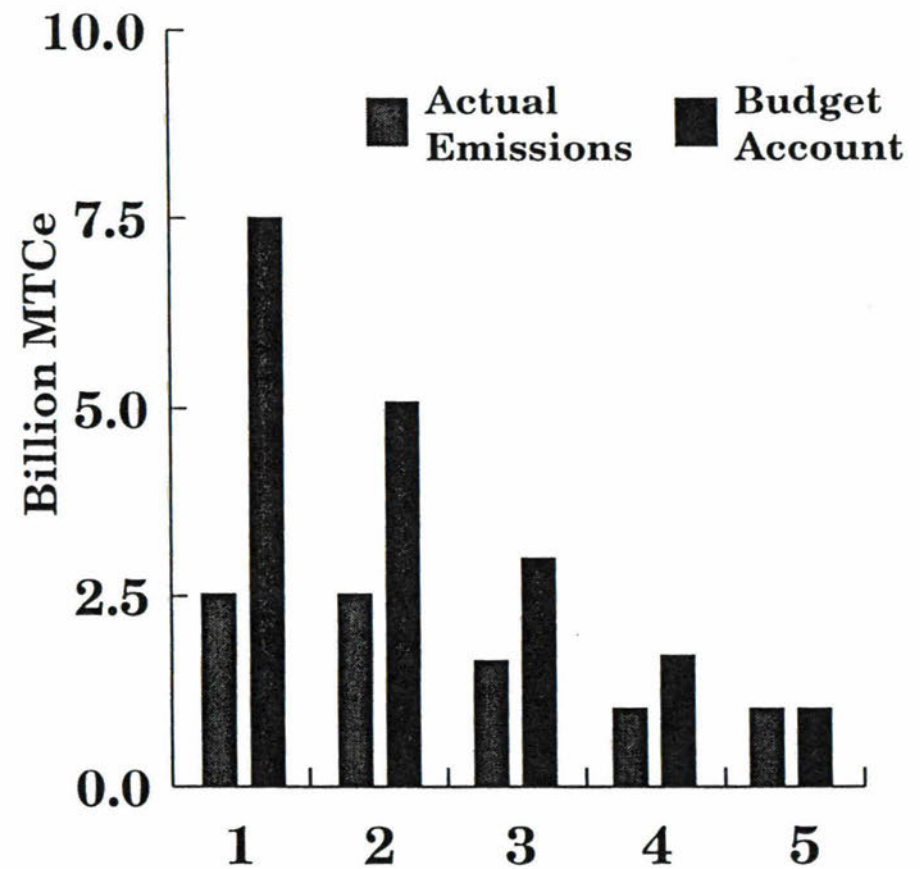
U.S. CLIMATE CHANGE POLICY

BASIC COMPLIANCE STRATEGY

Emissions Path



Budget Balances



U.S. CLIMATE CHANGE POLICY

INTERNATIONAL EMISSIONS TRADING

- **Parties with Emissions Budgets May Buy or Sell “Tonnes Allowed”**
 - “High-Cost” Parties Will Have Incentives to Buy
 - “Low-Cost” Parties Will Have Incentives to Sell
- **Parties Report Purchases or Sales Each Year, Adding To or Subtracting From Their Budgets**
- **Private Sector Can Facilitate Trades**
- **No New International Organization Needed**

U.S. CLIMATE CHANGE POLICY

JOINT IMPLEMENTATION

- **Project-Based, Not Budget-Based**
- **Developing Countries May Undertake Projects That Generate New “Tonnes Allowed”**
 - **Eligible Projects: Supporting National Environment and Developing Strategies, Providing Additional Reductions**
 - **Provisions for Measurement, Verification, Review, etc.**
- **Party May Keep the Credits, or Transfer Them in Return for Investment and Development Resources**
- **Developed Countries, Private Sector Can Facilitate JI Projects**

U.S. CLIMATE CHANGE POLICY

FAIR AND EQUITABLE PARTICIPATION

Developing Countries Adopt and Report on “No Regrets” Measures, With Assistance and Cooperation from Developed Countries

Voluntary Participation in Annex B

– Opt-In to Emissions Budgets, Emissions Trading

Evolution

U.S. CLIMATE CHANGE POLICY

NATIONAL ACCOUNTABILITY

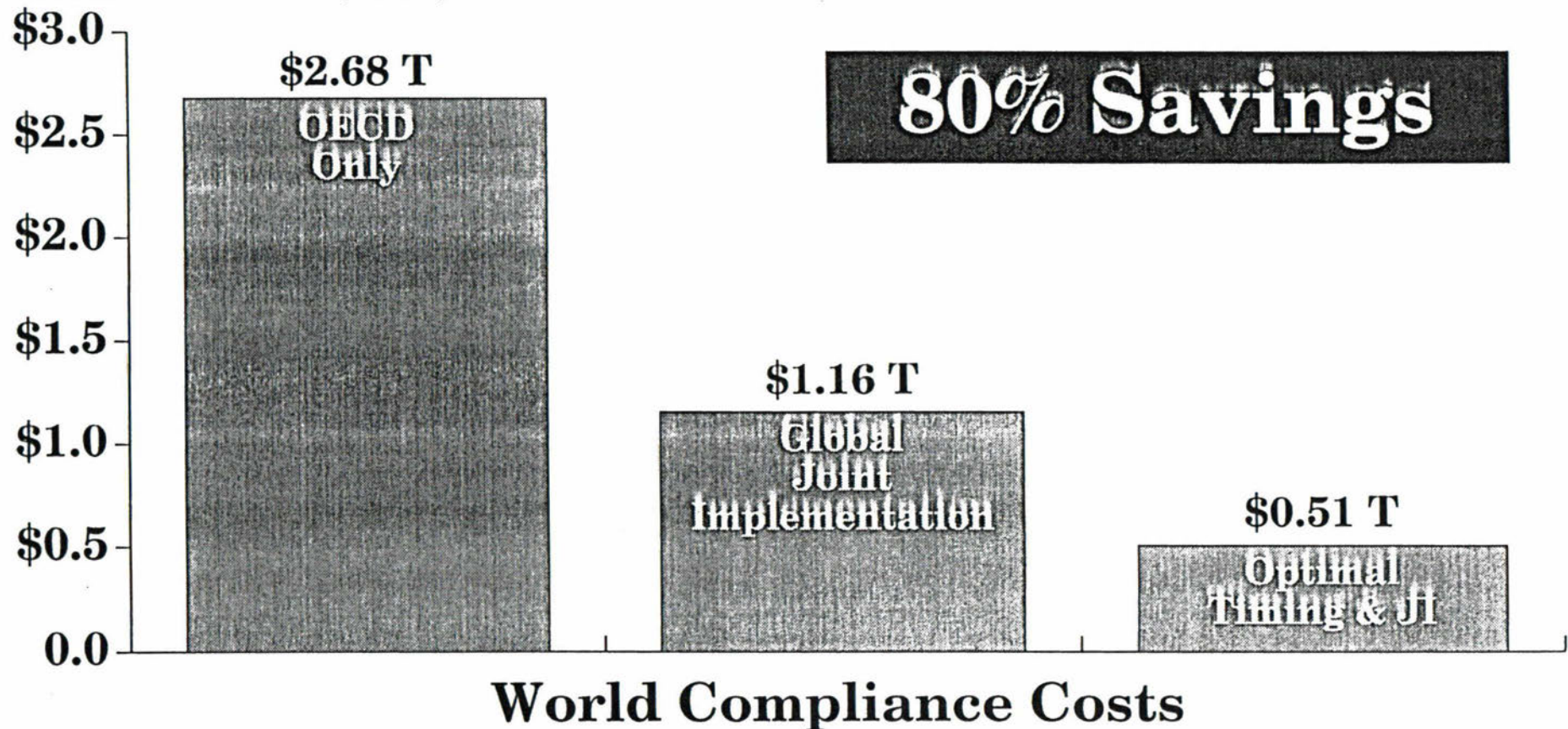
Parties With Emissions Budgets Must:

- **Adopt National Systems for Accurate Emissions Measurement**
- **Adopt National Compliance and Enforcement Programs**
- **Report on Policies and Measures Employed to Meet Budgets**
- **Report Annually on Emissions and Budget Consumption**

U.S. CLIMATE CHANGE POLICY

TARGET LIMITED CAPITAL TO GREATEST GOOD

Trillion Dollars (1990)



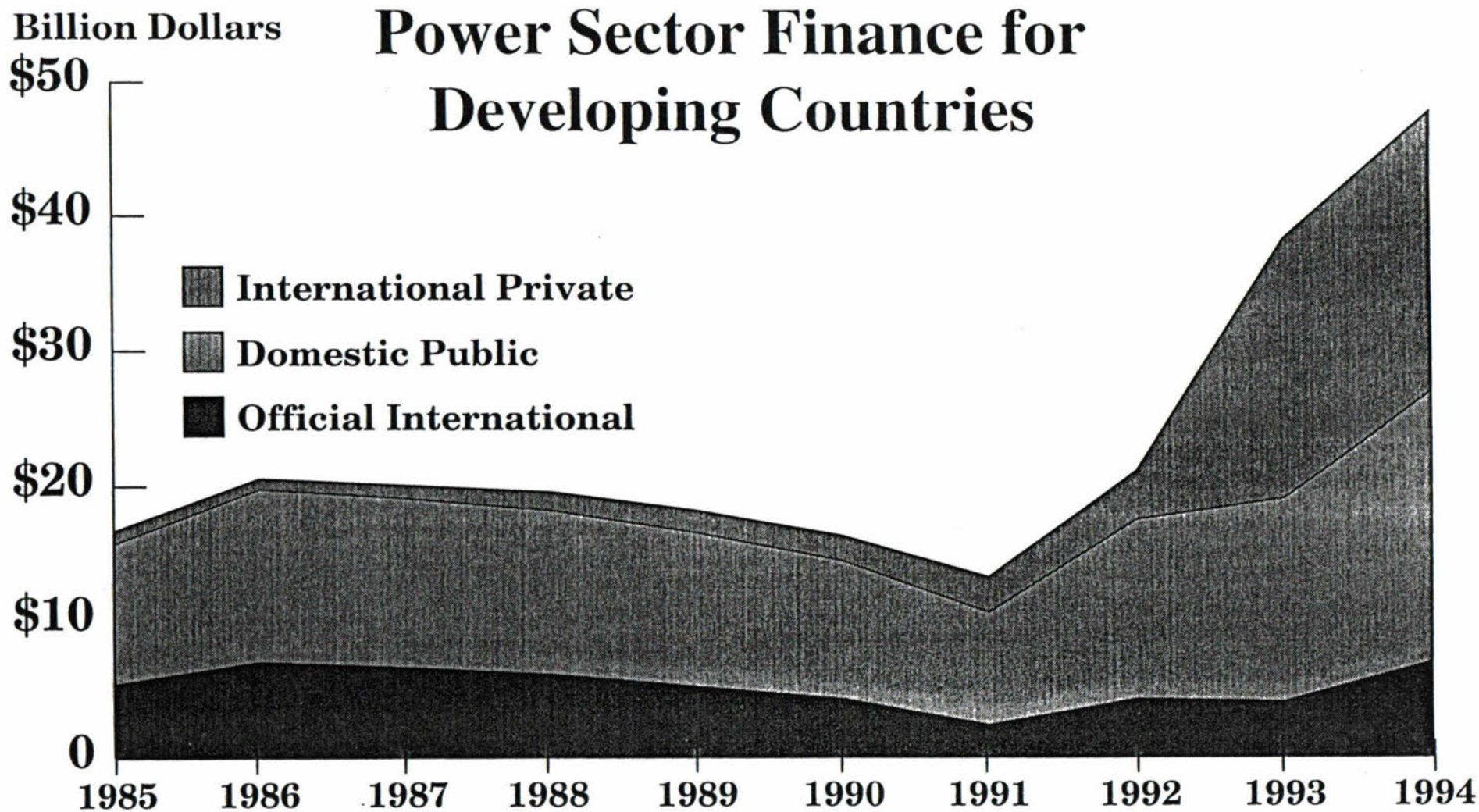
* The 2.2 trillion savings between the first and third columns is

roughly equivalent in value to 1/3 of current annual U.S. economic output.

Source: Electric Power Research Institute, 1995

U.S. CLIMATE CHANGE POLICY

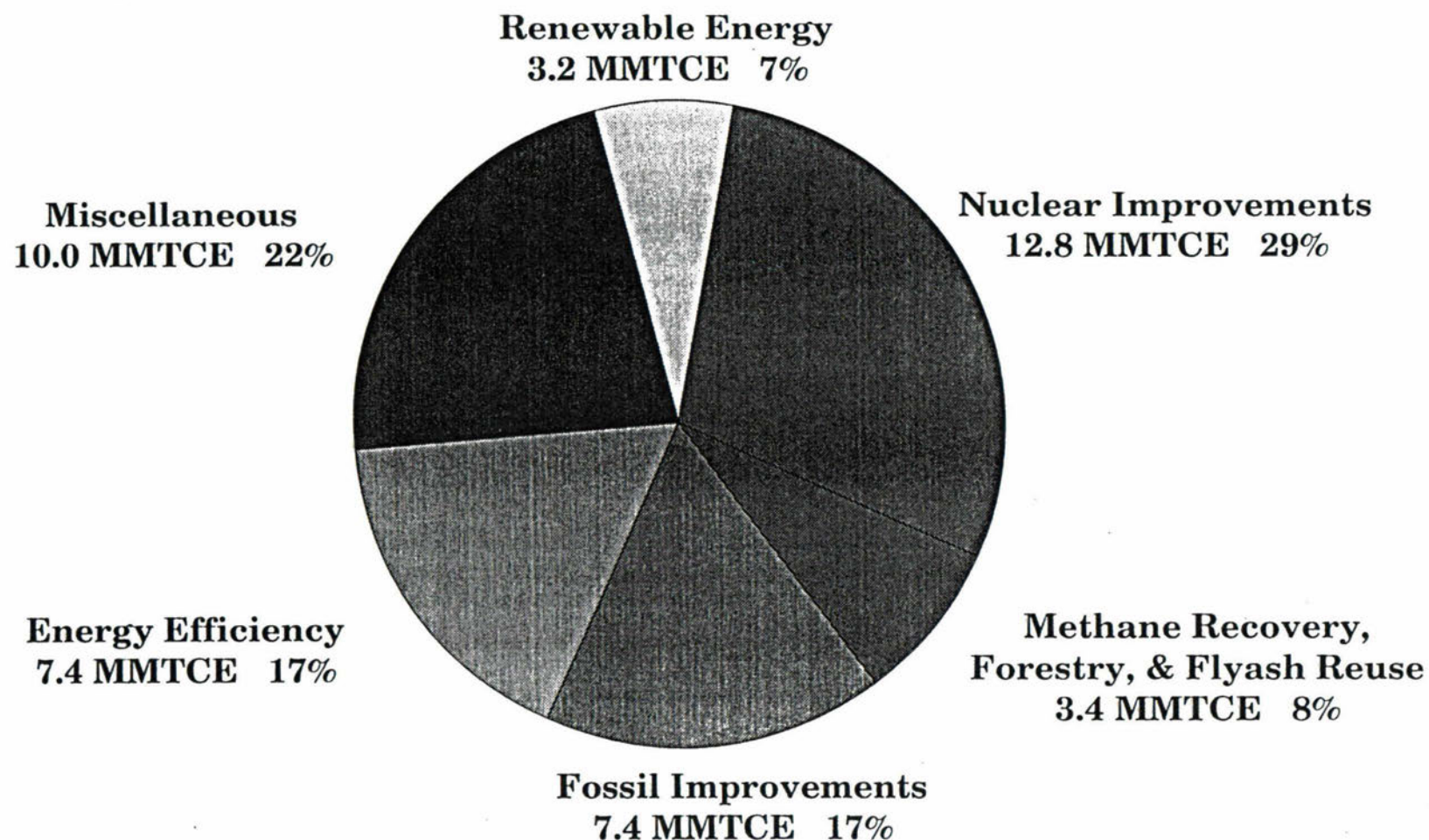
MOBILIZE PRIVATE POWER FINANCE



Source: Resource Dynamics Corp. 1996 for DOE

U.S. CLIMATE CHANGE POLICY

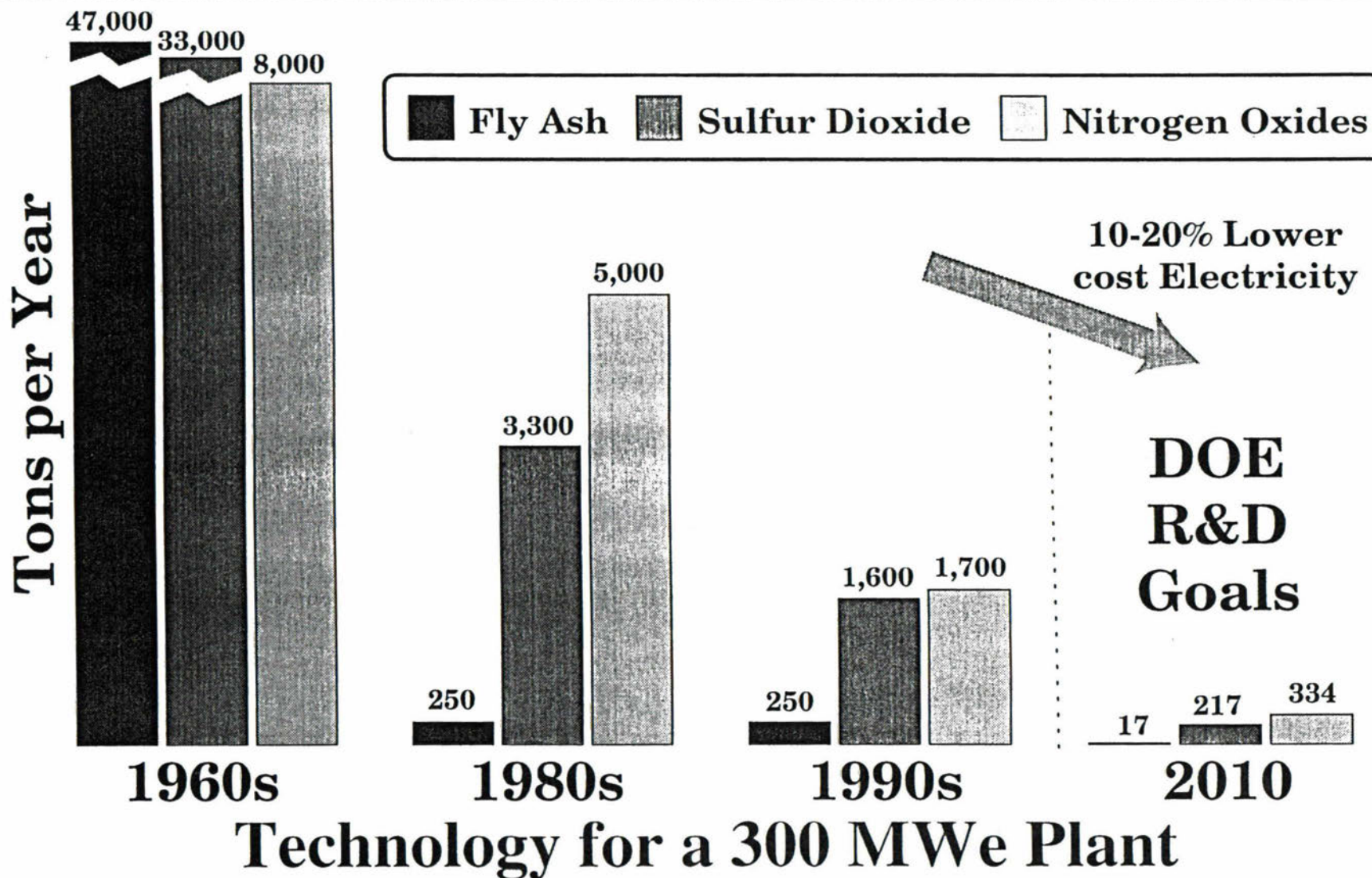
GHG REDUCTIONS PLEDGED BY CLIMATE CHALLENGE UTILITIES



Source: Climate Challenge Program Report, December 1996

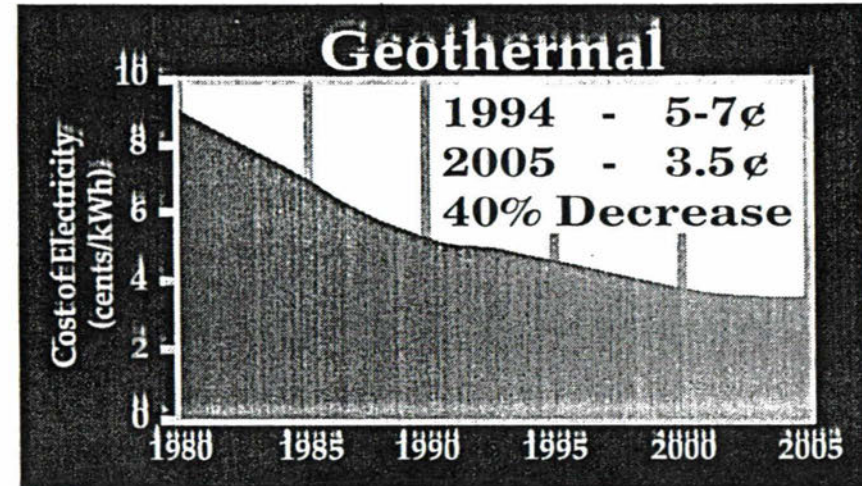
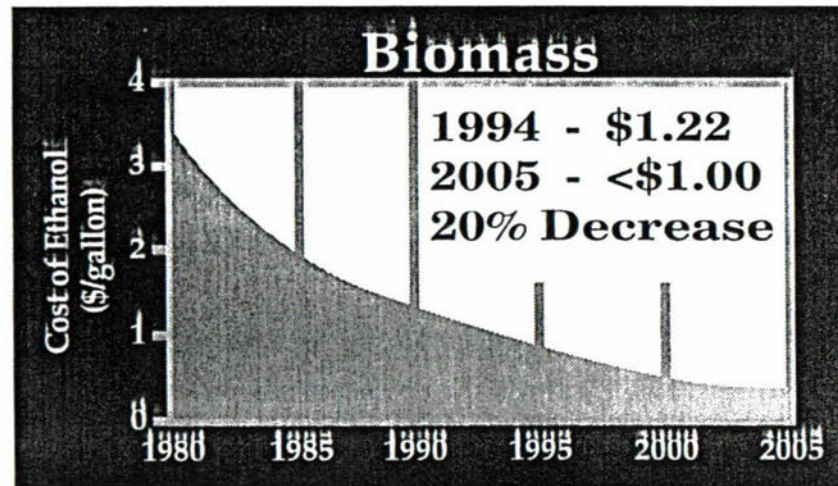
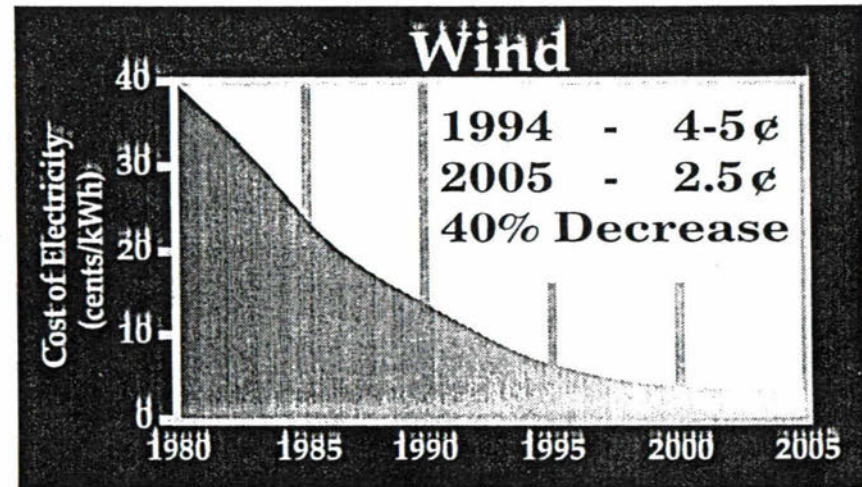
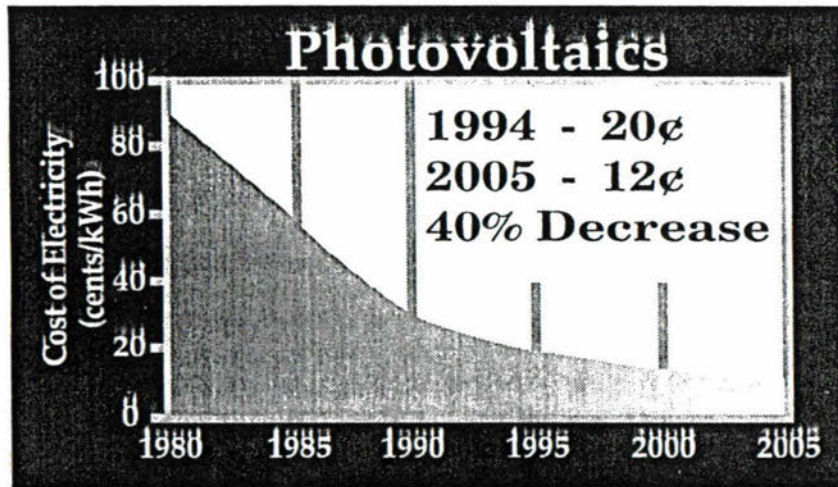
U.S. CLIMATE CHANGE POLICY

BENEFITS OF COAL R&D



U.S. CLIMATE CHANGE POLICY

RENEWABLES: PROGRESS



U.S. CLIMATE CHANGE POLICY

OPPORTUNITIES

No Other Approach Delivers . . .

More Environmental Benefit for Limited Funds

More Private Sector Funds & Technology

Technology to Greatest Reduction Potential

Likelihood of Political Success



Todd Stern

Henry!
Todd
Hank this is
a good start
later

97 SEP 22 AM 11:34

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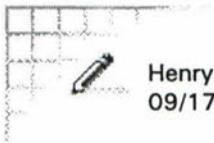
To: Robt

cc:

Subject: try this as an outline for the climate change pitch

pls print out.

----- Forwarded by Kathleen A. McGinty/CEQ/EOP on 09/17/97 09:13 AM -----



Henry C. Kelly
09/17/97 08:23:50 AM

cc: Ann Sanderson

Record Type: Record

To: Todd Stern/WHO/EOP, Kathleen A. McGinty/CEQ/EOP

cc: Rosina M. Bierbaum/OSTP/EOP

Subject: try this as an outline for the climate change pitch

I've sent it to TJ and we'll be meeting on it with several agency people this morning at 9. Any quick thoughts?

Our plan for avoiding the potential catastrophe of global climate change is built around a vision of a 21st century economy that works. Instead of coping by calling for curtailment and pain, our commitment to protecting the environment is built around a renewed national commitment to invention, investment, and expanding exports. We can do this by creating the best possible climate for innovation through low interest rates, streamlined regulations, and research partnerships with universities and businesses. A growing economy is a productive economy and a productive economy operates with minimal waste. The kinds of technologies needed to build a more prosperous American future are precisely the technologies we need to control climate change.

We have an 8 point program to unleash the power of American ingenuity:

1. CLEAN LIVING [HOUSING FOR THE 21st CENTURY] America's housing industry has committed to a ten year program that will produce higher quality homes, affordable homes that will use half the energy and produce half the greenhouse gases as today's homes. The insurance industry has joined the partnership and has committed to providing reduced insurance rates to buildings that meet the new voluntary quality standards. The governors of [Colorado and Florida] and the Mayor(s) of [Los Angeles] have committed to join with us to reinvent codes to ensure markets for these attractive new homes. We are also launching a new [\$ million program of research in advanced construction materials and products which can lead to even greater savings in energy costs and greater reductions in emissions. Many

buildings may eventually be able to sell electricity instead of consuming it. [discuss standards for appliances?]

2. REINVENTING ELECTRIC UTILITIES: We are proposing a radical reinvention of the way utilities are regulated in the United States. While utilities are now regulated as public monopolies, we will open the field to competition in a way that will greatly accelerate the invention and introduction of efficient new energy production technologies. As an element of the reform, we will ensure that rural and low income customers are protected and that funds remain available for investments in energy efficiency and renewable energy. The utility industry has agreed to invest for the future by accepting the challenge of providing at least 4.5% of all electricity from new renewable energy sources by 2010. We expect electricity costs for all customers to fall as a result of the efficiency improvements made possible by competitive markets.

3. ENERGY FARMING: America's farmers, rural communities, and forest products industries have joined with us to find ways to use agricultural and forest wastes as a new, clean source of fuels and electricity and to develop grasses or other energy crops that may become a new commodity crop for farmers. We have set a 2010 goal of providing a technology capable of turning wood chips, grasses, and waste materials from paper and lumber operations into a liquid fuel which can substitute for gasoline or electricity made at competitive prices. Pilot projects in places where the economics are favorable will begin next year.

4. SMART CITIES The mayors of [] have agreed to work with us to find ways to make America's cities better places to live and work during the coming decades with programs that will lead to cleaner air, lowered greenhouse gas emissions, and less congestion. DoE, EPA, and DoT will together offer \$[] million annually in direct support for community-led efforts to improve use of mass transit, invest in intelligent highway systems which can reduce congestion and increase highway safety, and improve parking and zoning policies.

5. SUPERCAR [yes that's what the big-3 want to call it] Four years ago the administration entered an unprecedented partnership with the Big-3 US automakers to develop an automobile capable of achieving up to three times the fuel efficiency of cars being sold in 1994) and reduce the greenhouse emissions from cars by a factor of three. We are proud of the progress made by an effort which has drawn on hundreds of research organizations in universities, supplier industries, small businesses, and government laboratories. As we approach the final phase of the project, the partners have indicated that we need increased funding for several technologies critical for meeting the goal. We have committed to \$[] to ensure success. We have also committed ourselves to a program which will ensure that progress does not stop when the 10-year program ends. Specifically, we are providing \$[] to accelerate support for fuel cells which have the potential to replace the internal combustion engine with a quiet, clean, reliable power source.

6. INDUSTRIES OF THE FUTURE During the past year we've worked with a number of industry groups to learn where they believe increased research would lead to the greatest gains in manufacturing. Today three major new partnerships which build on these roadmaps: (i) a partnership with the pulp and paper industry, the forest products industry, and [] to increase the production of electricity from

power-plants producing both heat and power to [1]GWe by 2010, (ii) an partnership with [Dupont, Dow, Monsanto, Goodrich....] which will revolutionize the production of chemicals in the US by substituting

clean, low-temperature, biological processes for systems which use energy inefficiently and produce many waste products that are costly to

contain [quantitative goal], and (iii) develop and introduce techniques for controlling the electric motors,

compressed air and steam in ways that reduces energy requirements for these primary industrial power sources

by a factor of [1]

7. THE MILLENNIUM ENERGY PROJECT: Stabilizing global greenhouse gas concentrations over the next few decades will require fundamental changes in the way energy is produced and consumed. Developing technologies that can reduce greenhouse gas production throughout the economy by factors of two or three is one of the great intellectual

challenges of our generation. We are prepared to meet this challenge

and will support \$[1] billion, ten-year program of basic scientific and engineering research in

partnership with the nation's businesses, universities, and government laboratories. [Presidents of several major universities, John Young and other technology CEOs, several DoE lab directors] We

will develop solar cells that can produce cheap

electricity, inexpensive lightweight materials for vehicles, crops that don't require fertilizers or pesticides, and possibly methods for disposing of greenhouse gases in places where they can do no harm.

[Building on successes of the past, we will manage this work ensure

that this research meets realistic business needs but not substitute

for research that would]

8. We are also ensuring that the federal government lead the nation in use of technologies which reduce greenhouse gases. It makes no sense for the federal government to be owning and operating buildings and other equipment which private businesses would consider wasteful and inefficient. We pledge that wherever we can save taxpayer money by using energy more

efficiently, we will do so. By doing this, we can commit ourselves to reduce the greenhouse gases produced by federal buildings [**% below 1990 levels by the year 2010.

Also rans:

- Building on the success of the PNGV partnership we are launching a new partnership with the producers of heavy trucks. DoD, engine manufacturers, truck CEOs

- We are committed to reduce energy use in aircraft by 35% during the next 15 years by improving aircraft engines, air-frames, and introducing air traffic control technologies that are safer and allow pilots to fly the most efficient route from point to point.

Todd

David Sandale
NSC

Michelle
Nicholas

File & Foreign
Policy

from
Bill Antholis

Energy Security in the Asia Pacific Region

Daniel Yergin
Cambridge Energy Research Associates

[Committee Two]

Co-Authored by
Dennis Eklof
J. Jefferson Edwards

Prepared for
The IISS 39th Annual Conference
Singapore, 11-14 September 1997

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DANIEL YERGIN, is President of Cambridge Energy Research Associates (CERA), an international research and consulting firm, and Vice Chairman of the Global Decision Group. Dr. Yergin received the 1992 Pulitzer Prize for General Nonfiction for his work *The Prize: The Epic Quest for Oil, Money & Power*, which has been translated into twelve languages and was made into an eight-hour international television series. Dr. Yergin is coauthoring a new book with Dr. Joseph Stanislaw, CERA Managing Director, *The Commanding Heights: The Battle Between Government and the Marketplace That Is Reshaping the Modern World*. His most recent book is *Russia 2010 and What It Means for the World*, coauthored by Thane Gustafson, CERA's Former Soviet Union Director. Dr. Yergin served as Chairman of the US Department of Energy's Task Force on Strategic Research and Development. He is a member of the Secretary of Energy's Advisory Board and a member of the Co-Chair Committee of the U.S. National Petroleum Council. He holds a PhD and an MA from Cambridge University (England), and a BA from Yale University. He also holds honorary doctorates from the University of Missouri and the University of Houston.

DENNIS EKLOF, Director of CERA's Asian Pacific Energy Research Service, is an authority on Asian oil and energy markets, refining, oil price risk management, and oil's competitive position with other fuels. He is co-director of CERA's major new study on the future of natural gas development in Asia. He is the author of the CERA Special Report *Refining in Asia: Will Growth Boost World Refining Markets*, and the author or coauthor of the CERA reports: *The Fight for Market Share: Will Oil Regain Lost Ground in Power Generation?*; *New Frontiers: The Emerging Competitive Landscape for Global E&P*; *China's Oil Industry: Predicament and Potential*; *Upstream Profitability in the 1990s: A New Perspective*; and *The US Strategic Petroleum Reserve: Margin of Security*. Dr. Eklof was the Project Director for the CERA multiclient study *The Future of the Asia/Pacific Oil Market*. Dr. Eklof holds a PhD from Johns Hopkins University. Dr. Eklof formerly worked with the Esso Eastern Corporation in its operations in the Far East.

JEFFERSON EDWARDS, CERA Associate, specializes in Asian energy markets, the global downstream oil industry, and energy finance issues. He focuses primarily on political, economic, and energy market developments in Southeast Asia. He is the author of the CERA Private Report *Planting a New Branch in an Old Tree: Political Change in Vietnam*. Prior to joining CERA, Mr. Edwards worked in the natural gas industry in Texas and served as the Country Representative for the US-Vietnam Trade Council in Hanoi, Vietnam. He holds an MS from the School of Foreign Service at Georgetown University.

Energy Security in the Asia Pacific Region

By Daniel Yergin, Dennis Eklof and Jefferson Edwards¹

Underlying the dramatic economic growth experienced by the majority of East and Southeast Asian countries over the past three decades has been a less readily apparent second "Asian miracle" -- rapid growth with severely limited energy resource endowments. Japan, South Korea, Taiwan, and Hong Kong all built powerful, dynamic economies without significant hydrocarbon resources. These countries achieved this impressive performance through a broad portfolio of strategies -- and by earning their way in the world economy.²

Some countries in the region, blessed with an abundance of natural resources, avoided the hardships of resource dependency in the past. In the coming years, however, virtually all of the countries in the region are or will become net importers of crude oil. All of them will experience rapid growth in energy demand. And for all, ensuring adequate supplies is essential to facilitating and protecting economic growth. How key players react to the inevitability of the region's increased dependence and the market pressures that go with it constitutes one of the major security questions for the region.

The uncertainty surrounding the resolution of this question makes energy security a particularly urgent question for the Asian countries themselves, for the countries that supply them -- and for the countries that participate with them in the marketplace. The issue, however, is not only a matter of tangible facts and future projections. It is also a question of perception -- of how countries view the problem and act upon it. Is the "second miracle" -- rapid growth with limited energy resources -- at risk?

The key signpost toward the emergence of energy security as a key issue in Asia appeared in 1993. That was the year that China moved from being an exporter of oil to being an importer. This represents a fundamental change in Asia's energy balance. Since then, it has been recognized that not only is Asia the locus of growth for the world's energy industries, but that the rapid demand growth and the attendant stresses and potential rivalries define a new calculus for energy security. Certainly, those familiar with global energy supply and demand issues during the past two decades will find themselves perplexed when reviewing Asia's energy supply situation in this decade's closing years and into the twenty-first century. On the one hand we see a mix of old imperatives -- diversification of supply,

¹ The authors would like to thank James C. Clad and Joseph A. Stanislaw for their contribution to this paper.

² On the impact of Asia's export orientation, see Jose Edgardo Campos and Hilton Root, *The Key to the Asian Economic Miracle: Making Shared Growth Credible* (Washington D.C., Brookings Institution, 1996) and The World Bank, *The East Asian Miracle* (Washington D.C., The World Bank and Oxford University Press, 1993).

development of strategic reserves; on the other hand we detect the interplay of new impulses and approaches. Consider Asia's perennial supply constraints but also the innovative commercial approaches that are emerging to overcome them. Consider also how the passage of time has actually increased some dependencies, the region being more dependent than ever on Middle Eastern petroleum. Yet consider as well how Asia's range of energy supplies has advanced over the intervening years.

This mix of old and new becomes especially perplexing when the position of some countries, notably China, comes under scrutiny. Analysts sometimes take as both starting and ending point the outlook of China's future energy demand. That country's needs are growing so rapidly that many analyses describe Beijing's policy options in ways that come perilously close to the 'shortage-equals-security-challenge' scenarios of the 1970s.³ But security planning follows closely on the heels of these assessments, and thus we need to think very clearly about the likely effects of the evolving energy picture to avoid creating misunderstandings, controversies, and conflicts that can be avoided. Certainly one area, the South China Sea, does stand out as a potential arena for competition and confrontation. And there are scenarios and sketches that point to a security clash and a struggle over resources that could shake the entire region.

However, this paper offers a contrasting view, one based upon cooperation, integration, and cross-border investment. It is one in which the issues and stresses can be resolved not through military power and blue water navies, but rather through markets and investment within the ever-denser web of international commerce. Interdependence and mutual benefit win out over confrontation. Let us leave no doubt; this is an optimistic view. But it rests upon the proposition that the end of the Cold War and technological change have accelerated the move towards a truly global economy. As we put it, the shift can be understood as a move from an era in which states sought to dominate the "commanding heights" of their economies to a world in which the ideas of markets, commercialization, deregulation, and privatization have captured the "commanding heights" of world economic thinking.⁴ One observes, in the post-Cold War world, a sharp split and indeed to some extent a mutual incomprehension between the perspective of the security specialist and that of the businessman. Our perspective in this paper tries to bring these perspectives together and heal the breach.

³ See Kent E. Calder (1996), *Pacific Defense: Arms, Energy and America's Future in Asia* (New York: William Morrow and Company, Inc.).

⁴ See Daniel Yergin and Joseph Stanislaw, *The Commanding Heights: the Battle Between Government and Marketplace That is Remaking the Modern World*, forthcoming, Simon & Schuster, December 1997.

Our view on Asian energy is being profoundly shaped by the learning that is coming out of the year-long study that Cambridge Energy Research Associates is undertaking - together with a number of international and regional energy companies and governments in the region - on the future development of Southeast Asian gas markets.⁵ It is becoming clear that the potential for new gas resources and for gas markets is much greater than has been anticipated up to now. If, however, that potential is to be achieved, there will have to be much more extensive infrastructure development. That, in turn, requires a new level of international cooperation among nations and a new level of confidence on the part of the private capital investors whose involvement will be essential if maximum use is to be made of this gas. In other words, cooperation and integration -- along with flexibility -- are the keys to bringing additional supplies to market, not elbow-jabbing neo-mercantilist rivalry.

With all this as context, let us offer a series of key observations and conclusions:

- Energy security is a major issue because of rapid growth - both in terms of the broader economies and the energy consumption that underpins that economic growth -- matched up against limited regional supplies, particularly of oil. Nothing so dramatizes the issue as the anticipated growth in Asian oil demand of more than 12 million barrels per day between 1996 and 2010 -- almost equivalent to the entire current output of Saudi Arabia, the United Arab Emirates, and Kuwait combined.
- The environment is becoming a new dimension of security, both on a national and regional base. Countries want to reduce air pollution in their own countries, and they want to be protected from pollution carried from other countries. The Kyoto climate change conference in December of this year could well push national energy supply decisions into the arena of international contention.
- Markets and market-based strategies will ease traditional energy supply concerns and allow the diversification of risk.
- Some countries are moving away from the traditional security strategies of the 1970s and 1980s and looking instead to privatization, competition, and open markets to supply the energy they need and the capital necessary to develop infrastructure sufficient to meet those needs. This is taking place partly out of conviction and experience -- and partly out of necessity.
- While markets will resolve more and more energy security issues, there are some areas in which diplomatic efforts are still urgently needed.

⁵ *Natural Gas in Southeast Asia: Scenarios for the Future of Gas Investment, Infrastructure Investment, and the Competitive Dynamics of the Energy Marketplace* (Cambridge Energy Research Associates, 1997).

- Governments can enhance their national energy security by taking steps to encourage market development rather than imposing policy solutions that disregard economic fundamentals.
- In many cases, the urgent security issue is not supply, but the securing of the infrastructure to transport and distribute supplies.
- Natural gas can play a larger role in regional energy supply than is generally recognized and, in so doing, will encourage cooperative, cross-border solutions.

It is appropriate to consider Asia's energy security at the IISS meeting in Singapore, the regional energy hub and a crucial location for refining product, for transshipping it, and for pricing it. In Singapore, the contractual instruments so prominent in our era--forwards, futures, and swaps--play an everyday role in getting product to markets. Singapore's role demonstrates the importance of market pricing; it underlines the fact that a mismatch between demand and supply points *not* to threat scenarios or to tense scrambles for resources, but rather to a *continuing diversification of supply risk* whether by Asian consumers, companies, importers, or governments. This diversification comes through many modes.

Such diversification most often results from an array of market responses scarcely imaginable twenty, or even ten years ago, responses that include the privatization of single-supplier firms or of various publicly owned "national patrimony" corporations intent upon *dirigiste* solutions within closed-off national markets; the development of regional markets; the reduction in international tension and the lowering of borders; and the emergence of entrepreneurial international developers -- whether from the oil, natural gas, or power business -- competing to provide solutions to nations' energy problems. . The choice of open markets reflects many pressures--fiscal imperatives; efficiency strictures, and (not least) a reordering of economic priorities. Multiplying commercial opportunities for energy supply can result from very urgent needs, such as relief of pressure on the public accounts or the need for immediate alleviation of electricity shortages. But with the need comes a growing conviction that an increasingly diversified regional and global energy marketplace can provide enough leeway even for smaller players and purchasers.

Whatever the primary or secondary motivations may be, an increasingly clear objective lies in the attainment of flexibility as a device to assure the security of supply via the marketplace. After surveying below the trends that characterize Asia's energy security situation, one cannot conclude that the marketplace itself has all the answers. We must, however, observe how powerfully markets have responded to resolve what seemed to be intractable energy security issues in the 1980s -- whether through the stimulus to conservation, new oil development and diversification, fuel switching -- or

through technological innovations that have married advanced computer technologies to the search for and production of hydrocarbons. In questions that turn on the exploration of resources, old-fashioned anxieties such as, 'who is sovereign over a particular piece of real estate or seabed floor?' guarantee the persistence of old-fashioned diplomacy resting, ultimately, on a balance of power. A wise approach to coping with Asia's steady demand growth and its comparatively static supply picture embraces a set of commercial *and* government policies. In the present era, 'energy security' does not mean a preparation for conflict, but rather a preparation for competition, an approach that fastens on achieving security of trade and financial flows across borders by competitive liberalization.

The starting point for the entire discussion, however, must be the fundamentals of the marketplace.

Asian Energy: Supply & Demand.

Despite a slowdown in energy demand growth across East Asia as economic growth slows, Asian energy demand itself will continue to be the single strongest impetus in world energy demand overall. Asia's export-driven growth, its dramatic shift to hydro-carbon powered transportation (a by-product of personal income growth overall), its rapid urbanization, and its politically central electricity programs all seem set to climb at a rate of between 4 to 5 percent per annum to the year 2010, in contrast to global demand rising by about two percent per annum. (Global, non-OECD demand will reach between 5.5 to 7% per year, with the higher values bunching in the first years of this projection as stagnant economies revive.) Our estimate is somewhat higher than others; for instance, Japan's Ministry of International Trade and Industry puts the growth at 4 percent.

Excluding Japan, Korea, Singapore, and Taiwan, already highly developed economies, CERA expects energy demand to rise by as much as ten percent each year in some areas, notably within the ASEAN countries. That is a huge number, but a realistic one. Between now and the year 2010, Asia will account for 56% of the global increase in oil demand, an annual growth of 4 percent each year, even though oil's share of the region's primary energy demand will be falling slightly, from 40% to just under 38%. Once again, we expect Asian oil demand to routinely reach six percent per annum, both in the ASEAN countries as well as in China. Transportation fuels will rise even more quickly.

In electricity demand, we expect Asian growth to measure 6.5 to 7% per annum, while the total non-OECD electricity demand will be higher, at ten per cent annually up to 2010. Meeting the needs for electricity -- rather than for personal transportation -- is the heart of the energy issue across Asia. The issue is not angry motorists, which is the specter that haunts politicians in the West. Rather, it is

brownouts and blackouts that disrupt hospitals, schools, and factories, and whose impact can be measured in terms of lost GDP. That is why infrastructure looms so high.

While coal remains at the heart of power strategies in China and India, much of the power demand in the region will be satisfied by as yet-unbuilt natural gas-fired generation, an outcome which will drive up demand for this fuel in Asia from its present 8.7% per annum growth rate (totaling 25 BCFD). Detailed scenarios developed by CERA's Integrated Natural Gas Study for Southeast Asia, a study in progress since 1996, show that natural gas demand in this region can grow at even higher rates given the right political and regulatory environment.⁶

Given rapid demand, from where comes the supply? The challenge is to supply the equivalent of an *increase* over 40 million mbd of oil equivalent in primary energy between 1996-2010. Analysts concerned by a perceived demand/supply gap with pressing security overtones have focused on Asian crude oil production -- and with good reason. Total liquid productive capacity (including condensate and natural gas liquids) is projected to peak at approximately 7.9 million barrels per day in the Far East during the same period. Crude oil productive capacity (excluding condensate and NGSs) is slated to peak at approximately 6.5 million barrels per day between 2000 and 2005. Outside of electricity generation, oil will remain the most important fuel. Self-sufficiency in coal and natural gas may augur important shifts in energy dependence over the longer haul, but the net difference in crude oil imports from 1996-2010 will be 12.4 mbd.

At present rates of oil demand increase -- and in the absence of major new supplies -- Indonesia, Malaysia, and possibly even Vietnam will join China as net importers of oil over the next decade. This alteration in fortune has especially significant implications for Indonesia, an OPEC member but soon to become another Asian oil importer. Jakarta now sees Indonesian fields providing approximately 20% of total Asia oil production; within as little time as five years Indonesia's current 0.6 mbd of oil exports may disappear altogether, due to rapidly increasing domestic demand and declining production.

In toto, the prospects for intra-regional oil supply in Asia look decidedly poor. By 2010, productive capacity will have declined to approximately 5.5 mbd, with new field developments proving nowhere near enough to compensate for the maturing of Indonesian, Malaysian and Australian fields. So, regardless of exploration, we see Asia as almost destined to import 23 mbd of oil by 2010. Perhaps the need will be for much more.

The tendency of security analysts, up to this point, is to stop the analysis at crude oil production. But we have also been looking closely at the effort being put into coal--into its efficiency, cleanliness,

⁶ See *Asia Pacific Energy Watch, Spring 1997* (Cambridge Energy Research Associates, 1997)

and export promotion. Both Indonesia and Australia are putting faith in coal exports. The overall result will be trade-offs between price and sulfur content. The result, however, will be much stiffer inter-fuel competition, the result of lower coal prices, especially when linked to cleaner burning technologies. Good quality, low-sulfur coal will go some way toward erasing the environmental premium. The export objectives of both Indonesian and Australian coal producers have received top-level endorsement from their respective governments.

Prospects are good for both increased production, and increased power generation utilization, of natural gas. With advances in exploration technology, more gas is being found in Southeast Asia with each passing year; with each boost to reserves, the producers have become more persuasive about long term supply and power generation prospects in the region. But getting to the natural gas end-users means a very different level of infrastructure than oil. Whether used for domestic or export, getting gas to market means building pipelines, power plants and or LNG facilities. Vast sums of capital must therefore go into non-portable infrastructure which must, to justify the investment, have very long life commitments. The implications of the growing attractiveness of natural gas, and of the particular infrastructure requirements of this resource, are discussed in the concluding section of this paper--which deals with the contemporary meaning to Asia of the words, "energy security." But natural gas could become a more flexible fuel with the technological advances that are beginning to attract attention in terms of competitive conversion of natural gas into a high quality liquid fuel.⁷

China's Energy Future

China has not yet become a "driver" of energy trends entirely in its own right, but its impact on world energy markets will only grow in the coming years. Few can argue with the proposition that China's growth rates, even if these were to be halved over the next decade, still points to an increasing dependence on imported oil and gas. Our working figure for China's primary energy demand growth is 4.5 percent per year from now to the year 2010. How is China to deal with such needs?

As should be clear from the earlier discussion, we believe that there is too much emphasis in recent writing on the ever-starker appearance of these deficits alongside Beijing's growing financial ability to purchase the sort of weapons platforms which will enable it to project military power over the horizon. The thrust of much of this recent writing is to equate China's energy insecurity to a longer-term prognosis of political insecurity for China's neighbors and, by implication, for U.S.-Japan interests.

Another dimension to China's energy situation lies in its increased reliance on indigenous energy – most notably coal but also untapped hydroelectric potential. This perspective converts energy insecurity to environmental insecurity, for the Chinese people themselves, of course, but also for countries adjacent to China (Japan's acid rain-diminished forests) and the world at large, fated to suffer large increases in greenhouse gas emissions.

The concerns raised by these analyses are not based on thin air. Natural gas demand in China may more than triple by 2010; even so, coal—which now accounts for more than 70% of China's energy - will remain the dominant fuel. In keeping with the other two of Asia's Big Three countries, India and Indonesia (which both possess large coal deposits as well), demand for coal will grow. In China we expect this demand to rise at about five percent p.a., despite improvements in combustion and conversion efficiencies.

China's breakneck growth; its transition to oil-importer; its insatiable urban demand for electricity; its disappointing oil and gas exploration results; its population densities; its environmental issues; the levels of air pollution in many of its cities -- all these point to levels of political insecurity and to environmental anxiety. The question is, what is missing from the analysis?

Our answer is that the global open market provides China with mechanisms that are already in use to mitigate the impact of its dependence on outside energy supplies. As China becomes ever more integrated into the world economy and an ever-larger exporter of manufactures, its international commercial role in world energy markets will also grow. Recent events support this view. China's two major oil companies in recent months have committed themselves to a variety of oil exploration and production ventures beyond its borders. Announced deals include:

- A planned \$4.3 billion investment to take a 60% stake in Kazakhstan's main oil company, develop fields in that country and build a 3,000 kilometer crude oil pipeline to China's Xinjiang province
- A successful \$359 million bid for the right to develop and operate two oil fields in Venezuela
- An agreement to invest \$1.2 billion to develop the Al-Ahdab oil field in southern Iraq, while discussion continues about development of two additional fields
- Agreement to form a joint venture with the National Iranian Oil Company to explore for offshore fields in Iran, China and in third countries, and to upgrade Chinese refineries in order to accommodate increased Iranian oil exports to China

⁷ Chuck Jordan, *New Developments in Gas-to-Liquids Technology: Fundamental Change or Just a Niche Role?*

- A \$750 million project to develop oil fields in southern Sudan with Malaysia's Petronas and Canada's Arakis Petroleum
- An open-ended supply agreement with Saudi Arabia to meet China's rising oil import needs (present imports stand at a modest 30,000 bpd)

In the past, large projects - such as the Kazakhstan pipeline and a proposed pipeline project designed to bring Russian natural gas to the Chinese, Korean and Japanese markets from the Russian Far East and Siberia- have been mooted as confidence building measures between neighboring states. However, the CNPC investment in a major Kazakh oil company implies a higher level of intent. There are two possible drivers behind China's upstream strategy: the corporate ambitions of China's national oil companies; and the national security concerns of China's political and military leadership. For the Kazakhs, this project with China also provides a very welcome diversification that goes to the heart of its new independence.

But the immediate problem remains: demand for oil has out paced rising (2 percent per annum) production levels in China, currently the world's seventh largest crude oil producer. Both the offshore areas and the Tarim basin have proven disappointments. The question is, what may China do to reduce dependence on imported oil and, more generally, minimize supply risk? In 1996, China imported almost 0.5 mbd; this figure could reach 1 mbd by the year 2000 and as much as 3 mbd by 2010--i.e. almost 50% of total oil demand. This must come, given the fading away of Indonesian supply, from the Middle East or from Central Asia. One early sign of China's strategy for dealing with its oil import needs is the arrangement with the Iranian National Oil Company to reconfigure Chinese refineries to received more Iranian crude.

Beyond that, China's moves to increased efficiencies in fuel consumption have begun to make some headway in reducing the energy intensity of the Chinese economy. Important in government thinking is the establishment of a strategic petroleum reserve to reduce the impact of market fluctuations. In this perspective, everything from port modernization to faster turnaround of larger and more efficient oil tankers has a place. Indeed, such modifications *must* occur if China is to liberalize, as it eventually must, its domestic pricing structure for oil products. Finally, the China National Petroleum Company (CNPC) has been moving actively to lay the foundation for a more diversified based of oil imports and, eventually, set-asides for longer term supply contracts.

These moves include the abovementioned taking of major equity stakes in Iraqi, Sudan, Iranian, Kazakhstan, and Venezuelan fields, as well as plans for a pipeline from Kazakhstan. These come in the wake of the China National Offshore Oil Company's (CNOOC) move into joint exploration and development of fields in Southeast Asia, notably a 40% stake in an Indonesian field within the strait of Malacca, but also in Thai, Malaysian, and Papua New Guinean territory. The Chinese political leadership clearly has become more amenable to suasion based on energy security rationale; hence the top-level push to import natural gas from Siberia and the Russian Far East, the long term use of which may reduce disagreements with Japan over coal-fired electricity in northeast China leading to acid-rain.

The drive by China's national oil companies to internationalize operations is a sign not only of China's desire to gain access to supplies, but also a sign of a desire to gain experience in international operations and to export their own know-how and experience. Such "commercialization" of the operations of state-owned enterprises is likely to be strongly emphasized in the upcoming the 15th party congress. In their international operations at least, Chinese oil companies could become, to borrow a phrase, international oil companies with "Chinese characteristics." Commercialization and internationalization will allow China's oil and gas companies to learn at an accelerated pace through exposure both to latest-generation exploration and production technology and to advanced financial risk management techniques. At the same time, indigenously produced Chinese technology, though perhaps not as advanced as some western technologies, is also not as expensive. In this sense, Chinese technology may in some cases be financially and technically more appropriate for developing countries – in effect creating a new export market for Chinese technology.

Beyond that, China faces another 'risk' – this one domestic in nature and the result of its economic success. For the likelihood is strong that China's citizens will be developing in the years ahead the same appetites and, on the coast at least, the same purchasing power as the burgeoning middle classes in Southeast Asia and Taiwan. Consumer-driven electricity demand, far more than increases in transportation fuel consumption, will drive energy policies and needs. Yet growth in private transportation has become associated with indicators of improved living standards in every high-growth Asian economy. Ensuring supplies within China's current infrastructure and supply constraints could amount to *the* urban challenge over the next decade.

The World Energy Supply Market

No question -- the years ahead will see a race between energy demand growth and supply development. As it is, the world oil market is operating at about 95 percent capacity utilization,

eliminating much of the "security margin" that became so familiar in the 1980s. Yet technological advances will allow for the development of resources once thought beyond reach; computers and information technology are transforming the world of oil and gas information. Indeed, it may well be correct to say that those IT advances did much to "save" the world oil industry after the 1986 price collapse.⁸

Building upon technological advances and opening borders, we expect world oil supply to grow from 78 mbd in 1997 to over 97 mbd in 2010; though production in Asia and the North Sea will drop in the early years of the next century, new production in the Middle East, Latin America, the former Soviet Union, and Canada on our present estimates will be adequate to meet global oil demand.⁹ This relatively-favorable supply situation will result, we believe, from three things: (a) technology; (b) increasingly open opportunities for firms regardless of commercial domicile; and (c) an overall shift toward a commercial mentality, from neo-mercantilist notions fixing petroleum resources as "national treasure" to the acceptance of them simply as a "tradable commodity."

The Middle East and Asia

Within this picture of global supply adequacy and Asian demand lies an important relationship: that of Asian consumers and Middle Eastern producers. This will deepen. The share that OPEC countries have of global production will probably rise, from 36% to about 45% of world production by 2010. The Middle East, overwhelmingly predominant within OPEC, will provide not only physical supply but also spare capacity, a security margin available in times of unanticipated supply reductions--as occurred when Iraqi crude disappeared from global markets after 1990.

As noted in the introduction to this paper, this steady, ever increasing dependence on the Middle Eastern is a recurring theme in the Asian energy picture. In 1975, Asia imported 5 mbd of its 9.3 mbd oil demand; by 1995, Middle Eastern imports had risen to 6 mbd, despite having dropped away in the 1980s by nearly half in response to Northeast Asian conservation measures and deliberate diversification policies aimed at coal, LNG and even nuclear power. Only in 1991 did Middle Eastern oil import levels reach volumes seen in the 1970s, a journey taking Asian fuel dependency full circle.

⁸ *Quiet Revolution: Information Technology and the Reshaping of the Oil and Gas Business* (1996) (Cambridge: Cambridge Energy Research Associates).

⁹ Robert Esser, *The Race to Supply Oil in the New Century: Expanding Horizons III* (Cambridge Energy Research Associates, 1997).

In Northeast Asia, Middle Eastern crude now provides over 70% of throughput; in Singapore, Middle East oil provides more than eighty per cent of refinery in-put. And crude oil procurement decisions by new refineries recently coming on line elsewhere in the Asian region show a preference for supply deals favoring Middle Eastern producers. For example, in the first half of this year, imports by Thai refineries of Middle East crude rose by more than 150%, with Indonesian and Malaysian imports sliding, by comparison to the previous half-year period, by over forty per cent. When Asia's imports of refined products are considered, the degree of Middle Eastern oil dependence has risen even more than the crude net import figures would suggest.

The question is, will Middle Eastern crude continue to provide the major incremental source of Asian refinery input? While proximity may favor its use in Southeast Asian refinery capacity, other signs point to a more diversified intake in East Asia, where crude from Russia, Turkmenistan, and even Kazakhstan has made an appearance. More to the point, the simple numbers showing Asian dependence upon the Middle East overlook three elements that will drive the future of the Asia – Middle East relationship. First is the transformation of the global energy market, with prices now far less subject to government control and far more transparent at every level of the value chain. This has enabled the evolution of a much wider spot market than existed two decades ago, and the more open trading environment has made possible the arbitrage that we see today. Second, new supply sources may emerge for Asia from the Former Soviet Union to compete with Middle East producers. Finally, the producers of the Middle East will increasingly depend on Asia for volume growth.

The Former Soviet Union and Asian Energy Security

A decade ago, the then Soviet Union was the world's biggest oil producer. In the years since, its output has plummeted by a daily volume greater than the entire current daily output of the North Sea. Meanwhile, out of the turbulence of the collapse of the USSR, a series of partly privatized Russian oil majors are emerging. Russia continues to be one of the major gas exporters, and indeed the entire former Soviet Union ranks as the "Saudi Arabia of natural gas." Under an Sino-Russian agreement signed earlier this year, Russian natural gas could become a major source of supply to the Chinese, Korean and Japanese markets through a proposed network of pipelines linking Siberia with Northeast Asia.

At the same time, perhaps the hottest development "spot" in the entire world oil industry is the Caspian region -- in Azerbaijan, Kazakhstan, Turkmenistan and in the waters of the Caspian Sea itself. The Caspian region may hold oil and gas reserves second only to those of the Middle East. Conservative estimates run as high as 100 billion barrels or more -- almost ten times the reserves of Alaska, and that

amount could increase as exploration moves into deeper waters. By as early as 2010, the Caspian could produce as much oil as the North Sea does today, making it one of the world's main production centers. The Caspian region also holds the potential of becoming a major supplier of natural gas. Turkmenistan alone is estimated to have as much gas as the United States.

There is an inherent and -- if old and new rivalries do not get in the way -- almost inevitable logic to conjoining the huge supplies of the former Soviet Union to the huge and growing Asian market. Much of the focus on the Caspian to date, understandably, has been on moving its oil west into the Black Sea and then on to Europe. But we are convinced that increasing amounts of oil and gas from the former Soviet Union will move east into the Asian markets. This will require investment, great amounts of investment. The gas transport will involve some combination of long-distance pipelines, but no more difficult or complex than the pipelines that now carry Russian gas to Europe. That gas will go into electric power generation.

Already the first signs of reorientation and focus are there. Japanese companies are becoming members of Caspian consortia. China's deal with Kazakhstan is a major bellwether for the future. As it is, increasing volumes of Kazakh oil are ingeniously finding their way into Chinese markets. These are harbingers of how the pressures that accentuate the energy security issues can be relieved through commercially-based deals that require cooperation and integration.

Continuing Controversies: The South China Sea

One issue turns back to very traditional areas of diplomacy. The maritime dispute in the South China Sea and its potential to disrupt regional confidence ranks as a front-burner issue in Southeast Asia. The focus is competing claims, which pit China against other countries in the region. To be sure, China has several ongoing maritime territorial disputes: with the Koreans and Japan in the Yellow and East China Seas; with Japan in the Senkaku Islands in the East China Sea; with Vietnam in the Gulf of Tonkin; and with Vietnam, the Philippines, Malaysia, Brunei and Taiwan in the Spratly Island region of the South China Sea. The claims in the Spratly Islands have garnered the most attention, for two reasons: the extent of the riches which some project under the disputed waters, and the broad expanse of territory covered by the Chinese claim.

How abundant are the resources of the South China Sea? Estimates range from six billion barrels of oil equivalent to over 105 billion barrels. Yet oil exploration in the region has, to date, been very disappointing, and it is currently thought that the region is largely gas-prone. If the experience in the Natuna field is a guide, gas resources in the region would be extremely difficult and expensive to

commercialize. Natuna, a huge gas field, has been under study for more than ten years and has an estimated total development cost of more than \$40 billion. The technical difficulties and huge cost of developing the field necessitated the creation of an international consortium to spread the investment risk and provide sufficient technical expertise and financial strength. Exploitation of a sizeable field in the nearby Spratly Islands would likely necessitate a similar approach involving extensive international cooperation. Such cooperation would prove difficult to marshal if jurisdictional issues are not clarified.

The Spratly Island group is the center of conflicting claims involving many nations -- China, Vietnam, Indonesia, Malaysia, and the Philippines. China's boundary claim potentially overlaps the major gas reserves of all these countries except Malaysia -- where only the source fields for the Malaysia III (Tiga) LNG project are included. The reserves contiguous to or included in the Chinese claims include many of Southeast Asia's most significant gas fields. The dominant reserve is, in fact, the undeveloped Natuna field, with an estimated 46 trillion feet (tcf) of natural gas. The South China Sea area already holds 65 tcf of natural gas with the potential to add 25 to 50 tcf more. Other reserves affected by the Chinese claim include:

- Vietnam's gas discoveries Lan Tay and Lan Do, both under development
- East Malaysia's Jintan and other fields under development to supply
- LNG along with recently issued high-potential deepwater blocks
- The Philippines' large Malampaya-Camago gas/condensate field being developed in deep water off northwest Palawan Island.

Regardless of the actual reserves underlying the waters of the South China Sea, the region will remain vitally important to Northeast Asian energy security. The disputed waters lie astride strategic sea lanes through which more than 70 percent of the crude oil and LNG supplies bound for Japan, Taiwan and South Korea transit. Equally important, manufactured goods bound outward from Northeast Asia for markets in South, Southeast Asia and West Asia also pass through these waters. Overall maritime traffic through the South China Sea is estimated to triple by 2010. The sea-lanes are also the strategic passageways for the US Navy in its transition from the Pacific to the Indian Oceans. The U.S. strategic relationship with Japan and South Korea is in no small part invested in the U.S. role as guarantor of energy security to these key Asian allies. Any country able to supplant the United States in that role would obviously gain enormous strategic leverage in the region.

Chinese officials have repeatedly asserted their willingness to jointly develop resources in the South China Sea on a bilateral basis. Despite the success of joint development programs in other

offshore areas in Southeast Asia, other claimants -- including Vietnam, Malaysia, and the Philippines -- have thus far resisted joint development, fearing that such cooperation would prove tacit acceptance of China's historically-based claims to the region. As they see it, the Chinese claim, if accepted, would extend Chinese sovereignty more than 500 miles off China's mainland coastline.

The South China Sea dispute is about energy. It is also, however, about the strategic balance in Asia and overall political relations. And it needs resolution.

Energy Sector Deregulation in Asia

A number of the factors mentioned above -- the effects of market prices, the flow of resources across borders, trade liberalization, a focus on national competitiveness, the need to attract investment dollars into the energy sector -- have led to the region-wide trend towards price deregulation of national energy sectors. Japan, South Korea, the Philippines, and Thailand have begun the liberalization of the downstream oil industry, leading to market-derived prices for oil products in those countries. Several countries, including Japan, Thailand and the Philippines, have begun deregulating and privatizing their respective electric power industries as well.

The primary driver toward deregulation differs across countries, as a result of differing economic structures and stages of development. For some of these countries, the drive for international competitiveness has been the overarching motivation behind liberalization -- this is clearly the Japanese and South Korean model. For other countries, such as the Philippines, the need to attract capital has provided the impetus for deregulation.

In all of these cases, however, the move toward freer energy markets represents a move from one form of energy security -- one based upon government mandate -- to another, based upon market competition. Supported by a stable political environment and motivated by the internationalization of their economies, these countries are moving away from the dirigiste strategies of supply security that emerged in the wake of the oil shocks of the 1970s toward market mechanisms for allocating risk. Japan, for instance, is now considering phasing out the remainder of its oil market regulations by 2001. This marks a dramatic shift in thinking about energy security. In the words of Ryozi Hayashi, MITI's Director General for Petroleum, "Adjustment in supply and demand can be achieved much more efficiently through market mechanisms than through government intervention."¹⁰

¹⁰ See Ryozi Hayashi, *Future Challenges for Global Energy Security: An Asian View*, IEA Conference on Global Long-Term Energy Security, April 1997.

The domestic political fallout from the exposing of consumers and domestic energy companies to potential supply shock risks is perceived as less of a concern than the long-term economic distortions associated with state intervention in the energy sector. As competition for export markets heats up between the developing economies of Southeast Asia and China, planners are searching for non-labor related foundations for national competitiveness. Reducing energy and other utility input costs is one strategy for boosting national productivity growth.

Conclusion: "Energy Security" in Contemporary Asia.

Does the region find itself in the middle of a transition between rather traditional notions of resource diplomacy and associated tensions over sovereignty toward the type of diversified free-market reliance we have been sketching out above? The answer is a qualified 'yes.'

In discussing the prospects for natural gas development within the evolving Asian energy supply situation, we mentioned the very different infrastructure requirements of this fuel. Large finds; an increasingly persuasive case for gas as *the* electricity generating fuel; the large capital investments needed for non-portable, long-life infrastructure--all this leads to the imperative of cross-border cooperation on a scale that matches the tariff reduction program of the ASEAN Free Trade Area and the ambitious free trade goal of the APEC. Such cooperation has already begun in areas such as the Thai-Malay Joint Development Area, where natural gas resources are being developed jointly by both countries. That is to say that both development necessities *and* commercial realities will drive the process becoming, along the way, as strong an indicator of true regionalization in Asia, as any measure adopted under the more traditional reduction of government barriers which we have seen to date.

That is the first segment of what "energy security" means, or will come to mean, in contemporary Asia. A second element of this new definition rests on a growing mutual dependence between Middle East producers and Asian countries. The dependence cuts both ways: when thinking strategically, the Middle Eastern producers readily see a world in which some of their potential market may be assumed by companies and enterprises working in areas outside the Middle East. Still, Middle Eastern producers realize that a large part of their future market growth must come from Asia, which will mean an intensification of the type of collaborative moves witnessed in recent years between Asian governments (and NOCs) and Middle Eastern producers, investment companies, and governments.

That is *not* to say that aversion to dependence does not exert a hold on the thinking of Asian political elites. The tendency toward government control over resources, in general, remains strong in Asia. The grip of 'resource diplomacy', dating from the 1970s, has not lessened. The satisfactions that

come from reinforcing one's strategic position with tangible commercial advantages have not diminished for any of the major players in Asia.

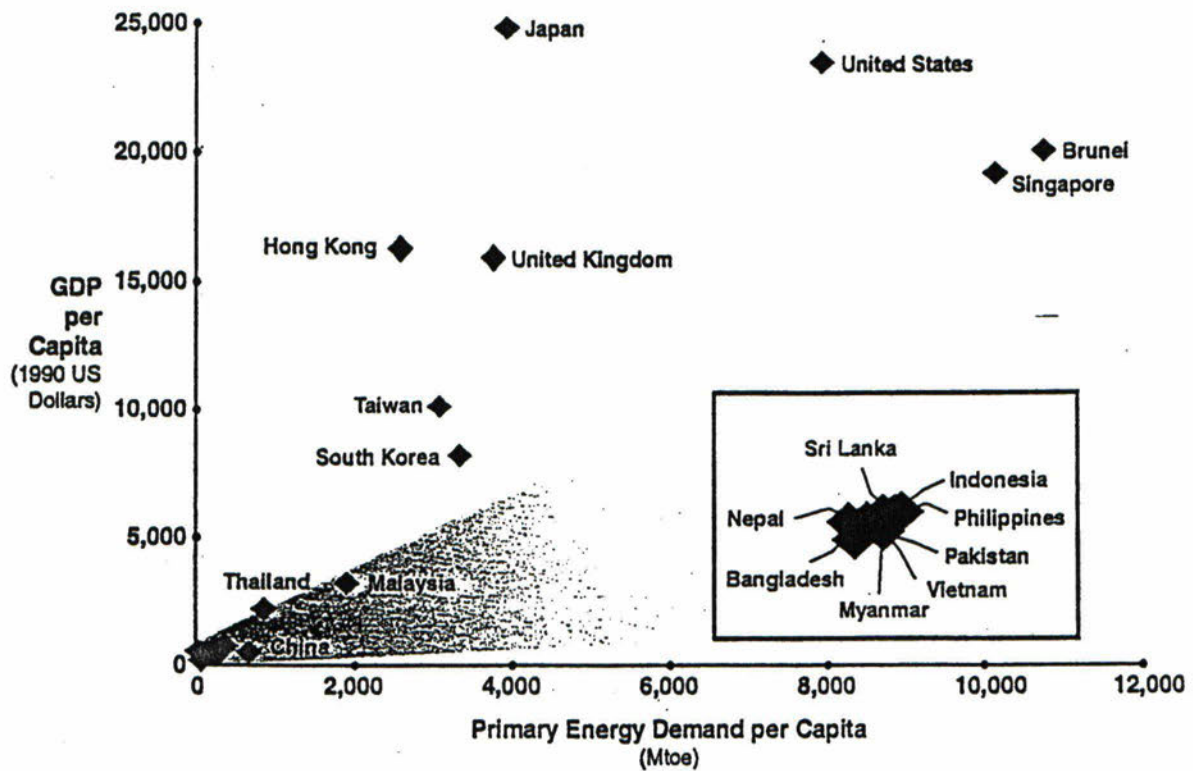
However, the dependence argument has dissipated over time, as the success of the resource poor countries in the region demonstrates. The steadiness of the market; its adaptability to meet new consumer and product demands; its growing size and transactional complexity—all these reinforce the argument that “security” now comes in the guise of diversified reliance on open markets. And Singapore's open market pricing mechanism has displayed one extra element of utility for a rapidly commercializing energy sector in Asia: the pricing indicators coming out of the Singapore market have enabled de-regulation to occur in a range of import markets, notably in the Philippines.

Many elements and *idees fixes* from the 1970s have changed, especially about “energy security.” One example is a lack of readiness to rely upon oil. But with oil, having the resources in the wrong place—if messy politics obtrudes—can have no lasting impact. It is otherwise with infrastructure for gas, inland coal, hydropower, or geothermal. These all require large fixed investments in infrastructure and depend on a range of political and economic concerns.

Some of these must necessarily, if the demand curve is to be met, depend in future on cross-border agreement. The evolving CERA study of Southeast Asian natural gas shows the logic behind the growing number of calls for various regional or even sub-regional grids. The future of the West Natuna field development, and of the associated benefits (perhaps) for Batam Island and for Singapore's electricity supply, provides just one example of this cross-border character of future solution.

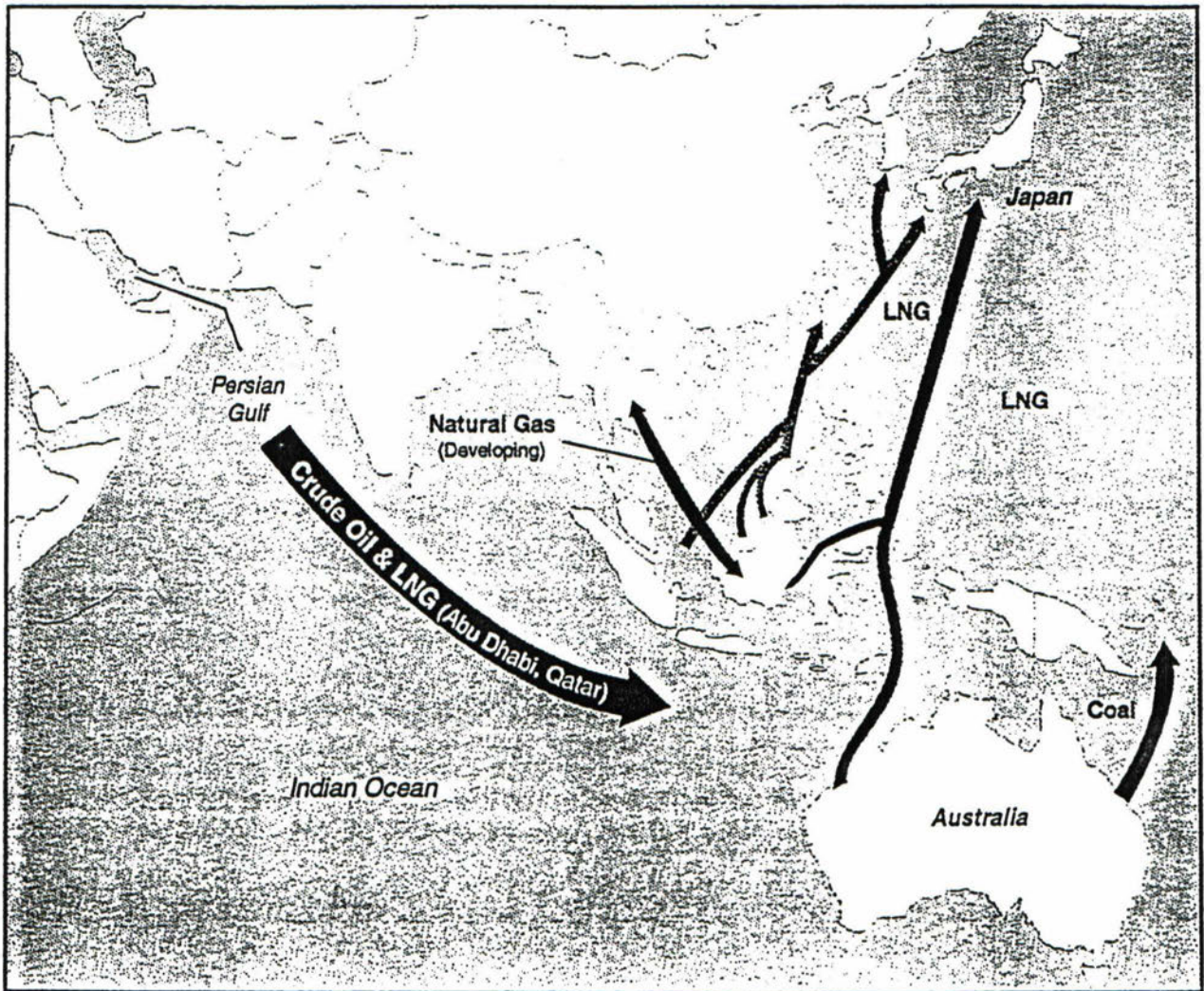
At the very beginning of this paper, we observed Asia's second miracle — high economic growth based upon very limited energy resources. That was because these countries oriented themselves to competing successfully in the international economy. They paid their own way. They made up for their lack of physical resources through their human resources, their capacity to innovate and to produce, and their capability to sell the fruits of their labors in the global marketplace. That gave them the wherewithal with which to pay for and finance their energy needs. The energy challenges facing Asia in the future are momentous, complex, and expensive. Yet that formula that served them surprisingly well in the past can well serve them in the future — all the more so as countries place greater confidence in the markets and see less urgent reason to rely on traditional government ownership and control. Thus, perhaps the true solution to the energy security needs of Asia will be found in the issues that underlie, at least in significant part, the currency crisis of 1997 — how well countries continue to adapt to the changing nature of the global marketplace and the rigors of international competition, and how successfully they maintain their astonishing record of earning their way in the world.

GDP per Capita versus Primary Energy Demand per Capita in Selected Asian Economies, 1995



Source: Cambridge Energy Research Associates.
61209-H7

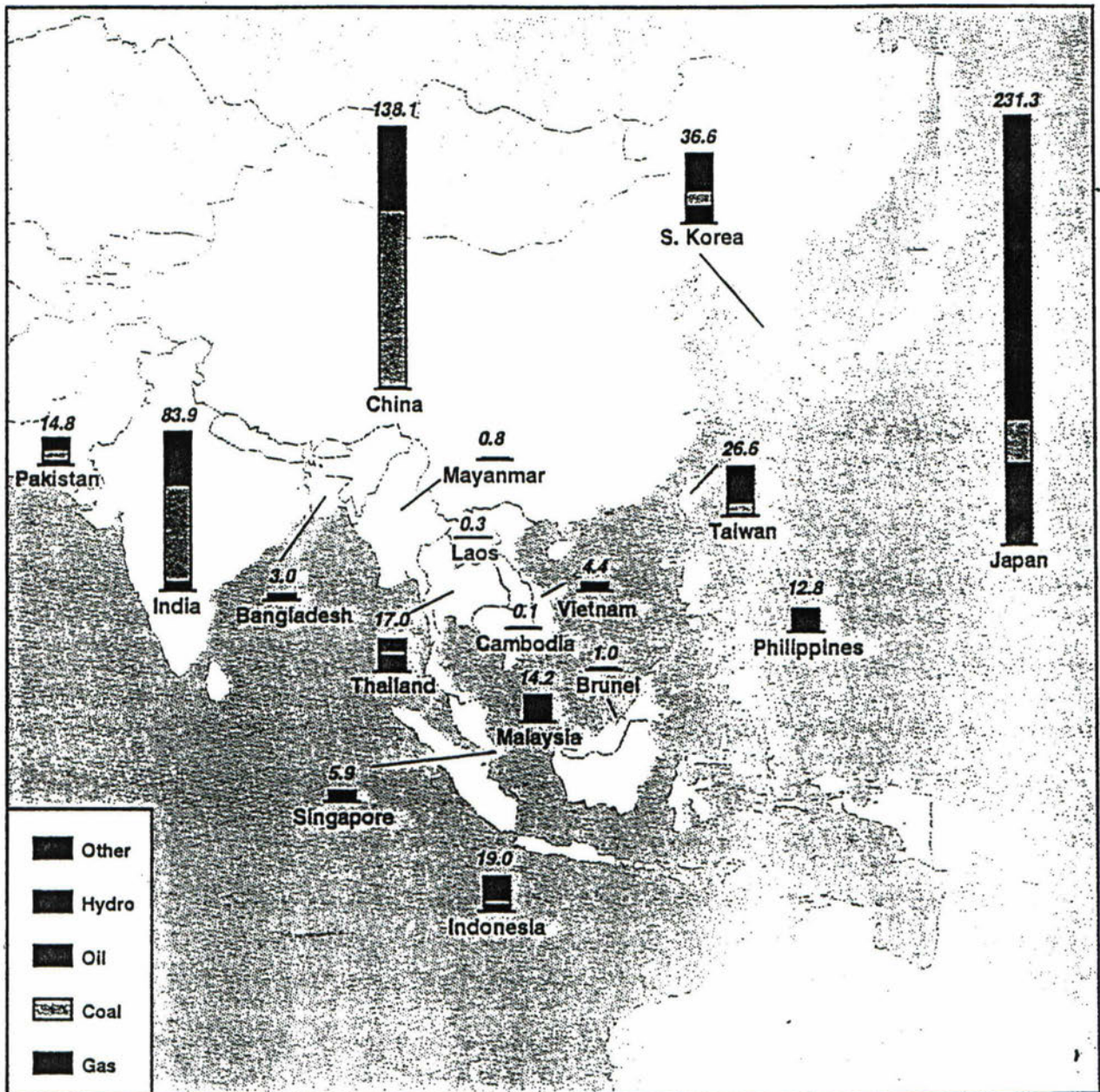
Energy Trade Flows in Asia



Source: Cambridge Energy Research Associates.

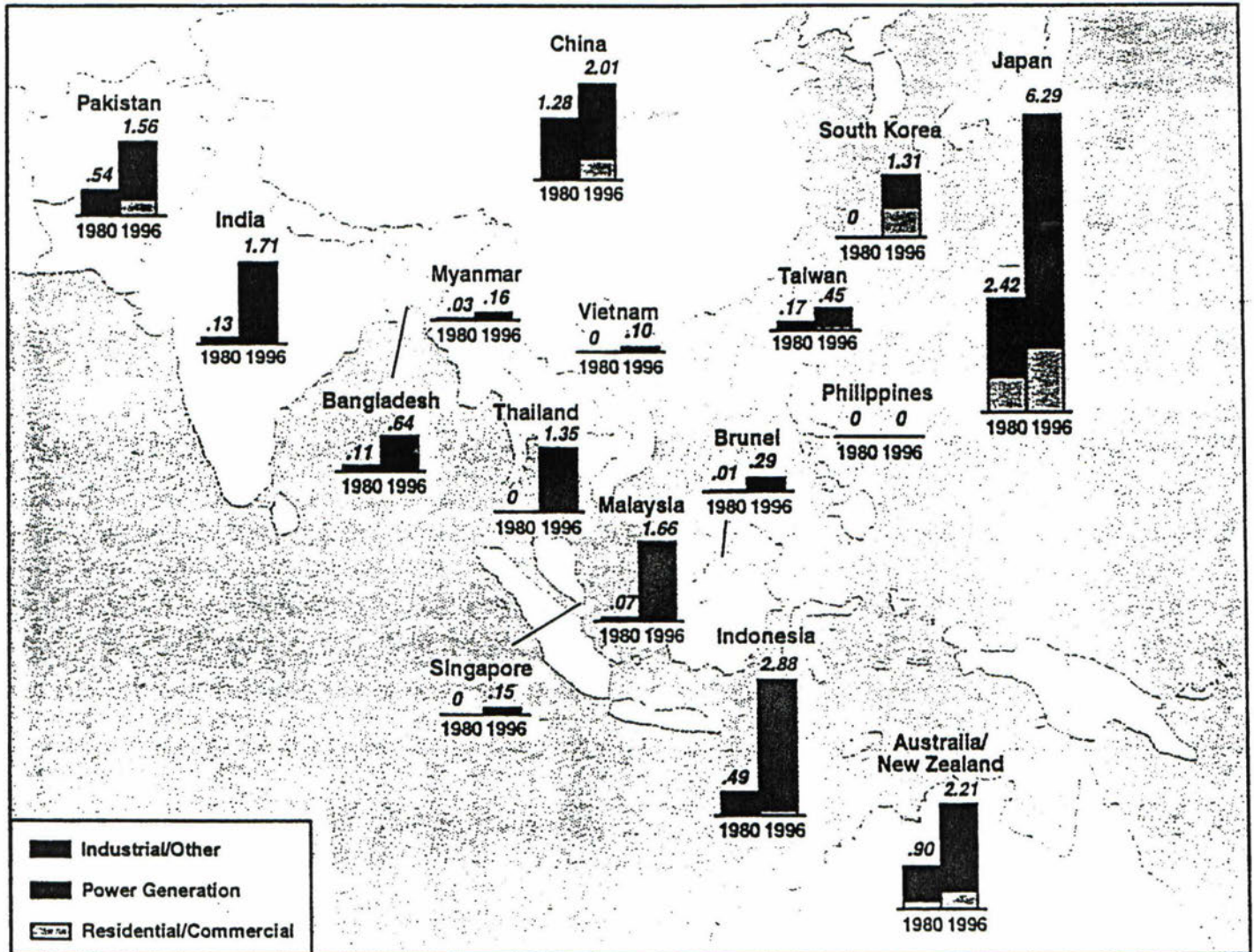
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Asian Power Generation Capacity: 1997 (GW)



Source: Cambridge Energy Research Associates.
70409-H9
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Asian Natural Gas Consumption, 1980 and 1996 (Bcf per Day)

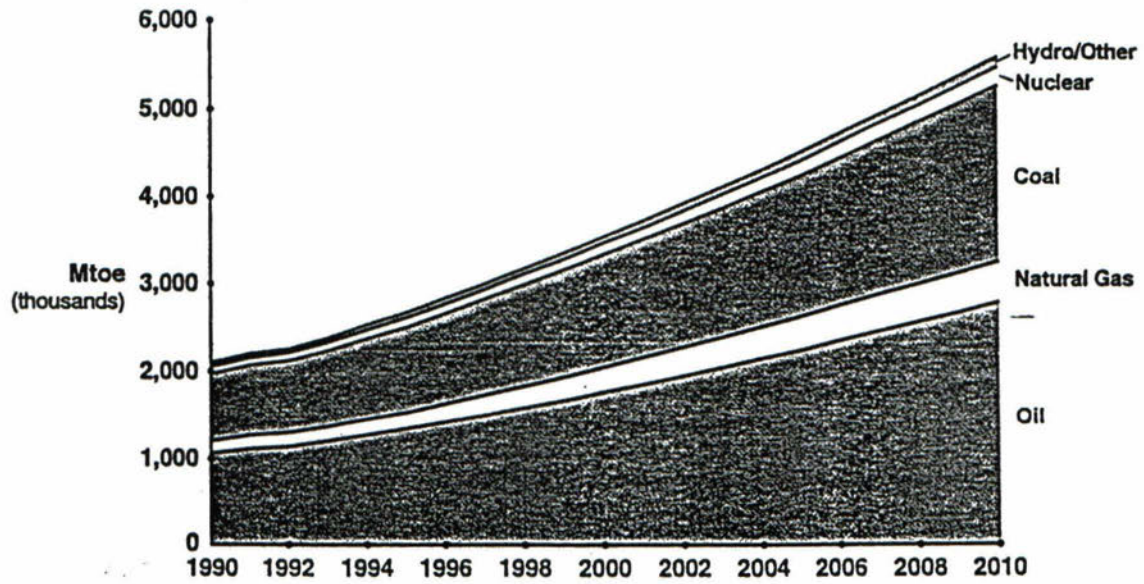


Source: Cambridge Energy Research Associates.

Note: 1996 numbers represent estimates

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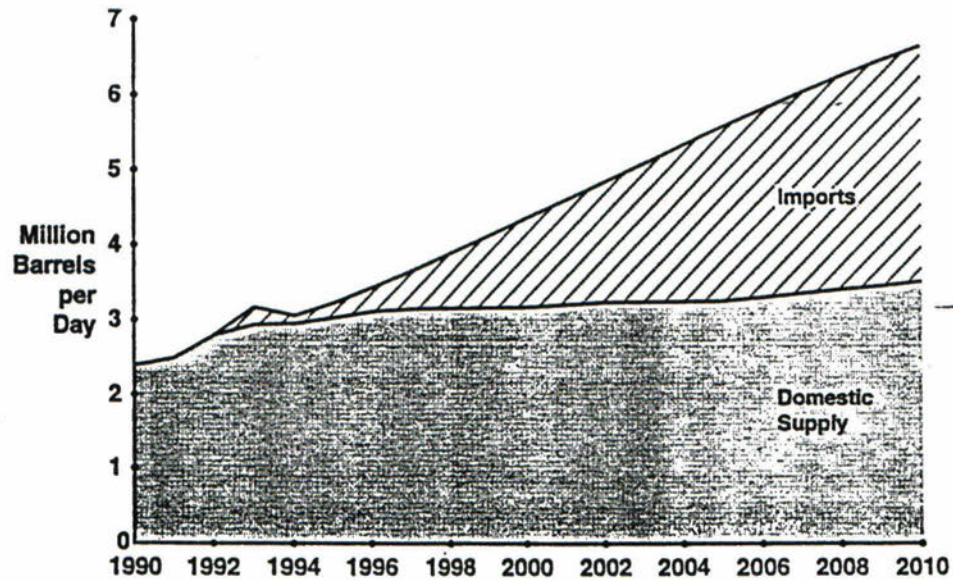
Primary Energy Demand: The Far East



Source: Cambridge Energy Research Associates.

70823-H1

Chinese Oil Demand: Growing Dependence Upon Imports



Source: Cambridge Energy Research Associates.
70829-H2

Policy

MIT Joint Program on the Science and Policy of Global Change



Needed: A Realistic Strategy for Global Warming

Henry D. Jacoby, Ronald G. Prinn and Richard Schmalensee

July 1997

The MIT Joint Program on the Science and Policy of Global Change is an organization for research, independent policy analysis, and public education in global environmental change. It seeks to provide leadership in understanding scientific, economic, and ecological aspects of this difficult issue, and combining them into policy assessments that serve the needs of ongoing national and international discussions. To this end, the Program brings together an interdisciplinary group from two established research centers at MIT: the Center for Global Change Science (CGCS) and the Center for Energy and Environmental Policy Research (CEEPR). These two centers bridge many key areas of the needed intellectual work, and additional essential areas are covered by other MIT departments, by collaboration with the Ecosystems Center of the Marine Biology Laboratory (MBL) at Woods Hole, and by short- and long-term visitors to the Program. The Program involves sponsorship and active participation by industry, government, and non-profit organizations.

To inform processes of policy development and implementation, climate change research needs to focus on improving the prediction of those variables that are most relevant to economic, social, and environmental effects. In turn, the greenhouse gas and atmospheric aerosol assumptions underlying climate analysis need to be related to the economic, technological, and political forces that drive emissions, and to the results of international agreements and mitigation. Further, assessments of possible societal and ecosystem impacts, and analysis of mitigation strategies, need to be based on realistic evaluation of the uncertainties of climate science.

This paper is intended to improve public understanding of the climate issue, and thereby contribute to informed debate about the climate issue, the uncertainties, and the economic and social implications of policy alternatives.

Henry D. Jacoby and Ronald G. Prinn,
Program Co-Directors

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Needed: A Realistic Strategy for Global Warming

Henry D. Jacoby, Ronald G. Prinn and Richard Schmalensee*

As the United States, along with other nations, struggles to develop a response to climate change, a swirl of overheated rhetoric and short-term political maneuvering is obscuring the basic features of this issue. One day we hear that all responsible scientists agree that global warming is a dagger at the heart of human civilization and that emissions of carbon dioxide (CO₂) and other greenhouse gases must be slashed immediately to save our planet. The next day we're told that global warming is the illegitimate offspring of sloppy science and green fanaticism and that laying a finger on U.S. CO₂ emissions would wreck our economy and enrich our foreign competitors.

This debate is motivated by intense, ongoing international negotiations on possible near-term CO₂ emission limits. The agenda for these negotiations, the so-called Berlin Mandate, was adopted at the first conference of Parties to the Framework Convention on Climate Change, held in Berlin in 1995. Diplomats were told to devise a set of national ceilings for greenhouse gas emissions for the early years of the next century. To make agreement more likely, developing countries were not to be asked to control emissions, although they account for roughly half the greenhouse emissions now and will emit a larger share in coming decades. These complex negotiations were to be completed in just two years, in time for the third Conference of Parties this December in Kyoto, Japan. Negotiations have become focused on a single question: how much will each of the developed nations promise to cut CO₂ emissions by 2010?

Our aim here is not to settle this near-term question, though the answer (if any) agreed to in Kyoto may be of great environmental and economic importance. Instead, we will show, through a brief look at the science and economics of climate, that if climate change turns out to be a serious threat, an effective response will require a substantial and very long-term global effort. Today's focus on near-term emissions reductions will be counter-productive if it delays development of the institutions and policy architectures that would be necessary to mount and sustain such an effort over much of the next century.

What Do We Know About Global Warming?

Global warming or cooling can be driven by an imbalance between the energy the Earth receives from the sun, largely as visible light, and the energy it radiates back to space as invisible infrared light. The "greenhouse effect" is caused by the presence in the air of gases and clouds that absorb some of the infrared light flowing upward and radiate it back downward. This warming effect is opposed by substances at the surface and in the atmosphere that reflect sunlight directly back into space. These include snow and desert sand, as well as clouds and aerosols from smog and volcanic action. (Aerosols are very tiny, submicroscopic solid or liquid particles suspended in the air. Smoke and fog are familiar examples.)

* The authors are William F. Pounds Professor of Management, TEPCO Professor of Atmospheric Chemistry, and Gordon Y. Billard Professor of Economics and Management, respectively, at the Massachusetts Institute of Technology (MIT). Professors Jacoby and Prinn are Co-Directors of the MIT Joint Program on the Science and Policy of Global Change, Professor Prinn is Director of the MIT Center for Global Change Science, and Professor Schmalensee is Director of the MIT Center for Energy and Environmental Policy Research. The authors are indebted to A. Denny Ellerman, Peter H. Stone, and Diane H. Schmalensee for useful comments.

The most important greenhouse gas is water vapor, which typically remains for a week or so in the atmosphere. Central to the climate change debate, however, are less important but much longer-lived greenhouse gases, most notably CO₂. Concern arises because the atmospheric concentrations of CO₂ and other long-lived greenhouse gases have increased substantially over the past century. When this happens, the flow of infrared energy to space is reduced, so that, *all else equal*, the Earth receives slightly more energy than it radiates to space. This imbalance, which is often called "radiative forcing," tends to raise temperatures at the Earth's surface. These aspects of the greenhouse effect are not controversial. It is also generally accepted that emissions of CO₂ from combustion of fossil fuels (primarily coal, oil, and natural gas) are the most important way humans can affect radiative forcing, and that this emitted CO₂ remains in the atmosphere for a long time, on the order of a century or so. Thus today's radiative forcing reflects, in small part, the CO₂ emitted when coal was burned to keep President William McKinley warm in the White House.

What is much more uncertain, and the cause of serious scientific debate, is the response to radiative forcing of the complex system that determines our climate. "Climate" is usefully defined as the average of the weather we experience over a ten- or twenty-year time period. In this context, it is important to emphasize that year-to-year changes in weather patterns or storm tracks should not be, but often are, confused with climate change. Some poorly understood processes in the climate system tend to amplify the warming effect of radiative forcing, while others, equally poorly understood, tend to counteract or delay that effect.

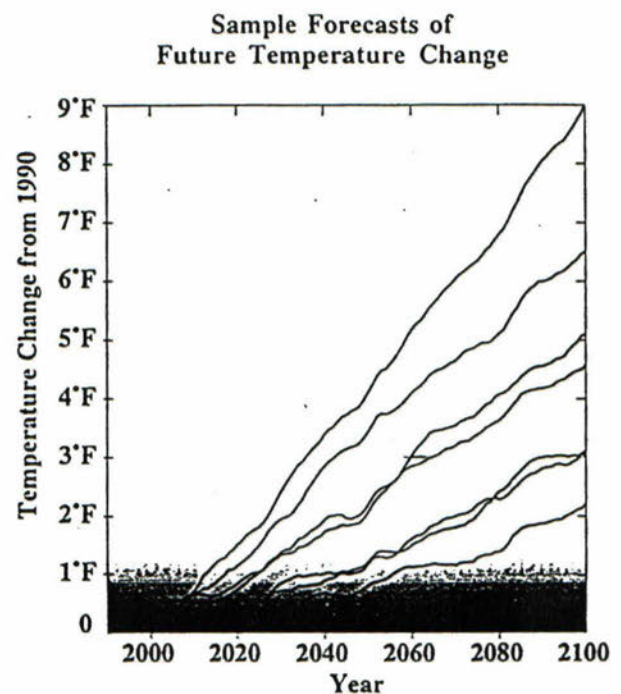
To take a familiar example, clouds in the daytime provide a cooling mechanism by reflecting sunlight back to space. But abundant clouds and high humidity at night help keep temperatures high because they contribute to the greenhouse effect. This is why on clear, cloud-free nights we can get rapid lowering of temperatures by tens of degrees Fahrenheit. Unfortunately, the processes that drive long-term changes in daytime and nighttime humidity and cloud cover are not well understood. Similarly, we know that any global warming will tend to be delayed because it takes a lot of heat to warm the oceans, but we're quite uncertain exactly how rapidly heat is carried into the deeper parts of the ocean.

Computer models used to predict climate attempt to simulate these and many other important processes on regional and global scales. These models are remarkable in their complexity and are invaluable tools for scientific research. However, their complexity taxes the capabilities of the world's largest computers. Moreover, they are based on incomplete knowledge about the key processes that control clouds, the ocean circulation, the natural cycles of greenhouse gases, and natural (volcanic) and manmade (smog) aerosols. Current climate models cannot reproduce the succession of ice ages and warm periods over the last 250,000 years, let alone the smaller climatic changes observed over the last century. In addition, climate models are driven by forecasts of emissions of greenhouse gases, and these rest on highly uncertain long-term forecasts of population and economic growth and of technological advance.

To help quantify the uncertainty in climate forecasts, a group of scientists and economists at MIT (including the authors) have recently developed a coupled model of global economic development, climate processes, and ecosystems. This model is unique in its combination of detailed treatments of the relevant natural and economic processes. Within this model, the researchers have explored the consequences of a range of plausible assumptions about future economic development (assuming no regulations are enacted to restrict future greenhouse gas

emissions) and about fundamental climate processes, to produce a family of seven forecasts of climate change over the next century. Each forecast in the family can be defended as reasonable given current knowledge.

To illustrate the range of uncertainty involved in climate forecasts, the first figure shows the predictions for the change in global average surface temperature from its 1990 value. Temperature increases by the year 2100 as small as two degrees Fahrenheit or as large as nine degrees Fahrenheit can be defended as plausible. About two thirds of the overall difference here is due to uncertainty about climate processes; the other third reflects uncertainty about emissions. Despite a great deal of research, we simply do not know which of these paths (or indeed other plausible paths) we are now on. Indeed, there may be rapid climate changes driven by purely natural processes that are not well handled by any current climate models and are not reflected in any of the forecasts shown here.



Unfortunately, we know less about the likely impacts of plausible changes in climate than about either future emissions or the natural processes determining climate. Warming may increase storm damage, for instance, but it may also decrease it. Almost nothing is known about likely (as opposed to possible) impacts on human health or about the ability of unmanaged ecosystems to adapt to climate change. Civilization has adapted to climate change in the past and can, to at least some degree, adapt to future changes. What we do know suggests that the changes summarized by the lowest path in the figure would do little harm over the next century and might even be beneficial on balance for some countries. Most analysts would agree, however, that the highest path would correspond to significant risks to a variety of important natural processes (including ocean circulation, polar glaciers, and unmanaged ecosystems) as well as to agriculture and other human activity.

In some respects the most important finding of climate research is that the range of possible outcomes is enormous. We believe it is impossible to make sound policy decisions in this field without taking explicit account of this profound uncertainty. In addition, it is plainly vital to continue research aimed at improving emissions forecasts, climate models, and impact estimates in order to narrow the range of plausible forecasts. An important component of this work is the search for a so-called "fingerprint" that would reveal human influence on the climate system.

Has Human-Induced Warming Begun?

Last year, the Intergovernmental Panel on Climate Change (IPCC) declared in its *Summary for Policymakers* that "the balance of evidence suggests a discernible human influence on climate." There were some qualifications and hedging in the *Summary* and much more in the detailed

Working Group Report upon which it was based. Nevertheless this statement, largely in isolation, was widely reported and has since shaped policy discussions around the world. But was this isolated, unqualified summary statement, written by governments' representatives, a scientifically defensible conclusion?

To establish a human influence on the global climate, we would ideally want to show that the observed global patterns of climate change over the past 100 years, say, are consistent with those predicted by climate models which include human activities such as production of CO₂ and aerosols from fossil fuels, but are not consistent with the patterns predicted when those activities are omitted. The latter predictions would reflect the natural variability of climate—the “noise” out of which the human “signal” (or “fingerprint”) must arise for a definitive detection. Unfortunately, current climate models are both uncertain predictors of the climate response to human influences and inadequate tools for assessing natural variability. In addition, data on the global climate and human influences in past decades, and our understanding of the cooling effects of manmade aerosols, are far from ideal.

For these and other reasons, some scientists have been skeptical about the IPCC's “balance of evidence” statement from the beginning. This group has grown substantially over time. Even some scientists who were significantly involved in producing the IPCC statement are now publicly expressing doubts. In an important news report on this subject in the journal *Science* in May 1997, Richard A. Kerr describes the growing skepticism about the original IPCC *Summary* conclusion, and the growing realization that it may be a decade or more before the human effects can be discerned above the noise of natural climate variability.

This does not mean that we should wait to take action until and unless human effects on climate are definitively detected. As the discussion above indicates, we know enough to know that significant global warming, with significant adverse impacts, may occur in the future. It would be irresponsible to ignore such a risk, just as it would be irresponsible to do nothing when you smell smoke at home until and unless you see flames. It would also be irresponsible, of course, to call the fire department and hose down all your belongings at the slightest whiff of what might be smoke.

Nevertheless, the search for a definitive detection of human-induced climate change can provide valuable information for the policy process. The figure above provides a simplified illustration of the point involved. The shaded region at the bottom represents a plausible estimate of the range of natural variability or noise in global mean temperature over the course of a century. As the figure shows, the greater the eventual warming, the sooner observed temperatures will rise above this range, and the signal of a human influence will emerge from this noise. (This conclusion holds whatever the noise level; higher noise levels simply imply later detection, all else equal.) The larger the human effects on climate, the sooner it should be possible to find definitive evidence of those effects, and the stronger will likely be the case for substantial emissions reductions.

Should Global Warming Be Stopped?

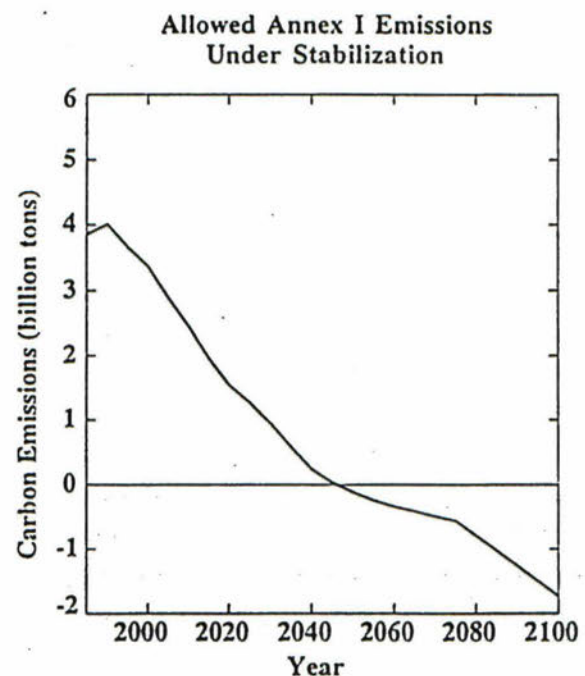
If climate change turns out to be a serious problem, the sorts of emissions reductions being fiercely debated in the run-up to the Kyoto meeting will not *by themselves* do much to solve it. Under the Berlin Mandate, emission reductions are to be sought only from countries listed in Annex I to the original climate treaty: the members of the Organization for Economic Cooperation

and Development (OECD) as of 1990 (Western Europe, the United States, Canada, Australia, New Zealand, and Japan) and the “economies in transition” (Eastern Europe and most of the Former Soviet Union). To illustrate the effects of restrictions limited to these nations, let us consider one of the toughest proposals now on the table: the call by the European Union (EU) to cut Annex I CO₂ emissions to 15% below 1990 levels by 2010.

When measured not in relation to 1990 but against emissions today or those expected in another 13 years, this proposal would require much more than a 15% reduction in most countries. There is little doubt that such sharp cuts in CO₂ emissions over little more than a decade would be very expensive, even if economic growth were to slow from its pace in recent decades. It would be even harder for Annex I nations to maintain the proposed 2010 level of emissions for the rest of the next century. Yet, largely because of projected emissions growth in the developing world, the MIT climate model shows that such a costly effort by the Annex I countries would reduce projected warming in 2100 by only about 20 percent in the mid-range of the forecasts illustrated in the first figure. If climate change turns out to be a serious threat, this response, by itself, would be inadequate; if it turns out not to be a threat, this response would be a large-scale waste of resources.

A policy aimed at reducing near-term emissions may, if properly designed, be a valuable first step toward a more serious (and even more expensive) response strategy that could be used if we learn that human-induced warming is a serious threat. The Framework Convention on Climate Change calls for stabilizing atmospheric concentrations of greenhouse gases at levels that will avoid “danger” to economies and ecosystems. The European Union, among others, has recommended stabilizing the concentration of CO₂ in the atmosphere at 550 parts per million, which is roughly twice pre-industrial levels. Doing this would substantially slow (but not stop) climate change. Following the particular path to stabilization at this level that was estimated by the IPCC would lower the projected warming in 2100 in the mid-range forecast in the earlier figure by only about 30%, though it would have larger relative effects in the following century.

Following this EU recommendation would require sharp cuts in global CO₂ emissions, however, and the Annex I nations almost certainly could not do the job by themselves. We can illustrate the magnitude of the task using a mid-range forecast from the set shown in the first figure, along with the IPCC’s estimate of a global emissions path that would lead to the 550 parts per million target. The second figure shows the maximum Annex I emissions consistent with this path, assuming that non-Annex I nations accept no restrictions. (To calculate the emissions allowed to Annex I countries, we simply subtracted the forecasted non-Annex I emissions from the global total.) Without participation by the developing world, emissions by Annex I nations would somehow



have to become negative around the middle of the next century! Even a total ban on all use of fossil fuels in all developed nations within a few decades would not do the job.

Of course, if the richer nations continue to reduce emissions over time some voluntary abatement by non-Annex I nations would probably occur. Over the coming decades, some non-Annex I nations will no doubt become wealthy enough to join the Annex I emissions reduction club voluntarily. But the countries most likely to do this account for only a small fraction of projected non-Annex I emissions. In China, India, Indonesia, Brazil, and other high-population, high-emissions countries, income growth seems unlikely to stimulate voluntary abatement much before the end of the next century. Until then, these nations will be more concerned with feeding themselves and their children than with protecting their grandchildren from potential global warming. Thus, if the rich countries want to stabilize greenhouse gas concentrations, they will have to pay poor countries to reduce their emissions. Rough estimates of the costs that would be involved, even assuming fully efficient abatement policies and neglecting costs of monitoring and enforcement, imply massive international transfers of wealth on a scale well beyond anything in recorded history.

What Should We Do Now?

There is little or no political support today for a long-term commitment to such a Herculean effort. Moreover, since climate change could turn out to be relatively harmless, making such a commitment now would make little economic sense. On the other hand, since climate change may also be a significant threat, it would make no more sense to do nothing. Unfortunately, there are no simple rules that can be relied upon to tell us what to do. We must consider costs and risks and take actions in the face of profound uncertainty about their consequences.

In such a setting, it is important not to lose the long-term perspective. Today's actions should aim to reduce the costs of massive global emissions reductions, in case advances in climate science show such reductions to be desirable. Investments in new technology and in the development of policy architectures and institutions are particularly attractive in this regard. While it is almost certainly too late to agree on investments of this sort before December's Kyoto meeting, that meeting is but one step in what will very likely be a long political and diplomatic process. Whatever else happens there, the participants will produce some sort of "Kyoto Mandate" to guide the next round of international negotiations. That Mandate should focus the process on investments with long-term benefits.

The potential value of investments in new technology is clear. It may well prove impossible to slow warming appreciably without condemning much of the world to poverty unless carbon-free energy sources become roughly competitive with conventional fossil sources. Further, a serious attempt to produce important new technological options would be cheap relative to the cost of controlling emissions resulting from the use of current technologies. The range of possible options is wide, stretching from solar electricity to the continued use of fossil fuels with capture and sequestration of the CO₂ their combustion produces.

Unfortunately, we know too little about what produces fundamental technical change. The available evidence points to the importance of marketplace incentives for private sector research and development and (with somewhat more controversy) to public expenditure on basic research and fundamental technologies. Politicians love to call for more research instead of more regulation, but

we see only a tiny and diminishing commitment to the development of greenhouse-friendly technology by those countries most capable of performing it.

It is at least as important to begin the development of an institutional structure for managing global emissions agreements that can evolve easily over time. Such a structure must be able to adjust the stringency of abatement effort to the evolving science, giving incentives for national participation but accommodating failures along the way, and to provide compensation to induce participation by the developing world.

This is a tall order, and we do not pretend to know the best design. Some useful insight and perspective can be gained from the international trade regime developed under the General Agreement on Tariffs and Trade (GATT), now the World Trade Organization. This regime has grown and evolved over time, adding countries and goods along the way, peacefully resolving substantial conflicts in national economic interests, contributing importantly to global economic growth, and producing a stunning success by the standards of international affairs. But it has taken 50 years of hard work to do this!

In this connection, experimenting with national emission ceilings of the type that are the near-total focus of the Berlin Mandate process may be of long-term value. Naturally, one objective of such an effort is to make actual reductions in the quantities of greenhouse gases we would otherwise put into the atmosphere over the next decade or two. We do not belittle this motivation. But it should not be allowed to completely dominate the design of international agreements in this area. Such experiments will be of long-term value only to the extent that they facilitate development of sets of possible policy measures, a policy architecture if you will, that can, if necessary, contribute to effective and cost-efficient stabilization of greenhouse gas concentrations. This architecture would need to address all important sources and sinks of significant greenhouse gases, not just CO₂ produced from fossil fuels. Such a system would need to provide for reliable emissions monitoring and for some system of sanctions for those who violate their obligations. A host of other important issues must also be confronted.

For example, since global participation will be necessary if global emissions are to be reduced, it is important to structure any Annex I targets and timetables to facilitate the inclusion of non-Annex I countries. This involves, at a minimum, development of a regime to govern climate-related international wealth transfers. In this regard, the Berlin Mandate's exclusive focus on Annex I countries is a double-edged sword. On the one hand, unless the rich nations control their emissions first and support abatement by poor nations, the latter are unlikely even to slow their emissions growth. On the other hand, CO₂ emissions controls will raise the cost of producing energy-intensive goods in Annex I countries, tending to encourage the development of energy-intensive industries in non-Annex I nations. (This is sometimes referred to as "emissions leakage.") Once this has happened, non-Annex I nations will be more reluctant to take actions to curb the CO₂ emissions that have become a more important source of wealth. Attempts by the rich Annex I countries to use trade policies to slow the migration of energy-intensive industries to poorer nations may create major international tensions.

In order to minimize the global cost of CO₂ emissions reductions, the cheapest abatement opportunities should be exploited first. In principle, a regime involving emissions trading, like that used to control sulfur dioxide pollution in the U.S., could contribute substantial savings. But this approach, which has been advanced by the U.S. in the ongoing negotiations, runs into a problem

if participation is restricted to Annex I countries. Trading can only work effectively among countries that have agreed to emissions caps. Without the participation of the developing countries, where most observers agree that many of the cheaper emissions reductions are to be found, the advantages of trading are drastically reduced.

Finally, agreeing to lower future emissions may increase incentives to develop energy-saving consumer devices, along with low-carbon energy sources. But commitments to modest, short-term emissions reductions may focus R&D efforts on small advances over current technologies. Credible commitments to substantial, long-term reductions may be necessary to stimulate the fundamental research necessary to produce needed breakthroughs in energy technology. Lack of adequate political support seems to rule out making such commitments now, however, and the inability of any government to bind its successors would limit the credibility of any long-term commitments that were made.

* * *

Unless climate scientists discover soon that greenhouse warming is definitely not a threat, the struggle to devise a global response will occupy our children, along with their children and grandchildren. We have discussed three legacies that our generation could leave that would make this struggle easier: (1) an international climate agreement that could, if necessary, reduce greenhouse gas emissions substantially, at least cost, while being responsive both to changes in our scientific understanding and to evolving political and economic conditions, (2) enhanced technical options that could, if necessary, ease the task of maintaining economic growth while controlling greenhouse gas emissions, and (3) an international system that could, if necessary, transfer substantial sums to developing countries to assist their participation in an emissions control effort. Building these legacies is a huge challenge, but this task merits at least the same sense of urgency that has motivated pre-Kyoto negotiations about short-term CO₂ emissions reductions.

I thought Todd
Should see this
Nat



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 15 1997

Policy

Dirk Forrister
Chairman, Climate Change Task Force
734 Jackson Place
Washington, D.C. 20503

OFFICE OF
POLICY, PLANNING AND EVALUATION

Dear Mr. Forrister:

I am pleased to present to you the latest climate change product to be produced by EPA's Office of Policy, Planning, and Evaluation. The brochure, *Cool Facts About Global Warming*, is designed to present climate change information, in plain English, to a variety of audiences who increasingly make requests of EPA for basic, user-friendly information about Global Warming.

The brochure provides information about climate change including: the definition of global warming and climate change; causes of global warming; scientific agreement on the issue; potential health and environmental impacts; and practical climate change mitigation opportunities. The brochure also unfolds into a full-size color poster listing ten ways people can help stop global warming.

I hope that the brochure, as well as several other upcoming EPA publications and regional workshops, will be useful to you in your higher level White House outreach efforts, and that you will be able to build on our ongoing outreach work. In turn, your publications and outreach efforts will be invaluable in helping EPA and other agencies keep the momentum moving on this important issue. I look forward to working closely with the White House Task Force in the coming months, doing everything I can to support a strategic and cooperative government-wide outreach effort on climate change.

Please do not hesitate to call me at 260-4332 if you have any suggestions about the distribution of the brochure or about any of our climate change outreach efforts.

Sincerely,

David P. Gardiner for

David Gardiner
Assistant Administrator

Enclosure



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July 1997

Office of Policy, Planning and Evaluation (2171)



Cool Facts About Global Warming





EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
WASHINGTON, D.C. 20503

Policy

August 28, 1997

MEMORANDUM FOR GENE SPERLING

TODD STERN
JIM STEINBERG
DAN TARULLO

FROM: KATHLEEN A. MCGINTY *RSK for*

CC: DAVID SANDALOW
PETER ORSZAG

'97 AUG 28 PM2:42

SUBJECT: CLIMATE AND GORE - CHERNOMYDRIAN

I have recently learned that the attached documents are being prepared for the Gore - Chernomydrian meeting. We need to conduct an expedited review of these documents. Please review these documents so that we can discuss them at next Tuesday's meeting.

Attachments

Importance of an Emissions Trading System to Implement FCCC Commitments
Russian Federation-United States Emissions Trading Subgroup
Record of Meeting on June 16-18, 1997

As Parties to the Framework Convention on Climate Change (FCCC), the governments of the United States and Russian Federation have agreed that the threat of global climate change from anthropogenic greenhouse gases is real, and must be addressed through cooperative action. Our two nations have formed this Russian Federation-United States Greenhouse Gas Emissions Trading Subgroup under the Climate Change Policy Working Group (CPG) of the Environment Committee of the Gore-Chernomyrdin Commission (GCC) to support the development of an international emissions trading system. Our governments are seeking agreement of all Annex I countries participating in the climate change negotiations under the FCCC to take concrete steps, including the adoption of legally binding targets and flexible implementation strategies at the Conference of the Parties to be held later this year in Kyoto, Japan.

Effective policies for slowing and eventually halting global climate change must minimize the cost of achieving substantial reductions in global emissions. The key to lowering costs is to allow maximum flexibility in reducing emissions, while ensuring the strict accountability of all parties involved. Such flexibility and accountability can best be attained through a system of binding emissions budgets with international trading. Allowing trading between nations with low and high marginal costs of abatement could reduce the costs of achieving significant emission reductions. The ultimate effectiveness of a trading system in lowering the costs of reducing emissions will depend on its ability to keep transaction costs low and its success in creating and maintaining the credibility of the commodity being traded.

Creating an international emission trading system requires three initial conditions: a legally-binding allocation of emission authorizations (starting emission budgets); a standardized and verifiable system of measurement and reporting that enables actual emissions to be matched to authorized amounts; and an effective mechanism to ensure that all Parties are complying with their obligations.

In addition to the three initial conditions necessary for an international emissions trading system, the Russian Federation-United States Emissions Trading Subgroup (RF-US ETS) held discussions among its experts on the key elements needed to ensure the success of such a trading system, including the nature of the emissions limit under a budget program (focusing on the timing and duration of the budget periods and a limit to be based on total mass of greenhouse gas emissions in 1990).

We believe that a trading system will encourage businesses and governments to undertake economically efficient actions to reduce greenhouse gas emissions. For

sellers, emission allowance trading will provide valuable capital. For buyers, trading will reduce the cost of complying with GHG commitments. Emissions trading will stimulate innovative and lower cost approaches to reducing greenhouse gas emissions, including the development of new technologies. New technologies and other low cost approaches to reduce greenhouse gas emissions will enable Parties to achieve even greater emission reductions in the future.

This paper documents the discussions held by the experts of the RF-US ETS during the June 16-18 meeting held in Moscow. The paper presents the broad areas of agreement on the specifics of an international emissions trading system and identifies some areas which merit further study and discussion. The RF-US ETS recommends that the Russian and U.S. governments jointly support an international emissions trading system as a tool which can enhance the flexibility for all participating nations to achieve their legally binding commitments to address greenhouse gases.

Preconditions for Participation in International Greenhouse Gas Trading System

Legally Binding Emissions Limit. Legally binding emission limits or budgets are a necessary precondition for any international greenhouse gas emissions trading system. The RF-US ETS expects that an international agreement shall identify a comprehensive list of greenhouse gas sources and sinks, and establish the legal limit as a uniform percentage of those emissions from 1990, with the Russian experts expressing a strong preference that initial budgets be set based on 100% of the 1990 levels. Under this approach, each Party would receive its initial budget allocation for the budget period in "tonnes of carbon equivalent emissions allowed", hereafter referred to as "tonnes-allowed".

Measurement and Reporting Systems. Verifiable measurement and annual reporting of emissions is a critical precondition to any international trading system. Adequate mechanisms for measuring and reporting actual emissions of all greenhouse gases must exist so that compliance with legally binding emission limits can be verified. The current IPCC guidelines allow a wide range of options for emissions measurement; therefore, standardized methods would be needed to ensure a consistent, minimum level of accuracy for all Parties. Thus, the RF-US ETS agreed to undertake further bilateral work (as an input to multilateral efforts in other appropriate international groups), to identify and enhance the methods to measure and report all greenhouse gases. Specifically, the RF-US ETS shall work with others to focus in particular on CO₂ from energy sources (e.g. to develop a standard method to collect and verify fuel delivery and combustion data on combustion sources) and carbon sequestration in forests (further bilateral activity would also include experts from the forestry subgroup under the Climate Policy Working Group); methane from pipelines, coal mines, landfills, and agriculture; and other gases. The additional work shall develop the standardized methods needed to support the international emissions trading system. Each Party would provide, on a standard schedule which allows Parties sufficient time for accurate data collection and verification, annual emissions and budget adjustment

reports to the FCCC Secretariat, which would record, track, and publish annual emissions inventories and budget balances.

Compliance Mechanisms. All Parties must be able to credibly demonstrate compliance with their emission targets. In addition to international mechanisms to assure compliance with budget commitments, parties should be encouraged to build mechanisms domestically. Before participating in international emissions trading under the FCCC, a Party must meet certain requirements. First, the Party must have an adequate monitoring and reporting system for tracking its emissions of greenhouse gases; and second, the Party must establish a certification and verification mechanism (which could mean identifying a government person as the "authorizing official") for budget adjustments. Further guidelines must be developed to specify these minimum standards, including evaluation requirements for in-depth review teams.

Elements of the International GHG Trading System

Timing, Length, and Duration of Budget Periods. The RF-US ETS recognized that the start date of emission budgets, the length of budget periods and the total duration covered by the Kyoto agreement could significantly affect the mechanics and benefits of establishing an international greenhouse gas emission trading system. Although final decisions on these elements shall be negotiated in Kyoto at the Third Conference of the Parties, the subgroup agreed that governments' positions or non-positions on these issues should not preclude further expert discussion and analysis of how alternatives would affect the workability of the international trading system.

With respect to the start date, the Russian experts expressed a strong preference for an early start for emissions trading, preferably as early as 2000. On the other hand, the U.S. believes that would be too early to start an emission budget. Both sides, however, agree that practical considerations involved in establishing the measurement, reporting and compliance preconditions for trading will make it difficult to start an emissions trading system until at least 2005. Both sides also agreed, however, that it would be important to develop and implement mechanisms which would encourage investment now, and during the time period before the first budget period takes effect, that would be consistent with the imperative for a high efficiency and low greenhouse gas emitting infrastructure. The two sides agreed to continue to pursue discussions to this end as a bilateral matter, recognizing that each Party shall have the ability to designate a fraction of its budget allocation for the purpose of providing incentives to invest in early reductions.

Both sides indicated that the length and combined duration of the budget periods could have important effects on the establishment of an active trading system, and on the ability of government and non-government entities to use the trading system to support both short term needs and long term investment strategies. According to the U.S. proposed protocol, the budgets would cover a fixed period of "x" years (where x would be at least 3 years, but no greater than 10 years), although during the RF-US ETS

discussions, the Russian experts preferred 10 year budget periods and expressed their position that budget periods should be no shorter than 5 years. Further discussions are necessary to improve our mutual understanding of the economic and environmental impacts of varying these aspects of the trading system.

Tradeable Units. The tradeable unit would be established as a "tonne of carbon equivalent emissions allowed" (tonne-allowed). The RF-US ETS recommends using agreed-upon 100-year Global Warming Potentials (GWPs) to convert all the greenhouse gases into carbon equivalent emissions. The FCCC Secretariat would record the initial budget of tonnes-allowed for each Party (the Secretariat would likely use an electronic database, with an "account" for each Party), together with the identifying information necessary to track trades of specific tonnes-allowed, including country-of-origin and budget period of issuance.

Standardized Reporting by Parties. All Parties must provide annual emissions reports to the FCCC Secretariat. To facilitate the accounting process, the Secretariat would likely use a standard electronic reporting format which Parties would be required to use in order to minimize administrative costs and reduce errors. In addition to the annual reports on emissions to be required of all Parties, those Parties participating in an international trading system would have to report annually on the status of their budget. Specifically, the Party would identify any tonnes-allowed traded and would identify sufficient tonnes-allowed to account for its annual emissions. The Secretariat would likely use a simple form to capture the needed tracking information.

Centralized Recordkeeping and Accounting. The FCCC Secretariat already records, tracks, and publishes emissions inventory reports based on the data submitted by each Party in its national communications. In order to provide Parties sufficient time to ensure accurate data collection and verification, the RF-US ETS believes that Parties should be allowed 9-12 months following the end of the year before they would be required to submit their annual emissions and budget reports to the FCCC Secretariat. The Secretariat should be authorized to administer budget transactions for Parties which meet the monitoring, reporting, verification, and compliance requirements established by the Parties. At least annually, the Secretariat would record any transfers of tonnes-allowed. The Secretariat would officially record a transfer by deducting the specified number of tonnes-allowed from the selling Party's account and adding that quantity to the buying Party's account. After all the transfers have been officially recorded by the end of each year, the Secretariat would retire enough tonnes-allowed from each Party to account for its annual emissions, as specified by each Party's annual report.

At the end of the budget period, the FCCC Secretariat would complete a final accounting of each Party's emissions and budget adjustments. If a Party held more than enough tonnes-allowed to match its actual emissions, the Secretariat would automatically transfer the unused tonnes-allowed into that Party's account for use during the next budget period. If a Party did not have sufficient tonnes-allowed to cover all of its emissions during the budget period, the Party would be permitted to buy

tonnes-allowed from other Parties to make up the difference. A Party could also have a limited number of tonnes-allowed automatically deducted from its subsequent budget in order to remain in compliance. A predetermined penalty would be associated with this type of "borrowing." For example, the Party would have its subsequent budget reduced by 12 tonnes-allowed in order to transfer 10 tonnes-allowed into the current budget period. (The two "penalty" tonnes would be immediately retired by the Secretariat.)

Public Availability of Emissions and Budget Data. Public availability of emissions data will promote confidence, compliance, and an efficient market. The experts of the RF-US ETS agree that the emissions data collected by Parties consistent with the measurement and reporting systems under this program should be made publicly available to the extent it is not protected by legitimate confidentiality concerns. The RF-US ETS agreed to exchange technical assessments of the treatment of confidential data and to engage experts in consideration of how legitimate confidentiality concerns and the need for transparency shall be balanced.

Emissions Trading Restrictions for Parties Not in Compliance. Parties must meet initial and ongoing minimum measurement, verification, and reporting requirements in order to maintain eligibility to participate in trading. In-depth review teams would periodically assess a Party's compliance according to minimum standards established by the Parties. The trading system is designed to foster and facilitate compliance with Parties' emissions budget by providing a mechanism which encourages low cost emission reductions but requires significant, automatic consequences for failure to achieve the required budget levels. Specifically, the FCCC Secretariat would be authorized to implement any emissions trading restrictions established by the Parties. Emissions trading restrictions would include preventing a non-complying Party from selling tonnes-allowed, or allowing the sale of such tonnes-allowed, but restricting their use by another Party until the question of compliance is resolved. In addition, Parties shall have the discretion to take any further action deemed necessary to address non-compliance.

The RF-US ETS discussed the possible role of insurance or other forms of indemnification as a mechanism for guaranteeing that government and non-government entities would fulfill the international commitments or private commercial contracts they have agreed to under an international greenhouse gas emission trading system. There was a consensus that the possible role of such government-sanctioned or private insurance would require further discussions.

Party Authorization Required for Trades Initiated by Domestic Entities. Although any Party could permit private entities to take actions that would lead to international trades of tonnes-allowed, the Party would have to provide official authorization before the tonnes-allowed could be transferred to the purchaser (or acquired by the buyer). Such verification would be necessary because the Party is legally responsible for meeting its commitments, and transfers modify a Party's compliance obligation.

National Mechanisms for Meeting Budget Requirements.

Parties with legally binding targets would not be required to have a domestic trading system to participate in the international greenhouse gas trading system. Specifically, the RF-US ETS believes that international emissions trading may involve government-government trading, legal entity-legal entity trading, and government-legal entity trading. For example:

1. Party "A" could adopt a policies and measures approach (e.g. carbon taxes, efficiency standards) to reduce greenhouse gas emissions, while also trading tonnes-allowed internationally in order to reduce the cost of meeting its obligations.
2. Party "B" could adopt a domestic emissions trading program to control its emissions. It might allocate its entire budget of tonnes-allowed to an appropriate set of private entities which are responsible for greenhouse gas emissions. These private entities would monitor and report their emissions to the Party, and the Party would have domestic enforcement mechanisms to hold each source accountable for its emissions. Then, a domestic entity could choose its own compliance strategy. For example, a domestic entity could reduce its own emissions and sell its "extra" tonnes-allowed on the domestic market or internationally, with approval from its own Party. Another domestic entity could choose to purchase tonnes-allowed from the international market (with approval from the appropriate Parties). The RF-US ETS believes that further study of the U.S. SO₂ trading program could illuminate further thinking about the issues which could be encountered in the design of domestic greenhouse gas systems.
3. Party "C" could adopt a combination of approaches to reduce its emissions. For example, it could use policies and measures for some sectors and an emissions trading system for other sectors. Under this approach, domestic entities in those sectors which are assigned tonnes-allowed in a domestic emissions trading system could participate as described above for Party B. At the same time, the government could choose to purchase or sell tonnes-allowed to account for emissions from those sectors being addressed by policies and measures.

Conclusion

If the Agreement establishes a clear environmental goal with legally binding targets, Parties must meet certain minimum standards for monitoring, verification, compliance, and reporting in order to demonstrate compliance. These minimum standards are also necessary for an international greenhouse gas emissions trading system. Such a trading system will be an extremely valuable tool, providing Parties with the flexibility to achieve their commitments at the lowest possible cost.

Areas for Additional Work by Expert Consultations:

Further bilateral work to identify and enhance methods to measure, report, and verify all greenhouse gases, including specifically:

- CO₂ from fossil fuels
- Carbon sequestration in forests
- Methane from pipelines, coal mines, landfills, and agriculture
- Other gases.

Further study of the impact of decisions on the starting date, length of budget periods, and the total duration of budgets on operation and benefits of the trading system.

Further study on the issue of confidential business data and existing practices for the handling of such data to serve the needs of emission data transparency and legitimate business confidentiality.

Survey of insurance and indemnity provisions that may be available to guarantee the performance of future or long term commitments by private and government entities under the trading system.

Further information exchanges between the US and Russia on existing management practices under the existing SO₂ monitoring and trading system:

Develop and implement mechanisms that would encourage investment now, and during the time before the first budget period begins.

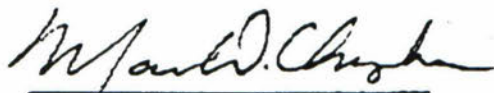
Recommend text for approval by Gore-Chernomyrdin Commission:

The experts of the Russian Federation-United States Emission Trading Subgroup (RF-US ETS) consider it worthwhile to prepare a draft statement for the Gore-Chernomyrdin Commission for its meeting in September 1997. The text shall include the following items:

1. Despite progress made by Parties and the significant contributions of voluntary actions, countries under the FCCC should agree to undertake legally binding agreements.
2. Both nations support the creation of an international greenhouse gas emission trading system in order to reduce compliance costs, to stimulate innovative approaches and the adoption of new technologies, and to enable further reductions of greenhouse gas emissions.
3. Such an international emissions trading system must be founded on accurate verifiable emissions measurement and reporting.

4. Such an emissions trading system can provide certainty and flexibility needed to encourage governments and businesses to undertake economically efficient actions to reduce their greenhouse gas emissions.

Recommend that appropriate Russian Federation and U.S. experts draft a joint statement or protocol for submission to the next meeting of the Ad Hoc Group to the Berlin Mandate to be held in Bonn in July/August.



Marc W. Chupka
Assistant Secretary for Policy
and International Affairs
Department of Energy
USA



Sergey N. Kurayev
Deputy Director, Department
for International Cooperation
State Committee
for Environmental Protection
Russian Federation



Nancy Kate
Deputy Director for Office of
Atmospheric Programs
Environmental Protection Agency
USA



Aleksandr Golub
Representative of Bureau
of Economic Analysis
Russian Federation

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WHITE HOUSE SITUATION ROOM

DIST:

PREC: CLASS: UNCLASSIFIED DTG:

FM:

TO:

UNCLAS STATE 136336

E.O. 12958: N/A

TAGS: KGCC, SENV, RS

SUBJECT: GCC ENVIRONMENT COMMITTEE: LETTER FROM CLIMATE
POLICY GROUP CO-CHAIR RAFA POMERANCE TO HYDROMET CHAIR
BEDRITSKY

1. SUMMARY AND ACTION REQUEST: PAPA 2 CONTAINS THE TEXT
OF A LETTER AND ATTACHMENT FROM RAFA POMERANCE, US CO-CHAIR
OF THE CLIMATE POLICY GROUP, TO HIS COUNTERPART, HYDROMET
CHAIRMAN A.I. BEDRITSKY. SIGNED ORIGINAL WILL BE HAND-
CARRIED TO MOSCOW BY MARILYN PIPER ON WEDNESDAY, JULY 23.
EMBASSY PLEASE ARRANGE AN APPOINTMENT FOR PIPER TO DELIVER
THE LETTER TO HYDROMET ON THE AFTERNOON OF JULY 23, PRIOR
TO THE ENVIRONMENT COMMITTEE MEETING JULY 24-25. END
SUMMARY AND ACTION REQUEST.

2. BEGIN TEXT:

JULY 21, 1997

DR A.I. BEDRITSKY, CHIEF
RUSSIAN FEDERAL SERVICE
FOR HYDROMETEOROLOGY
AND ENVIRONMENTAL MONITORING
NOVOVAGAN'KOVSKY STREET, 12
123242 MOSCOW

RUSSIA

DEAR DR. BEDRITSKY:

THANK YOU FOR YOUR LETTER OF APRIL 2, AND MY SINCERE
APOLOGIES FOR BEING SO SLOW TO RESPOND. SEVERAL ASPECTS OF
OUR CLIMATE POLICY WORKING GROUP'S (CPG) INTERESTS HAVE
PROGRESSED CONSIDERABLY, AND I WOULD LIKE TO GIVE YOU MY
PERSPECTIVE ON HOW WE MIGHT PROCEED FROM HERE.

I AM VERY PLEASED THAT THE JUNE 16-18 MEETING OF THE CPG
EMISSIONS TRADING SUBGROUP FOUND WIDE AREAS OF AGREEMENT.
FROM MY READING OF THE EXPERTS' REPORT, I THINK IT WAS A
SUCCESSFUL EXCHANGE. IN MY VIEW, WE SHOULD ENDORSE THEIR

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CONCLUSIONS IN A REPORT TO THE CO-CHAIRS OF THE GORE-CHERNOMYRDIN ENVIRONMENT COMMITTEE AT THE COMMITTEE'S MEETING JULY 24-25.

I ALSO FEEL THAT THE AREAS OF AGREEMENT ON EMISSIONS TRADING WERE BROAD ENOUGH, AND THE URGENCY OF THE ISSUE GREAT ENOUGH, THAT WE SHOULD RECOMMEND THAT OUR LEADERS ISSUE A JOINT STATEMENT ON EMISSIONS TRADING AT THE GORE-CHERNOMYRDIN COMMISSION'S MEETING THIS SEPTEMBER. I HAVE ENCLOSED A SHORT STATEMENT, DRAFTED BY THE PARTICIPANTS IN THE JUNE MEETING, WHICH I PROPOSE WE USE AS A WORKING DOCUMENT.

I AM PLEASED TO REPORT THAT DR. WILLIAM T. SOMMERS OF THE U.S. FOREST SERVICE HAS AGREED TO BE THE U.S. CO-CHAIR OF THE FOREST SUBGROUP. DR. SOMMERS HAS WORKED WITH RUSSIAN EXPERTS FOR SEVERAL YEARS AS A MEMBER OF THE INTERNATIONAL BOREAL FORESTRY RESEARCH ASSOCIATION AND IS WELL-QUALIFIED TO LEAD THIS EFFORT FOR THE U.S. SIDE. THE GROUP WILL ALSO INCLUDE REPRESENTATIVES OF EPA, NASA, AID, AND THE DEPARTMENT OF STATE. CARBON SEQUESTRATION IN FORESTS IS A CRITICAL FACTOR IN THE GLOBAL CARBON CYCLE. THIS GROUP MAY BE ABLE TO IMPROVE MEASUREMENT, VERIFICATION, AND REPORTING METHODS OF THIS VERY IMPORTANT CARBON SINK. DR. SOMMERS WILL CONTACT THE RUSSIAN CO-CHAIR, PROF. NAZAROV THROUGH OUR EMBASSY TO PROPOSE AN INITIAL SCOPE OF WORK FOR THE SUBGROUP.

A "JI BUSINESS ROUNDTABLE", AS ENDORSED AT OUR PREVIOUS MEETING, COULD ADVANCE THE EMERGING DIALOG AMONG RUSSIAN AND US GOVERNMENTS, PRIVATE SECTOR, AND NGOS ABOUT

OPPORTUNITIES FOR MUTUALLY BENEFICIAL CLIMATE CHANGE ACTIVITIES THAT MIGHT EVOLVE OVER THE NEXT SEVERAL YEARS. THIS MEETING, CONVENED WITH EXPERTS FROM BOTH RUSSIA AND THE U.S., WOULD ADDRESS: 1) OPPORTUNITIES FOR ENHANCING CLIMATE CHANGE INVESTMENT (INCLUDING A DISCUSSION OF POSSIBLE BARRIERS TO INVESTMENT); 2) FINANCING MECHANISMS AVAILABLE FOR GREENHOUSE GAS MITIGATION ACTIVITIES; 3) DISCUSSION OF SECTORAL AND PROJECT-SPECIFIC OPPORTUNITIES FOR INVESTORS; AND 4) MECHANISMS BY WHICH EARLY ACTIONS COULD OCCUR. THIS MEETING WOULD PROVIDE THE OPPORTUNITY TO DESCRIBE THE BROAD OPTIONS AVAILABLE TO ADVANCE MITIGATION ACTIVITIES PRIOR TO A TRADING REGIME UNDER THE PROTOCOL OR OTHER LEGAL INSTRUMENT. INITIAL FUNDING IS IN PLACE FOR THIS MEETING, AND WE HOPE TO IDENTIFY A PRIVATE SECTOR CO-SPONSOR, ALONG WITH ONE OR MORE OF THE INSTITUTES, MINISTRIES, NGO, OR PRIVATE PARTIES YOU RECOMMEND AS CO-SPONSORS. WE SHOULD AIM TO HOLD THE MEETING IN OCTOBER.

I PROPOSE THAT WE HOLD A FOURTH MEETING OF OUR CLIMATE POLICY GROUP IN OCTOBER, IDEALLY AFTER THE BUSINESS ROUNDTABLE. I WILL ASK AMBASSADOR HAMBLEY, WHEN HE SEES YOU IN BONN, TO DISCUSS POSSIBLE DATES FOR THAT MEETING.

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THE FOREST SUBGROUP MIGHT HOLD ITS FIRST MEETING IN
CONJUNCTION WITH THAT SESSION.

I LOOK FORWARD TO HEARING FROM YOU ON THESE ISSUES.

SINCERELY,

RAFE POMERANCE
DEPUTY ASSISTANT SECRETARY
FOR ENVIRONMENT AND DEVELOPMENT

END TEXT OF LETTER
BEGIN TEXT OF ATTACHMENT

DRAFT

U.S.-RUSSIAN JOINT COMMISSION
ON ECONOMIC AND TECHNOLOGICAL COOPERATION

JOINT STATEMENT ON INTERNATIONAL TRADING
OF GREENHOUSE GAS EMISSION ALLOWANCES

THE VICE PRESIDENT OF THE UNITED STATES OF AMERICA, AL GORE, AND THE CHAIRMAN OF THE GOVERNMENT OF THE RUSSIAN FEDERATION, VIKTOR CHERNOMYRDIN, REAFFIRM THEIR SUPPORT FOR THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (FCCC), WHICH REPRESENTS A SHARED COMMITMENT BY NATIONS AROUND THE WORLD TO REDUCE THE POTENTIAL RISKS OF A MAJOR GLOBAL PROBLEM. IN PARTICULAR, THEY RESOLVED TO SUPPORT THE ADOPTION OF LEGALLY BINDING TARGETS AND INTERNATIONAL EMISSION TRADING AT THE CONFERENCE OF THE PARTIES TO BE HELD LATER THIS YEAR IN KYOTO, JAPAN. THEY ENDORSED THE WORK OF THE U.S.-RUSSIAN GREENHOUSE GAS EMISSIONS TRADING SUBGROUP UNDER THE CLIMATE CHANGE POLICY WORKING GROUP OF THE ENVIRONMENT COMMITTEE, WHICH HAS DEMONSTRATED THE FEASIBILITY AND BENEFITS OF ESTABLISHING AN INTERNATIONAL SYSTEM OF EMISSION ALLOWANCE TRADING.

THE VICE PRESIDENT AND THE CHAIRMAN BELIEVE IT IS IMPERATIVE TO ADOPT POLICIES THAT WILL MINIMIZE THE COST OF ACHIEVING THE SUBSTANTIAL EMISSION REDUCTIONS THAT WILL BE NECESSARY TO SLOW ANTHROPOGENIC GLOBAL CLIMATE CHANGE. THEREFORE, THEY SUPPORT THE CREATION OF AN INTERNATIONAL GREENHOUSE GAS EMISSIONS TRADING SYSTEM FOUNDED UPON ACCURATE, VERIFIABLE EMISSIONS MEASUREMENT AND REPORTING. THEY BELIEVE SUCH AN INTERNATIONAL EMISSIONS TRADING SYSTEM CAN BE DESIGNED TO PROVIDE THE CERTAINTY AND FLEXIBILITY NEEDED TO ENCOURAGE THE PRIVATE SECTOR TO TAKE ECONOMICALLY EFFICIENT ACTIONS TO REDUCE THEIR GREENHOUSE GAS EMISSIONS. IN PARTICULAR, INTERNATIONAL EMISSIONS TRADING WILL

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STIMULATE INNOVATIVE AND LOWER COST APPROACHES TO REDUCING GREENHOUSE GAS EMISSIONS, INCLUDING THE DEVELOPMENT OF NEW TECHNOLOGIES. NEW TECHNOLOGIES AND OTHER LOW COST APPROACHES TO REDUCE GREENHOUSE GAS EMISSIONS WILL ENABLE THE PARTIES TO ACHIEVE EVEN GREATER EMISSION REDUCTION IN THE FUTURE.

THE VICE PRESIDENT AND THE CHAIRMAN REQUESTED THE SUBGROUP TO CONTINUE ITS WORK TO DEFINE THE NECESSARY ELEMENTS OF AN INTERNATIONAL TRADING SYSTEM AND, AS NEEDED, TO DEVELOP SPECIFIC LANGUAGE FOR INCLUSION IN ANY INTERNATIONAL AGREEMENT. THEY EXPRESSED THE HOPE THAT ALL ANNEX I COUNTRIES PARTICIPATING IN THE CLIMATE CHANGE NEGOTIATIONS UNDER THE FCCC WILL AGREE TO TAKE CONCRETE STEPS, INCLUDING THE ADOPTION OF LEGALLY BINDING TARGETS AND AN INTERNATIONAL SYSTEM OF EMISSIONS TRADING, AT THE CONFERENCE OF THE PARTIES IN KYOTO.

END TEXT OF ATTACHMENT.

3. EMBASSYS ASSISTANCE IS GREATLY APPRECIATED.

TALBOTT

<^SECT>SECTION: 01 OF 01

<^SSN>6336

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FROM:

Noelle B. Bujold/National Security Council

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CLIMATE CHANGE POLICY PROCESS TIMELINE

Principals Meetings:

July 18 - Developing Country Commitments
July 25 - Technology Strategy
August 1 - International Emissions Trading
August 8 - TBD

early-mid September: principals consider decision memoes on domestic programs (emissions trading, technology programs, etc.)

mid-late September: principals consider decision memoes on international issues (targets and timetables, emissions trading, developing country commitments

early October: White House conference

mid-October: decisions on all issues (level of detail will vary)

November and early December: refine decisions on all issues

Policy

Climate Change Working Groups
Core Members
July 14, 1997

I. Domestic emissions trading

1. EPA (Gardiner and Doniger)
2. Treasury (Wilcox and Gruber)
3. OMB (Minarik)
4. CEA (Shogren)

II. Developing country commitments

1. State (Pomerance)
2. AID (Hales)
3. Treasury (Geithner)
4. Commerce (Hunker)
5. WH Task Force (Forrister)

III. International emissions trading and joint implementation

1. State (Pomerance)
2. AID (Hales)
3. Justice (Simon)
4. CEA (Frankel)
5. OMB (Gotbaum)
6. DOE (Reicher)
7. Commerce (Hunker)
8. WH Task Force (Forrister)

IV. Technology programs

1. OMB (Glauthier)
2. DoE (Reicher and Romm)
3. OSTP (Henry Kelly and Rosina Bierbaum)
4. EPA (Gardiner and Doniger)
5. Treasury (Gillingham)
6. CEA (Frankel)
7. DoT (Kruesi)
8. USDA (Rawls)
9. Commerce (Hunker, Good)

V. Regulations and Standards

1. OMB (Glauthier)
2. EPA (Gardiner and Doniger)
3. DoE (Reicher and Romm)
4. Treasury (Gruber)

VI. Transition Assistance

1. Labor (Montgomery)
2. EPA (Gardiner)
3. NEC (Robyn)

Policy
Dan C

THE WHITE HOUSE
WASHINGTON

August 15, 1997

NOTE FOR CLIMATE CHANGE POLICY OVERSIGHT GROUP

FROM: PETER ORSZAG
DAVID SANDALOW

Subject: Summer Reading

Attached is a summary of workgroup activity underway.

Also attached are papers on:

1. Joint Implementation "Additionality"
2. International Emissions Trading, and
3. Developing country commitments.

CLIMATE CHANGE POLICY ANALYSIS

(Lead authors indicated in parentheses)

1. Domestic Emissions Trading (Gardiner, Gruber)
Paper delivered to WH oversight group.
 - WTO/MAI issues (Haverkamp)
Paper due Aug. 29
 - Relationship to international trading (Simon)
Draft distributed to Assistant Secretaries group. Final due Aug. 29.
2. International Emissions Trading and Joint Implementation (Doniger, Gruber)
Paper delivered to WH oversight group.
 - joint implementation/additionality (Doniger, Gruber)
Paper delivered to WH oversight group.
 - payment/trade account questions (Hunker, Shogren)
Draft distributed to Assistant Secretaries group.
 - WTO/MAI issues (Haverkamp)
Paper due Aug. 29
3. Technology (Glauthier/Bierbaum)
Discussion paper delivered to WH oversight group. Options memo due Aug. 29.
President's Committee of Advisers on Science and Technology (PCAST) and DoE Labs preparing reports to the President for October 1 delivery.
4. Developing country commitments (Pomerance, Hunker)
Paper delivered to WH oversight group.
 - escape clause (Pomerance, Gruber)
Draft distributed to Assistant Secretaries group. Final due Aug 22.
 - competitiveness/trade issues (Orszag)
Draft distributed to Assistant Secretaries group. Revisions underway.
5. Federal undertakings (Goodman, Glauthier)
Paper setting forth major policy options due Aug. 29.
6. Negotiating implications of different targets and timetables (Pomerance, Orszag)
Paper due Aug. 22

Additionality in the Context of Joint Implementation

Issue:

The U.S. is calling for joint implementation (JI) with credit to be included in the new agreement adopted in Kyoto under the Framework Convention on Climate Change (FCCC). JI is a mechanism by which a private entity in a country with an emissions budget (developed countries) invests in greenhouse gas mitigation projects in a country without a budget (developing countries). In exchange, the investor (and its country) receives credit towards its emission budget.¹

There is a broad consensus among countries and private parties that for JI to make sense, the emission reductions that give rise to JI credit must be "additional" to -- above and beyond -- reductions that would have happened anyway in the baseline case. Consider the case where a developer wants credit for building a low-GHG-emitting plant rather than a high-GHG-emitting plant. If the high-emitting plant truly represents what would have happened in the baseline case, then it would be appropriate to give the developer credit for the difference in emissions between the high and low-emitting plant. But if the low-emitting plant would have been built anyway (because its technology represents the business-as-usual case), then credit would not be appropriate. The project would have no environmental benefit.

The principal problem identified to date is that the question "what would have happened anyway" is extraordinarily difficult to answer. Experience in the U.S. pilot program on JI indicates that analysts can differ over whether a proposal will go forward without the reward of JI credit, or conversely that it will be implemented only if credit is available.

The consequences of "getting it wrong" are large in both directions. If credit is given systematically for projects that would happen anyway, then the use of these credits to meet developed country obligations will result in higher global emissions. Consider only one area in which JI projects may be undertaken: energy efficiency improvements. The energy efficiency of electric power projects and other industrial projects in developing countries is expected to improve significantly over the next 10-20 years, reflecting the normal penetration of better technologies. Indeed, a key part of the U.S. negotiating position is to require countries to undertake "no regrets" reductions in emissions that are economically justified on their own. Preliminary analysis by EPA suggests that currently anticipated improvements in the efficiency of energy production and use in developing countries will reduce their expected emissions growth in 2010 by as much as 865 million tons of carbon, as compared with growth on the basis of existing technologies.² If credit were given for projects in developing countries without accounting for these expected improvements, a large amount of excess carbon emission credits could be awarded. Developed countries, as a whole, only

¹Note that several modelers have interpreted JI to mean international trading between Annex I and non-Annex I countries. This interpretation is not correct and is not adopted here.

²Recent SGM model runs.

need 750 million tons of carbon reductions to reach 1990 levels by 2010.³

On the other hand, if the standard of "additionality" is set too high (i.e., if unrealistic improvements are taken into the baseline case), or if projects are choked off by transaction costs associated with resolving baseline and additionality questions, then the large potential savings associated with JI will be lost.

The issue discussed in this paper is how "additionality" for JI can be assured on a practical basis in the Kyoto agreement. Since there are a large number GHG mitigation opportunities available in the developing world which are inexpensive compared to domestic opportunities, it would greatly benefit the U.S. if practical methods could be developed to assure additionality. To that end, this paper presents and develops six options for addressing additionality. All of the options are briefly evaluated in terms of their development costs, ongoing costs (transaction costs for project developers and verification costs for verifiers), comprehensiveness of applicability, accuracy,⁴ and robustness over time. A final section presents stakeholder positions on JI and additionality in particular, to the extent that agencies are familiar with such positions.

The extent to which the issues surrounding additionality need to be addressed prior to Kyoto is uncertain. Some would argue that the agreement need only reference a method for addressing additionality or simply reference the need to address additionality. The details of a method for addressing additionality could be worked out by Parties post-Kyoto. Others see the resolution of issues related to additionality, to the degree possible, as essential prior to Kyoto. As discussed above, the consequences of getting additionality "wrong" are large.

Option 1. Forward-Looking Benchmarking:

A set of benchmarks could be developed and internationally agreed upon for specific technologies and practices associated with JI. JI projects would be considered additional if the technology they employed were lower-emitting (more efficient) than the benchmark emission level. Credits would be calculated as the difference between the performance of the JI technology or practice and the benchmark performance level.

From a practical standpoint, these benchmarks would have to be developed and negotiated following Kyoto. JI provisions in the Kyoto agreement would have to include a description of the option and a call for the subsequent adoption of guidelines by the Parties to the agreement. The first set of benchmarks would be applicable to JI projects undertaken in the first budget period. They would

³This number is based on the Interagency Analytic Team's (IAT) results. IAT's baseline projections of energy use and fuel mix were based on DOE's Annual Energy Outlook (1997), and the International Energy Administration's 1997 World Energy Outlook.

⁴None of the options can truly be "accurate" at determining additionality since it is impossible to answer the question "what would have happened anyway." The paper presumes, however, that some methods are better at answering this question than others.

need to be updated and renegotiated for subsequent budget periods, reflecting improvements in the baseline ("would have happened anyway") case over time.

Several simple examples may serve to illustrate the benchmark concept.

Some JI proposals involve upgrades of existing energy production facilities. Consider a proposal to reduce the emissions of an electric power plant, by increasing the efficiency (improving the heat-rate) of the generator or by switching fuels. A benchmark would be developed for the expected future of such facilities. For illustration, that might take two forms:

- Based on economic forecasts, estimated technology penetration rates, and other factors, it may be agreed that in the business-as-usual case, these facilities would continue to be operated indefinitely without upgrade. In that case, the benchmark would reflect the emissions rate of the current facilities and credit would be given for improvements made.
- Alternatively, forecasts may show that the proposed technologies are already penetrating these markets and that these upgrades are expected to take place in the business-as-usual case. In that case, the benchmark would reflect these improvements, and no credit would be given for making them.

Other JI proposals involve projects to meet new power demand with lower emissions. Proposals include building lower-emitting power projects (e.g., renewable, gas-fired, or very efficient coal-fired plants) in place of building relatively inefficient coal-fired plants. A benchmark would be developed for the emissions-intensity of base case power production facilities, with credit given for lower-emitting projects. For illustration:

- Based on economic forecasts, estimated technology penetration rates, and other factors, it may be agreed that the baseline case is the construction of high-emitting plants, with credit given for alternative technologies with lower emissions per kilowatt-hour output. On the other hand, it may be agreed that a certain penetration of gas, wind, or other technologies is already expected, and thus JI credit should not be given to low-emitting projects which are part of that expected technology penetration.

Similar benchmarks could be developed for other technologies, such as new automobiles (carbon per mile per vehicle), or steel mills (tonnes carbon per tonne of steel). Similar issues are presented by projects to enhance the sequestration of carbon in forests or soils. A range of projects have been proposed, from preservation of existing forests, to changing logging practices (e.g., selective logging rather than clear-cutting), to the creation of tree plantations. Benchmarks for logging projects might be in tonnes of carbon emissions per board feet of lumber.

Forecasting and negotiating benchmarks for these expected emissions futures will be complex. Consideration should be given to ways to reduce such complexity. Can a single set of global benchmarks can be used, or do they will need to be regionally- or nationally-specific? Moreover, should the energy sector benchmarks be fuel neutral (tonnes of carbon equivalent emissions per unit MWh) so that it is less difficult to determine the appropriate benchmark from which to determine additionality.

The characteristics of this option are:

- *High accuracy* -- This option is likely to be highly accurate since it attempts to account for many of

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the factors which affect "what would have happened anyway" such as changing economic conditions and rates of technology penetration.

- *Low verification costs* -- Once benchmarks are developed, it would be easy for verifiers to evaluate additionality. A project's emissions are either less than a benchmark or they are not.
- *Low transaction costs for project developers* -- Additionality could be determined quite easily. A project's emissions are either less than a benchmark or they are not.
- *Uncertain comprehensiveness* -- The comprehensiveness of this option depends on the extent to which benchmarks can be developed and negotiated. To the extent benchmarks are developed for a broad set of technologies and practices, the option would be fairly comprehensive. Comprehensiveness is important because the larger the set of JI mitigation opportunities, the lower the cost of reducing greenhouse gas emissions.
- *High development costs* -- Such costs would be high because countries would have to conduct a great deal of data collection and analysis to determine appropriate benchmarks and would have to negotiate benchmarks internationally.
- *Low robustness over time* -- The benchmarks not only have to be developed and negotiated initially, but they also have to be updated over time.

Option 2. Historical Benchmarking

Historical benchmarking works on the same basic principle as forward-looking benchmarking. Benchmarks are developed for technologies and practices associated with JI projects. JI projects are considered additional if the technology they employ is lower-emitting than the benchmark.

The difference between this option and the first option is that in this option the benchmarks are not negotiated at the beginning of each budget period for the entire budget period based on economic forecasts, estimated technology penetration rates, and other factors. They are instead determined on a project by project basis based on historical emissions in the sector of the project. Consider a proposal to build a lower-emitting power project (e.g., renewable, gas-fired, or even very efficient coal-fired plants) in place of a relatively inefficient coal-fired plant. The benchmark might be the average emissions intensity of coal-fired power plants in that country in the past year. Credit would be given for the difference between the emissions intensity of the benchmark and the emissions intensity performance of the project if it is lower than the benchmark.

The benchmark would not take into account factors which affect the emissions intensity of JI technology or practices as a particular JI project progresses. In this example, for instance, energy efficiency improvements in baseline coal technology in the country of the project would not be accounted for in calculating the credit for the project. Such changes would not be ignored, however. As a each new JI project is implemented, a new benchmark is utilized. Since more and more efficient processes would be implemented over time, the emissions intensity of the benchmarks would fall over time. Thus the extent to which JI credits could be created in a sectors where emission intensity is decreasing over time would diminish over time.

Presumably the methods for determining such benchmarks, rather than the benchmarks themselves, would be negotiated internationally.

The evaluation of this option is very similar to evaluation of Option 1 except that this option has lower development costs, is more robust over time, may be more comprehensive, and is less accurate. The option has lower development costs because only methods, not benchmarks, have to be developed and negotiated. The option is more robust over time because neither benchmarks nor methods would have to be renegotiated every budget period. The option may be more comprehensive to the extent that it is easier to develop methods to determine additionality rather than actual benchmarks. The option is less accurate because individual projects would be getting credit from a benchmark that does not take into account forward-looking factors which will affect what would have happened anyway such as business as usual technology penetration. Moreover, the use of average emission intensities in formulating historical benchmarks can be problematic. Averages can change slowly or be weighted down if, even as new less greenhouse gas intensive technologies are introduced, old inefficient technologies continue to be used.

Option 3. Measuring Additionality From Sector-Specific Emission Baselines

This option would involve the development of sector-specific (rather than project or technology specific) emission baselines in countries which wish to host JI for the sectors in which each country wishes to host JI. These baselines would constitute a quantitative determination of projected future GHG emissions for relevant sectors. The emissions baseline for each sector would be based on such factors as forecasted economic growth, expected penetration rates of technologies or practices, and adopted and projected policies and measures affecting the sector. Before a JI project could be deemed additional, a determination would first have to be made that emissions from an entire sector in a developing country are below the emissions baseline. The same methodologies used to report and verify emissions by Annex I countries could be used for this assessment of actual emissions. Then, the host country in conjunction with project developers, could attribute the "surplus" emission reductions to specific projects deemed worthy.

The characteristics of this option are:

- *High accuracy* -- This option is likely to be highly accurate since it attempts to account for many of the factors which affect "what would have happened anyway" such as changing economic conditions and rates of technology penetration.
- *Uncertain robustness over time* -- This option would be robust to the extent that developing countries do not change their emissions baselines or methods for allocating surplus emission reductions over time.
- *Uncertain transaction costs for project developers* -- The process used to allocate surplus emissions reductions to projects would vary by country and possibly by sector within a country. To the extent that such allocation systems are straightforward and transparent, transaction costs would be low.
- *Uncertain verification costs* -- Such costs would depend on how this option is implemented by countries.
- *Uncertain comprehensiveness* -- To the extent that all host countries develop baselines for all sectors available for investment from JI, this option would allow a broad set of projects to be eligible for JI and as a result potentially many countries. To the extent that some countries may do not develop baselines such comprehensiveness would be limited.
- *High development costs* -- Such costs would be high because countries would have to conduct a great deal of analysis to determine the appropriate emission baselines. The availability of

international guidelines, developed for Annex I countries, for determining actual emissions would reduce the costs of determining sector-wide surplus emissions.

- *Low political feasibility* -- Political feasibility is not a criteria on which the other options have been evaluated since many of these ideas are new and it is very unclear how countries would react to them. It is possible to predict that this option would be very unpopular with developing countries, however. They are likely to view this option as a step toward their acceptance of national, quantitative, GHG emission reduction commitments.

Option 4. Defining Additionality As Overcoming Project-Specific Barriers

An option, which is being advanced internationally by the International Energy Agency, would involve assessing whether a project breaks ground by overcoming barriers (institutional, financial, technological, informational, policy, financing, or market) specific to that project in the country where it is proposed. A project would be deemed additional if it is demonstrated that the existence of such barriers is inhibiting the project from going forward, that the project would represent an innovation in overcoming those barriers, and that JI credit would supply the necessary incentive to go forward. The IEA has developed a typology of barriers which provides developers and evaluators with a framework for identifying and evaluating barriers.⁵ The typology defines and categorizes generic barrier types for specific sectors (power generation, transport, etc.).

The characteristics of this option are:

- *High comprehensiveness* -- The barrier typology can easily be expanded to include multiple project types.
- *Low development costs* -- To the extent that many of the development costs of this option have already been borne by the IEA (or are currently being borne as they further develop it), this option would have minimal development costs.
- *High robustness over time* -- The barrier typology can be adjusted as needed fairly easily.
- *Moderate transaction costs and investor uncertainty for project developers* -- Transaction costs and investor uncertainty will be lowered by the standardization presented by the barrier typology, but it will be unclear to project developers which additionality arguments will be accepted by reviewers. Consistency of decisions by reviewers is not guaranteed since decisions will be made on a case by case basis.
- *High verification costs for organizations determining compliance* -- Review on a project by project basis of unique additionality arguments is resource-intensive.
- *Low accuracy* -- Low probability of accuracy results from the difficulty of digesting subjective arguments about additionality and then making a determination of additionality. Also, both parties selling and buying credits would have incentives to promote the existence of barriers that might not exist.

Option 5. Assess additionality using a general set of guidelines

⁵Not yet published International Energy Agency paper titled "Activities Implemented Jointly Under the FCCC."

This option would provide for project by project judgments of additionality based on information provided by project developers. Project developers and evaluators would use a general set of guidelines to develop and evaluate additionality arguments. This is similar to the approach currently used by the U.S. Initiative on Joint Implementation (USIJI). For example, in the original guidelines for development of a project proposal USIJI asks, regarding additionality, that project developers include a discussion of the following subjects in their project proposal:

- (1) How the existence of the USIJI program helped or could help overcome any barriers to develop or implement the project;
- (2) A discussion of whether the specific measures taken by the project to reduce or sequester greenhouse gas emissions are required by existing laws or regulations applicable in the U.S. or host country; and
- (3) A description of the prevailing technologies and management practices now used in the host country and how the specific measures proposed in the project differ from them.⁶

The characteristics of this option are:

- *Low development costs* -- Guidelines used for existing JI programs could be compiled.
- *High robustness over time* -- General guidelines can be adjusted as needed fairly easily.
- *High comprehensiveness* -- General guidelines are not project specific and can be comprehensively-applied.
- *High transaction costs and investor uncertainty for project developers* -- High transaction costs and investor uncertainty result from the lack of standardization of the process. Which arguments will work? Which will not? Consistency of reviewer decisions is not guaranteed since they will be developed on a case by case basis.
- *High verification costs* -- Review on a project by project basis of unique additionality arguments is resource-intensive.
- *Low accuracy* -- Low accuracy results from the difficulty of digesting subjective additionality arguments and then making a determination of additionality.

Option 6. Employing safeguards such as discounting

Given that any method to determine additionality is likely to be imperfect, this option would employ safeguards, such as discounting, in addition to whatever method is adopted for addressing additionality. In this way the overall quantity of credits created through JI, some of which may have happened anyway, could be reduced. Other options for safeguards include phasing out JI in some future year, or limiting the scope of JI (e.g. developed countries might be limited to meeting 10% of their emission reduction targets through JI).

This option cannot be evaluated like other options since the results are dependent on which safeguard is selected and which method to address additionality is used in combination with the safeguard.

Stakeholder Positions On JI And Additionality

⁶Description of the U.S. Initiative on Joint Implementation, 1994.

Most business NGOs involved in the climate change debate are supportive of including JI in the Kyoto agreement, while most environmental NGOs are opposed to such inclusion. Two organizations actively involved in the climate change debate support the inclusion of JI in the Kyoto agreement only on the condition that the emission reductions associated with JI are both credible and verifiable (Environmental Defense Fund, Business Council for Sustainable Energy).^{7 8}

Several stakeholders not only have positions on JI but have also developed positions on the topic of additionality. The Edison Electric Institute has suggested that a form of historical benchmarking be used for the electric power sector.⁹ If JI is included in the Kyoto agreement, the U.S. Climate Action Network suggests that credits be based on clear criteria and benchmarks, rather than "an inherently subjective and unverifiable project-by-project determination of what would otherwise have happened"¹⁰ The Environmental Defense Fund takes the opposite tack and suggests that additionality be determined on a project by project basis. They specifically reject the benchmarking approach stating that past U.S. use of centrally-defined best available technology (BAT) standards failed; a one-size-fits-all approach to BAT overlooks the differences among nations and among regions within nations; and efforts to develop definitions of BAT will likely deteriorate into difficult and divisive trade negotiations.¹¹ Finally, the Center for Clean Air Policy has recommended that the U.S. drop the additionality test altogether for 1) projects that reduce net emissions (fuel switching, efficiency improvement and other projects that reduce emissions at existing facilities) and 2) all renewable energy projects. They argue that dropping the additionality test would make credits produced by these projects more fungible, increase transparency and reduce the transaction costs associated with the current JI process both here and abroad. They also recommend the discounting of JI project credits to account for uncertainty and to improve the credibility of JI generally.¹²

⁷Facsimile from Annie Petsonk of the Environmental Defense Fund to Lisa Carter of the U. S. Environmental Protection Agency dated February 7, 1997

⁸BCSE "Position Statement -- Global Climate Change" 1997

⁹Letter to Eileen B. Claussen, Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs, March 24, 1997 from Edison Electric Institute.

¹⁰Letter to Eileen B. Claussen, Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs, May 2, 1997 from the U.S. Climate Action Network.

¹¹Facsimile from Annie Petsonk of the Environmental Defense Fund to Lisa Carter of the U.S. Environmental Protection Agency dated February 7, 1997.

¹²Letter to Bob Dixon from Edward A. Helme, Director, Center for Clean Air Policy, dated June 26, 1997 which accompanies a paper titled "Integration of Joint Implementation into an Annex I Greenhouse Gas Trading System."

U.S. Views: International Greenhouse Gas Trading System

The U.S. has proposed an international greenhouse gas (GHG) trading system as a mechanism to achieve greenhouse gas emission reductions cost effectively.

Effective policies for slowing and eventually halting global climate change must minimize the cost of achieving substantial reductions in global emissions. The key to lowering costs is to allow maximum flexibility in reducing emissions, while ensuring the strict accountability of all parties involved. Such flexibility and accountability can best be attained through a system of binding emissions budgets, with international trading. Allowing trading between nations with low and high marginal costs of abatement could reduce the costs of achieving significant emission reductions by as much as 50 percent. The ultimate effectiveness of a trading system in lowering the costs of reducing emissions will depend on its ability to keep transaction costs low, and its success in creating and maintaining the credibility of the commodity being traded.

Creating an international emission trading system requires three initial conditions: a legally-binding allocation of emission authorizations (or starting emission budgets); a standardized and verifiable system of measurement and reporting that enables actual emissions to be matched to authorized amounts; and an effective mechanism to ensure that all Parties are complying with their obligations.

Preconditions for Participation in International Greenhouse Gas Trading System

Legally Binding Emissions Limit. Legally binding emission limits or budgets are a necessary precondition for any international greenhouse gas emissions trading system. The U.S. expects that an international agreement will identify a comprehensive list of greenhouse gas sources and sinks, and establish the legal limit as a uniform percentage of those emissions from 1990. According to the U.S. proposed protocol, the budgets would cover a fixed period of "x" years (where x would be at least 3 years, but no greater than 10 years). Under this approach, each Party would receive its initial budget allocation for the budget period in "tonnes of carbon equivalent emissions allowed", hereafter referred to as "tonnes-allowed".

Measurement and Reporting Systems. Verifiable measurement and annual reporting of emissions is a critical precondition to any international trading system. Adequate mechanisms for measuring and reporting actual emissions of greenhouse gases must exist so that compliance with legally binding emission limits can be verified. The current IPCC guidelines allow a wide range of options for emissions measurement; therefore, standardized methods would be needed to ensure a consistent, minimum level of accuracy for all Parties. Each Party would provide annual emissions and budget adjustment reports to the FCCC Secretariat, which would record, track, and publish annual emissions inventories and budget balances.

Compliance Mechanisms. All Parties must be able to credibly demonstrate compliance with their emission targets. In addition to international mechanisms to assure compliance with budget commitments, parties should be encouraged to build mechanisms domestically. Before participating in emissions trading, a Party must meet certain requirements. First, the Party must have an adequate monitoring and reporting system for tracking its emissions of greenhouse gases; and second, the Party must establish a certification and verification mechanism (which could mean identifying a government person as the "authorizing official") for budget adjustments. Further guidelines must be developed to specify these minimum standards, including evaluation requirements for in-depth review teams.

Elements of the International GHG Trading System

Tradeable Units. The tradeable unit would be established as a "tonne of carbon equivalent emissions allowed" (tonne-allowed). The FCCC Secretariat would record the initial budget of tonnes-allowed for each Party (the Secretariat would likely use an electronic database, with an "account" for each Party), together with the identifying information necessary to track trades of specific tonnes-allowed, including country-of-origin and budget period of issuance.

Standardized Reporting by Parties. All Parties must provide annual emissions reports to the FCCC Secretariat. To facilitate the accounting process, the Secretariat would likely use a standard electronic reporting format which Parties would be required to use in order to minimize administrative costs and reduce errors. In addition to the annual reports on emissions to be required of all Parties, those Parties participating in an international trading system would have to report annually on the status of their budget. Specifically, the Party would identify any tonnes-allowed traded and would identify sufficient tonnes-allowed to account for its annual emissions. The Secretariat would likely use a simple form to capture the needed tracking information.

Centralized Recordkeeping and Accounting. The FCCC Secretariat already records, tracks, and publishes emissions inventory reports based on the data submitted by each Party in its national communications. Under the proposed protocol, the Secretariat would be authorized to administer budget transactions for Parties which meet the monitoring, reporting, verification, and compliance requirements established by the Parties. At least annually, the Secretariat would record any transfers of tonnes-allowed. The Secretariat would officially record a transfer by deducting the specified number of tonnes-allowed from the selling Party's account and adding that quantity to the buying Party's account. After all the transfers have been officially recorded by the end of each year, the Secretariat would retire enough tonnes-allowed from each Party to account for its annual emissions, as specified by each Party's annual report.

At the end of the budget period: The FCCC Secretariat would complete a final accounting of each Party's emissions and budget adjustments. If a Party held more than enough tonnes-allowed to match its actual emissions, the Secretariat would automatically transfer the unused tonnes-allowed into that Party's account for use during the next budget period. If a Party did not have sufficient tonnes-allowed to cover all of its emissions during the budget period, the Party would be permitted to buy tonnes-allowed from other Parties to make up the difference. A Party could also have a limited number of tonnes-allowed automatically deducted from its subsequent budget in order to remain in compliance. A predetermined penalty would be associated with this type of "borrowing." For example, the Party would have its subsequent budget reduced by 12 tonnes-allowed in order to transfer 10 tonnes-allowed into the current budget period. (The two "penalty" tonnes would be immediately retired by the Secretariat.)

Emissions Trading Restrictions for Parties Not in Compliance. Parties must meet initial and ongoing minimum measurement, verification, and reporting requirements in order to maintain eligibility to participate in trading. In-depth review teams would periodically assess a Party's compliance according to minimum standards established by the Parties. The trading system is designed to foster and facilitate compliance with Parties' emissions budget by providing a mechanism which encourages low cost emission reductions but requires significant, automatic consequences for failure to achieve the required budget levels. Specifically, the FCCC Secretariat would be authorized to implement any emissions trading restrictions established by the Parties. Emissions trading restrictions would include preventing a non-complying Party from selling tonnes-allowed, or allowing the sale of such tonnes-allowed, but restricting their use by another Party until the question of

compliance is resolved. In addition, Parties will have the discretion to take any further action deemed necessary to address non-compliance.

Party Authorization Required for Trades Initiated by Domestic Entities. Although any Party could permit private entities to take actions that would lead to international trades of tonnes-allowed, the Party would have to provide official authorization before the tonnes-allowed could be transferred to the purchaser (or acquired by the buyer). Such verification would be necessary because the Party is legally responsible for meeting its commitments, and transfers modify a Party's compliance obligation.

National Mechanisms for Meeting Budget Requirements.

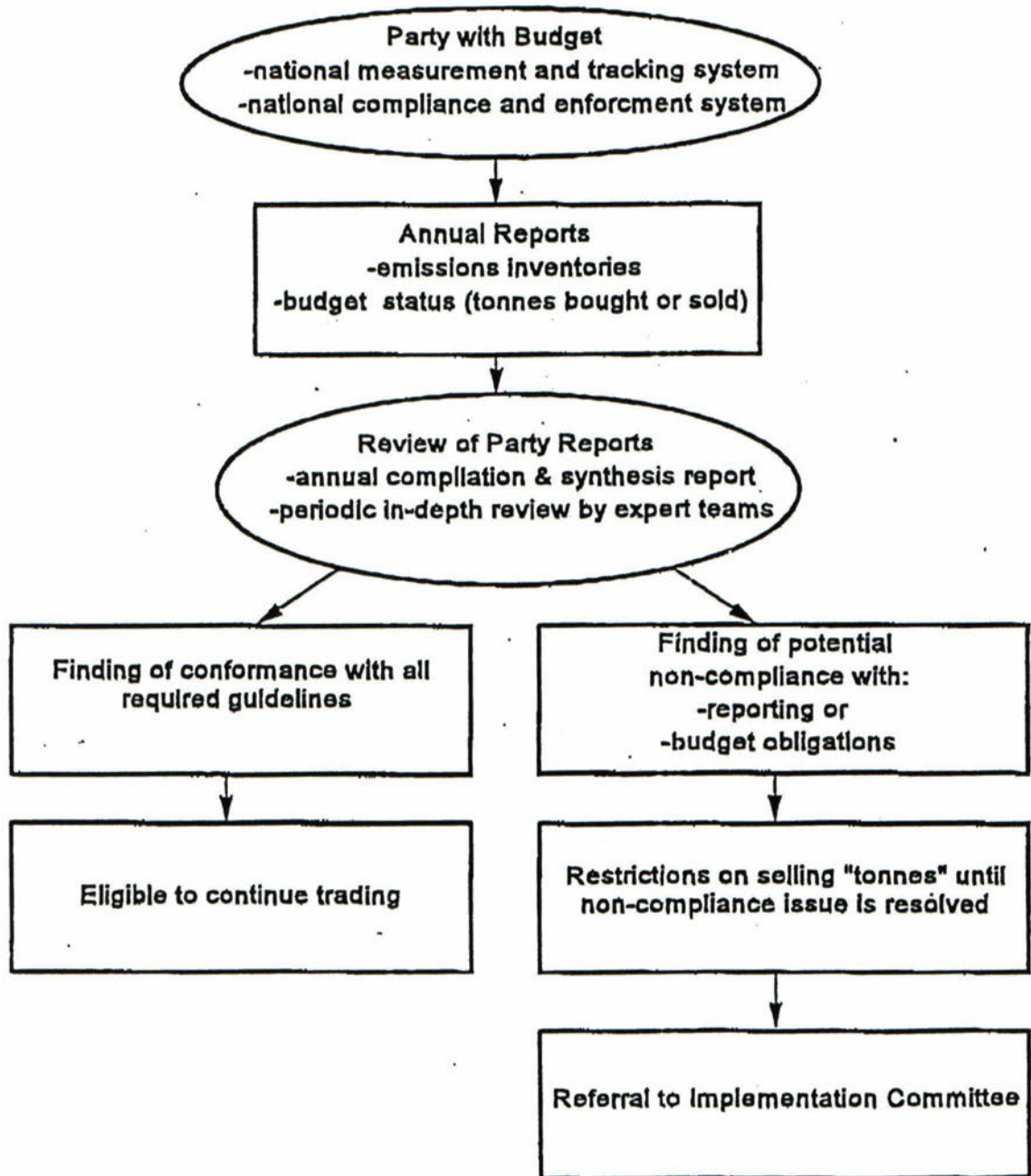
Parties with legally binding targets would not be required to have a domestic trading system to participate in the international greenhouse gas trading system. For example:

1. Party "A" could adopt a policies and measures approach (e.g. carbon taxes, efficiency standards) to reduce greenhouse gas emissions, while also trading tonnes-allowed internationally in order to reduce the cost of meeting its obligations.
2. Party "B" could adopt a domestic emissions trading program to control its emissions. It might allocate its entire budget of tonnes-allowed to an appropriate set of private entities which are responsible for greenhouse gas emissions. These private entities would monitor and report their emissions to the Party, and the Party would have domestic enforcement mechanisms to hold each source accountable for its emissions. Then, a domestic entity could choose its own compliance strategy. For example, a domestic entity could reduce its own emissions and sell its "extra" tonnes-allowed on the domestic market or internationally, with approval from its own Party. Another domestic entity could choose to purchase tonnes-allowed from the international market (with approval from the appropriate Parties).
3. Party "C" could adopt a combination of approaches to reduce its emissions. For example, it could use policies and measures for some sectors and an emissions trading system for other sectors. Under this approach, domestic entities in those sectors which are assigned tonnes-allowed in a domestic emissions trading system could participate as described above for Party B. At the same time, the government could choose to purchase or sell tonnes-allowed to account for emissions from those sectors being addressed by policies and measures.

Conclusion

If the Agreement establishes a clear environmental goal with legally binding targets, Parties must meet certain minimum standards for monitoring, verification, compliance, and reporting in order to demonstrate compliance. These minimum standards are also necessary for an international greenhouse gas emissions trading system. Such a trading system will be an extremely valuable tool, providing Parties with the flexibility to achieve their commitments at the lowest possible cost.

International Trading Reporting & Verification Process



*Legally binding budgets established in the International Agreement

International Emissions Trading: Commonly Asked Questions

1. Why does the U.S. believe that emissions trading programs are cost effective tools to achieve emissions reductions?

The U.S. view is based on the experience with the U.S. sulfur dioxide (SO₂) trading program to reduce the emissions from electric utilities which cause acid rain. When the authorizing legislation was developed in 1990, a typical policies and measures program (which would have required each electric utility boiler to install standard pollution control technology) was estimated to cost about \$5 billion annually. To achieve the same level of emissions reductions using an emissions trading program (which would allow electric utilities to choose the most cost effective approach for each boiler) was estimated in 1990 to cost about \$4 billion annually. Once the program actually became effective, pollution control costs dropped dramatically, and with trading, the U.S. Government Accounting Office has since estimated that the SO₂ program is costing about \$2 billion annually. The U.S. has already experienced significant emission reductions under the first phase of the control program: by 1995, the U.S. experienced a 30% drop in national SO₂ emissions from 1980 (and the monitoring results show that the 263 Phase 1 units reduced their emissions by 3 million tons from 1994 to 1995 - a 40% reduction attributed to the first year of the SO₂ trading program).

2. Why is the cost of compliance with the U.S. SO₂ trading program so much lower than anticipated when the program was first designed?

The cost of reducing a ton of SO₂ from the utility sector has dropped dramatically from the initial estimates. Recent studies have highlighted the innovation and efficiency improvements in pollution controls which have developed since the SO₂ trading program was implemented. In the past, policies and measures in the United States prescribed the specific scrubber technology required to meet a required removal efficiency. Scrubber costs have dropped significantly in the last six years, and their sulfur removal efficiencies have improved. In addition, there have been innovations in the blending of high-sulfur and low-sulfur coals, while expected increases in cost associated with the increased use of low sulfur coal have not materialized. The market mechanism provides an incentive to spur the efficiency and innovation which lowers costs.

3. How would Party "A", using policies and measures, participate in an international emissions trading system?

Party "A" has imposed various policies and measures on its domestic entities in various emission sectors. Assume that by the last year of the budget period, its national policies and measures have been extremely effective, and Party "A" will have 50 million "tonnes-allowed" left over after deducting all of its emissions. If Party "B" has estimated that it will need an additional 30 million "tonnes-allowed" to meet its budget, then Party "A" could sell 30 million tonnes-allowed to Party "B" at a negotiated price that would be acceptable to both Parties (presumably, at a total price less than the cost for Party B to reduce 30 million tonnes domestically).

4. How would a Party "B" using a domestic trading system, participate in an international emissions trading system?

Party "B" could develop a domestic trading system which is designed to transparently delegate its tonnes-allowed to its domestic entities. Domestic entities would then try to make emission reduction choices based on both domestic and international costs of compliance. Because Party B would presumably have a compliance system which requires its domestic entities to retain enough "tonnes-allowed" to account for their emission reductions, Party B may be willing to approve its domestic entities' request to purchase or sell tonnes-allowed with fairly minimal government involvement in the details leading to the transaction. Nevertheless, the official transfer of tonnes-allowed cannot take place without official review and authorization of the transaction by Party B.

Detailed example of a Trade Initiated by a Private Company:

Party B allocates tonnes-allowed to Company X, requiring Company X to hold enough tonnes-allowed to account for its emissions. Company X installs energy efficient technology which reduces its emissions. Company X determines that it now has extra tonnes-allowed, which it could choose to sell either domestically or on the international market. Company X could choose to sell its extra tonnes-allowed to Party A (at a mutually agreeable price). However, Party B would have to authorize the transaction before the FCCC Secretariat could officially record the transfer, deducting the specified number of tonnes-allowed from Party B's account and adding that quantity to Party A's account.

Summary of Scenarios:

Government to Government trades

(domestic trading system is not necessary for either country)

Company X request, approved by its Government, trades with another Government

(Government of Company X has delegated tonnes-allowed to its company in a transparent domestic trading system; trading system is not necessary for the other government)

Company X request, approved by X's Government, trades with Company Y, approved by Y's Government

(Assumes domestic trading systems in both countries)

5. What is the Accounting Role of the FCCC Secretariat?

The FCCC Secretariat serves as the "bookkeeper" for tracking emissions inventories and budget adjustments. The FCCC Secretariat would create a simple computerized database and with the approval of the SBSTA/SBI develop standardized forms to make tracking easier to implement. The Secretariat would set up an account for each Party containing the initial allocations set in the Agreement. The Secretariat would then record emissions and budgets based on the annual reports submitted by Parties in their national communications. After determining that all necessary information was properly included, the Secretariat would implement budget transfers reported by the Parties by adjusting each Party's account to add any "tonnes-allowed" purchased and subtract any "tonnes-allowed" sold by the Party. The Secretariat would then permanently deduct (retire) enough "tonnes-allowed" to account for each Party's annual emissions. At the end of the budget period, the Secretariat would automatically record any budget adjustments required by banking and borrowing provisions.

6. What is the Role of the Private Sector?

Although a trade does not officially take place until the Secretariat records the transfer at the end of the year based on each Party's annual submission, there is a role for the private sector to facilitate the private transactions which lead to the official transfer. Indeed, private brokers may negotiate trades among Parties at any time during the year. "Tonnes-allowed" might be informally exchanged several times through various Parties during the year, with only certain transfers being officially recorded by the Secretariat. The Secretariat might facilitate the role of brokers by creating a "market account" (separate from the accounts created for each Party) where parties could transfer their tonnes-allowed to be held until the broker eventually finds another Party to purchase those tonnes-allowed for compliance. It might be possible to allow brokers and other various nongovernmental organizations to participate directly in official transfers recorded by the Secretariat, although there is some concern about the level of resources which would be required.

7. What happens at the end of the budget, if a Party does not have enough tonnes allowed to account for all of its emissions?

If there are cases where a Party does not have enough tonnes-allowed to cover all of its emissions during the budget period, the Party would be permitted to buy enough tonnes-allowed from other Parties to make up the difference. However, if the Party still does not have enough tonnes-allowed to account for its emissions, then the Secretariat would automatically transfer a sufficient quantity of "borrowed" tonnes-allowed from the Party's subsequent budget period into the Party's current account. The Secretariat would simultaneously deduct the appropriate number of "penalty" tonnes-allowed from the Party's subsequent budget period and immediately transfer those tonnes-allowed into a permanent "retirement" account. In addition, a Party would be restricted from selling any additional tonnes-allowed until the question of compliance was resolved.