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[Climate Change Mitigation Group] [2]

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S	20	5	7	2

F Envr. (CCM6)

Report to Congress

Expand AgStar

Expand AgStar

Reductions in 2000	Cumulative FY 94-2000 Budget Cost	Agency
1.0 - 2.0 MMTCE	\$6.5 million	EPA: 5 FTE
	\$24.5 million	USDA: 36 FTE

Description:

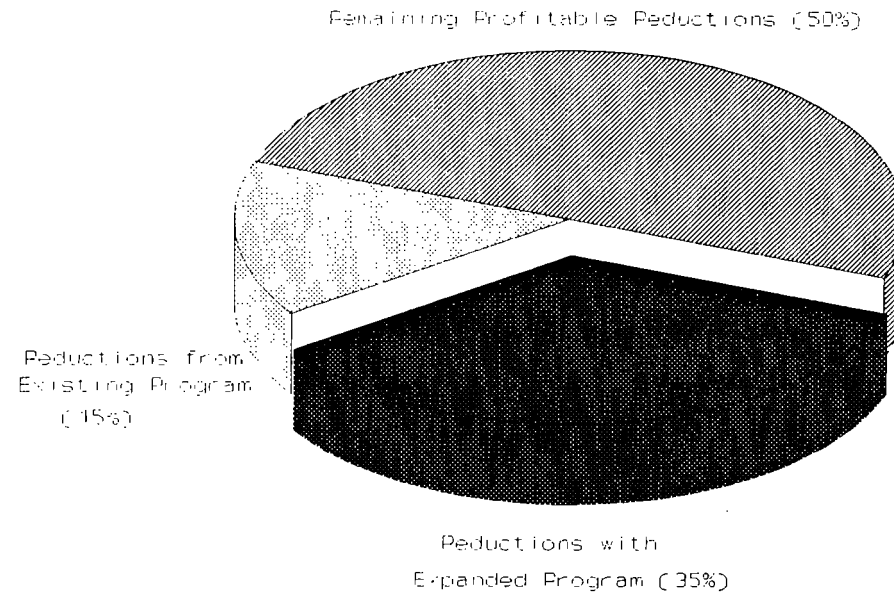
- ◆ Voluntary program that encourages dairy and swine facilities to capture methane emitted from animal waste and use it for on-farm energy needs
- ◆ Farms agree to identify and implement profitable measures for capturing and utilizing methane emitted from animal waste
 - covered lagoons
 - manure digesters
- ◆ Focused on selected regions where most of large dairy and swine operations are located
- ◆ Demonstration programs already in place
- ◆ The program will be officially launched in key states in late Summer 1993

Expand AgStar (continued)

Analysis:

1. Profitable reductions in 2000 = 3.0 - 6.0 MMTCE
2. Achieve reductions from program equivalent to 15% of profitable reductions with current FTE level = 0.5 - 1.0 MMTCE
3. Remaining profitable reductions = 2.5 - 5.0 MMTCE
4. Achieve reductions equivalent to additional 35% of profitable reductions from expanded program = 1.0 - 2.0 MMTCE
5. Total reductions equivalent to 50% of profitable reductions = 1.5 - 3.0 MMTCE

Expand AgStar



	Low MMTCE	High MMTCE
Profitable Reductions	3.0	6.0
Reductions from Program with current FTE level = 15% of Profitable Reductions	0.5	1.0
Reductions from Expanded AgStar Program = 35% of Profitable Reductions	1.0	2.0

Liquid Systems Produce Most of the Methane

Methane Emissions from Livestock Manure - 1990		
Emissions by Manure Management System	Tg of Carbon Equivalent	Percent of Total
✓ Liquid Systems		
Anaerobic Lagoons	8.5	63%
Pit & Liquid/Slurry Storage	2.6	19%
Total Liquid Systems	11.1	82%
Solid Systems		
Pasture/Range	0.7	5%
Drylot	0.2	1%
Other	1.6	12%
Total Solid Systems	2.5	18%
<i>Total</i>	<i>13.6</i>	<i>100%</i>

Dairy and Swine Farms Produce Most of the Methane

Emissions by Livestock Type	Tg of Carbon Equivalent	Percent of Total
✓ Dairy	4.4	32%
✓ Swine	6.7	49%
Beef	1.0	7%
Poultry	1.4	10%
Other	0.1	1%
<i>Total</i>	<i>13.6</i>	<i>100%</i>

Source: US EPA (1993).

Expand AgStar (continued)

Profitability Analysis:

- ◆ Financial analysis at the individual farm level
- ◆ Assessment of the profitable options nationally

Discounted Cash Flow Analysis

Key Parameters	Value Used
Real Discount Rate	10%
Capital Costs	Incurred as a lump sum when equipment is installed - highly variable
Measure of Costs	Based on representative average cost relationships from existing projects
Benefits	Average state electricity prices
Time Period	10 years

Exhibit 6-21

Total Costs of Representative Gas Recovery and Utilization Projects

Recovery Option	Utilization Option	Farm Size ^a (head)	Installation Costs	Annual O&M Costs
Dairies: Parlor Manure Only				
Covered Lagoon	Heating and Cooling	250	\$49,000	\$500
		500	\$60,800	\$1,100
		1,000	\$88,900	\$2,200
	Electricity Generation	250	\$49,600	\$600
		500	\$62,800	\$1,200
		1,000	\$88,700	\$2,300
Complete Mix Digester	Electricity Generation	250	\$76,500	\$400
		500	\$92,900	\$800
		1,000	\$122,100	\$1,700
Dairies: Parlor and Apron Manure				
Covered Lagoon	Heating and Cooling	250	\$55,800	\$500
		500	\$68,000	\$1,100
		1,000	\$103,600	\$2,200
	Electricity Generation	250	\$69,500	\$2,100
		500	\$99,800	\$4,200
		1,000	\$163,800	\$8,500
Complete Mix Digester	Electricity Generation	250	\$117,400	\$1,500
		500	\$168,200	\$3,100
		1,000	\$261,800	\$6,100
Plug Flow Digester (apron manure only)	Electricity Generation	250	\$97,800	\$1,100
		500	\$130,100	\$2,200
		1,000	\$190,300	\$4,400
Hog Farms				
Covered Lagoon	Electricity Generation	500	\$48,900	\$1,100
		1,000	\$71,700	\$2,300
		5,000	\$249,600	\$11,300
Complete Mix Digester	Electricity Generation	500	\$86,000	\$1,000
		1,000	\$112,000	\$2,000
		5,000	\$292,400	\$10,300

^a Number of milking cows with an average weight of 1,400 lbs. or the number of hogs with an average weight of 138 lbs

Cost and Benefit Summary of Methane Recovery Systems

Recovery System	Farm Size ^a (head)	Total Cost	Annual Benefit	Payback Period	NPV	Annualized Benefit Per Animal
Dairy Farms: II. On-Farm Electricity Generation with Parlor Manure						
Covered Lagoon	250	\$44,900	\$4,400	---	(\$17,800)	(\$12)
Complete Mix	250	\$76,500	\$2,300	---	(\$49,100)	(\$32)
Covered Lagoon	500	\$56,300	\$8,700	---	(\$10,300)	(\$3)
Complete Mix	500	\$92,900	\$4,700	---	(\$52,800)	(\$17)
Covered Lagoon	1,000	\$78,600	\$17,400	9.0	\$5,000	\$1
Complete Mix	1,000	\$122,100	\$9,300	---	(\$57,600)	(\$9)
Dairy Farms: IV. On-Farm Electricity Generation with Parlor and Apron Manure						
Covered Lagoon	250	\$61,000	\$10,600	---	(\$6,800)	(\$4)
Complete Mix	250	\$117,400	\$8,600	---	(\$56,900)	(\$37)
Plug Flow	250	\$97,800	\$6,200	---	(\$50,800)	(\$33)
Covered Lagoon	500	\$85,800	\$21,300	7.9	\$13,800	\$4
Complete Mix	500	\$168,200	\$17,100	---	(\$63,700)	(\$21)
Plug Flow	500	\$130,100	\$12,500	---	(\$52,200)	(\$17)
Covered Lagoon	1,000	\$138,600	\$42,600	6.2	\$52,400	\$9
Complete Mix	1,000	\$261,800	\$34,300	---	(\$71,100)	(\$12)
Plug Flow	1,000	\$190,300	\$24,900	---	(\$51,700)	(\$8)
Hog Farms: On-Farm Electricity Generation with All Manure						
Covered Lagoon	500	\$44,000	\$6,100	---	(\$10,500)	(\$29)
Complete Mix	500	\$86,000	\$6,400	---	(\$41,400)	(\$13)
Covered Lagoon	1,000	\$64,600	\$12,300	---	(\$3,500)	(\$9)
Complete Mix	1,000	\$112,000	\$12,700	---	(\$37,500)	(\$6)
Covered Lagoon	5,000	\$225,100	\$61,300	7.1	\$56,400	\$153
Complete Mix	5,000	\$292,400	\$63,700	9.2	\$14,300	\$0

^a Refers to the number of milking cows having an average weight of 1,400 lbs. or the number of hogs having an average weight of 138 lbs.

Notes: For dairy farms, average gas recovery rates and electricity rates for Erath County, Texas were applied. For hog farms, average gas recovery rates and electricity rates for Sampson County, North Carolina were applied. Plug flow systems do not include parlor manure.

F. Ennis
(CCMB)

Expand Natural Gas Star

Expand Natural Gas Star

Reductions in 2000	Cumulative FY 94-2000 Budget Cost	Agency
1.8 - 3.4 MMTCE	\$6.15 million	EPA: 3 FTE

Description:

- ◆ Voluntary program that promotes adoption of cost-effective technologies - companies agree to identify and implement BMPs to reduce emissions
- ◆ Currently includes 20 transmission and distribution companies

Transmission:

- directed I&M at compressor stations
- use turbines at compressor stations for new installations or when retiring reciprocating engines
- replace high-bleed pneumatics

Distribution:

- directed I&M at surface facilities
- rehabilitate leaky pipe
- ◆ Will be expanded in these areas and to include production companies
- ◆ Transmission + Distribution + Production $\Rightarrow$ 80% of emissions



Star Partner Responsibilities



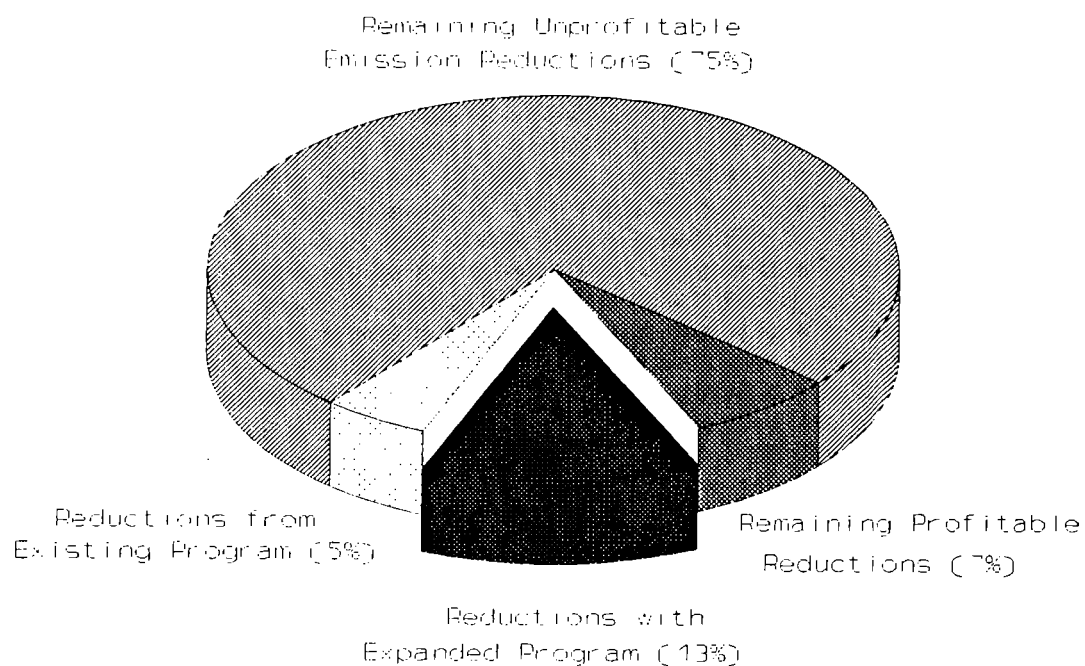
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- **Consider all “BMPs”**
 - **Develop implementation plans (6 months)**
 - **Fully implement plan within 3 years**
 - **Assist in testing new technologies**
 - **New facilities include “BMPs”**
 - **Document participation**
 - **Participate in workshops**

Expand Natural Gas Star (continued)

Analysis:

1. Year 2000 emissions with no program = 13.8 - 26.4 MMTCE
 2. Approximately 25% of total natural gas system emissions could be reduced profitably
 3. Achieve 5% reduction from total emissions with existing program = 0.7 - 1.3 MMTCE
 4. 13% additional reductions from total with expanded program = 1.8 - 3.4 MMTCE
 5. 18% total reductions from program in 2000 = 2.5 - 4.7 MMTCE
- ⇒ total reductions equivalent to about 70% of total profitable reductions

Expand Natural Gas Star



	Low MMTCE	High MMTCE
2000 Emissions with no program	13.8	26.4
Profitable Reductions - 25%	3.5	6.6
Reductions from Existing Natural Gas Star Program = 5%	0.7	1.3
Reductions from Expanded Natural Gas Star Program = 13%	1.8	3.4

Expand Natural Gas Star (continued)

Profitability Analysis:

Discounted Cash Flow Analysis

Key Parameters	Value Used
Real Discount Rate	6%
Labor Costs	\$25/hour**
Capital Costs	Incurred as a lump sum when equipment is installed - highly variable
Benefits:	
wellhead gas	\$1.59/Mcf**
pipeline gas	\$2.01/Mcf**
distribution system gas	\$2.91/Mcf**
Time Period	30 years
** Increase at a real rate of 2 percent per year	

Methane Emissions and Potential Reductions By Stage of the Natural Gas Industry
(Tg of Carbon Equivalent per Year)

Stage	1990	2000			2010		
	Emissions	Emissions	Potential Reductions		Emissions	Potential Reduction	
			Technically Feasible	Profitable		Technically Feasible	Profitable
Production	6.5	7.8	3.3	2.2	8.0	3.4	2.2
Processing	0.5	0.6	0.0	0.0	0.6	0.0	0.0
Storage	0.1	0.1	0.0	0.0	0.2	0.0	0.0
Transmission	6.2	6.6	2.3	2.2	6.9	2.3	2.2
Distribution	2.0	2.1	0.6	0.6	2.2	0.7	0.7
Compressor Engine Exhaust	2.5	3.1	0.4	0.0	3.1	0.8	0.0
Total	17.8 (13.1-25.6)	20.3 (14.6-30.0)	6.6 (4.7-9.6)	5.0 (1.6-7.2)	21.0 (14.7-32.3)	7.2 (5.0-11.0)	5.1 (1.6-8.0)

Reduction Technologies Analyzed

Production	Directed I&M programs; replacement of pneumatic devices; installation of flash tank separators on dehydrators.
Processing	No emissions reduction techniques were analyzed for this stage.
Storage	No emissions reduction techniques were analyzed for this stage.
Transmission	Directed I&M programs for compressors; replacement of pneumatic devices; and gas recovery before repair.
Distribution	Directed I&M programs at gate stations.
Compressor Exhaust	Turbines instead of reciprocating engines.

Source: USEPA (1993).

Summary of Major Options for Reducing Methane Emissions from the Natural Gas Industry

Option	Stage	1990	2000			2010		
		Emissions (Tg of C Eqiv./yr)	Emissions (Tg of C Eqiv./yr)	Potential Reductions (Tg of C Eqiv./yr)		Emissions (Tg of C Eqiv./yr)	Potential Reduction (Tg of C Eqiv./yr)	
				Technically Feasible	Profitable		Technically Feasible	Profitable
Directed I&M Programs at Gas Wellsites	Production	1.38	1.62	1.14	0.00	1.68	1.20	0.00
Replace High-Bleed Pneumatic Devices		2.22	2.64	1.44	1.44	2.70	1.50	1.50
Recover Emissions from Dehydrator Vents		0.66	0.78	0.72	0.72	0.78	0.72	0.72
Directed I&M Programs at Compressor Stations	Transmission	1.98	2.04	1.44	1.44	2.16	1.50	1.50
Replace High-Bleed Pneumatic Devices		1.20	1.26	0.72	0.72	1.32	0.72	0.72
Recover Gas Vented During Pipeline Blowdowns		1.32	1.44	0.12	0.00	1.50	0.12	0.00
Directed I&M Programs at Gate Stations	Distribution	0.72	0.84	0.60	0.60	0.96	0.66	0.66
Use Turbines Instead of Reciprocating Engines on Transmission Pipelines	Engine Exhaust (Transmission)	1.08	1.32	0.42	0.00	1.38	0.78	0.00
Subtotal		10.56	11.94	6.60	4.92	12.48	7.20	5.10
Emissions from Other Gas System Sources	All	7.26	8.34	--	--	8.52	--	--
Total		17.82	20.28	6.60	4.92	21.00	7.20	5.10

JUL 19 1993

F. Enman (CLMG)
METHANE AND OTHER GASES WORKING GROUP

"NO-BRAINER" LIST

Option Code	Option Title	Reductions 2000 (MMTCe)		Cumulative Budget Cost (x million \$)	Agency
		Low	High		
ME-1	Increase Stringency of Landfill Rule	4.6	4.6		EPA
ME-2	Landfill Outreach Program	1.1	1.1	5.9	EPA
ME-3(a)	Coalbed Methane Outreach Program	2.4	4.2	18.25	EPA, DOE
ME-5	Expand AgStar	1.0	2.0	6.5	EPA
				24.5	USDA
ME-6 - ME-8	Improve Ruminant Productivity and Product Marketing	1.0	2.6	63.25**	USDA
				4.5	EPA
ME-9	Expand Natural Gas Star	1.8	3.4	6.15	EPA
ME-12	RD&D for Methane Recovery from Coal Mining	1.0	3.0	10.0	DOE
ME-13	Enhanced Methane Generation from Landfills	0.5	2.0	3.5	DOE, EPA
ME-14	Use Low-Bleed Pneumatics in the Natural Gas System	1.0	2.0	Not estimated	DOE
ME-15	Improve Fertilizer Nitrogen Use Efficiency	0.8	2.3	***	USDA
ME-16	[Methane from Combustion - Accounting]	1.0**	5.0**		
ME-17	[N2O from Transportation - Accounting]	1.0**	5.0**		
TOTAL		15.2	27.2	142.55	

*** USDA costs and FTE to implement ME6-8 and ME15 will be shared.

** Rough estimates -- not yet included in total

JUL 19 1993

ME1

Option: Increase Stringency of Landfill Rule

1. Description: The landfill NSPS and Existing Source Guidelines, which requires control of landfill gas under Sections 111(b) and 111 (d) of the CAA, was proposed in May 1991. Promulgation of the final rule is expected this Fall. At proposal, a stringency level of 150 Mg NMOC was proposed. However, the supporting analysis has changed substantially since proposal. This options assumes that a 75 Mg rule is the base, and looks at the incremental impact of a 50 Mg rule.
2.

<u>Emission Reduction from Base</u>	2000	2010
MMTCE:	4.6	4.9
3.

<u>Compliance Cost</u>	\$30 million in incremental private compliance costs in 2000
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4.

<u>Federal Budget Cost</u>	No incremental costs
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5.

<u>Cost-Effectiveness</u>	2000	2010
	\$6.50/MTCE	not available
6. Interaction with Other Options The landfill outreach option is designed to capture emissions not captured by a 50 Mg rule. The outreach option will achieve greater reductions if a 75 Mg rule is promulgated, but not as much as the 50 Mg rule would guarantee.
7. Contact Cindy Jacobs, EPA (202) 233-9042; fax: 233-9569

Option: Landfill Outreach Program

1. Description: There are over 6,000 active landfills in the United States. The Landfill Rule being promulgated by EPA will affect only a fraction of these landfills. There are landfills not affected by the Rule that could profitably recover and utilize the methane they emit (in part because the Rule applies to NMOC emissions, which vary independently of methane emissions). These landfills have not installed energy recovery systems because they face a number of barriers, such as disincentives for utility purchases of landfill gas, artificially low prices, lack of information, regulatory constraints, and technological constraints. The outreach program will overcome the barriers to profitable landfill methane recovery at these landfills through coordination with landfill owners/operators, utilities, state regulators, and others.
2.

<u>Emission Reduction from Base</u>	2000	2010
MMTCE:	1.1	1.1
3. Compliance Cost: The cost of installing an energy recovery system ranges from about \$1.5 million to several million. However, only those landfills that could profitably recover their methane would take action as a result of the outreach program. Therefore, net compliance costs would be negative.
4. Federal Budget Cost

Agency	FTE	FY94	FY95	FY96	FY94-2000
EPA	4	\$250 K	\$650 K	\$850 K	\$5.9 m

5. Cost-Effectiveness Voluntary program - \$0/MTCe
6. Interaction with Other Options This option assumes that the option to increase the stringency of the landfill rule is in place and targets reductions in addition to those achieved with a more stringent rule. If a higher stringency is not promulgated, the outreach program will have the potential to achieve greater reductions, but not as great as the total reductions possible with the more stringent rule.
7. Contact Cindy Jacobs, EPA, (202) 233-9042, fax: 233-9569

JUL 19 1993

ME3(a)

Option: Coalbed Methane Outreach Program

1. Description: The outreach program would raise the awareness of the potential for cost-effective emissions reductions with key coal companies and state agencies. It would help to ensure that the Energy Policy Act provisions resolving coalbed methane ownership issues in the key states achieve the potential reductions in these states.
2. Emission Reduction from Base 2000 2010

MMTCE: 2.4 - 4.2 2.4 - 2.7
3. Compliance Cost Net compliance costs will be negative because only those mines that could profitably recover their methane would be affected by the outreach program.
4. Federal Budget Cost

Agency	FTE	FY94	FY95	FY96	FY94-2000
EPA	5	\$450 K	\$ 800 K	\$1.5 m	\$18.25 m
DOE					

5. Cost-Effectiveness Voluntary program - \$0/MTCe
6. Interaction with Other Options If the coalbed methane financial incentive and funding for the RD&D option are in place, the reductions possible with an outreach program may be greater.
7. Contact Dina Kruger, EPA, (202) 233-9039; fax: 233-9569

JUL 19 1993

ME3 (b)

Option: Coalbed Methane Financial Incentive

1. Description: The financial incentive would be modeled on the Section 29 tax credit and directed at methane from mines. It would provide a tax credit of \$0.75/mcf for methane from mines that would otherwise be vented.

There are two options for implementation: (a) restrict the credit only to methane from coal seams that are currently or will be mined, or (b) extend the credit to coal seams not likely to be mined. Option (a) provides the maximum avoided carbon emissions, while option (b) adds an important gas supply to U.S. energy resources.

2. Emission Reduction from Base

	2000	2010
MMTCE:	1.5 - 3.6	1.4 - 1.8
3. Compliance Cost N/A
4. Federal Budget Cost Less than \$100 m in 2000

Agency	FY94	FY95	FY96	FY94-2000
Commerce	not avail.	not avail.	not avail.	not avail.

5. Cost-Effectiveness N/A
6. Interaction with Other Options If the outreach and RD&D option for coalbed methane are funded, the amount of methane recovered will likely increase and use of the financial incentive would be greater. The most effective coalbed methane reduction strategy is implementation of all three options, which have synergistic effects.

Undoubtedly, the mines recovering their methane as a result of resolution of ownership issues, accounted for in the baseline, will use the tax credit if available. Therefore, the total methane recovered under the tax credit will likely be larger than given above. The approach used here avoids double counting the reductions anticipated in the baseline.

7. Contact Dina Kruger, EPA (202) 233-9039; fax: 233-9569

Option: Expand AgStar, Voluntary Program with Dairy and Swine Producers

1. Description: AgStar is a voluntary pollution prevention program with the livestock industry. The AgStar program will encourage dairy and swine facilities to adopt animal manure best management practices that can help farmers profitably manage their animal manure, protect surface and groundwater, and reduce fertilizer costs. The AgStar program is designed to overcome a number of barriers which currently hinder the more widespread use of on-farm energy recovery technologies.

Under the program, producers commit to survey their facilities to identify profitable options for capture and use of methane for on-farm power usage. Producers install most profitable option within a specified time period. The program will be launched in late Summer 1993. With current staff and funding, the program is expected to achieve 0.5 to 1.0 MMTCE reductions by 2000. This option is for an expansion of the AgStar program to achieve 50% of total emissions that can be profitably recovered.

2. Emission Reduction from Base

	2000	2010
MMTCE:	1.0 - 2.0	1.3 - 2.2

3. Compliance Cost AgStar encourages recovery and use of methane only where it is profitable to do so. There will be initial costs to install the recovery equipment, but net compliance costs will be negative.

4. Federal Budget Cost

Agency	FTE	FY94	FY95	FY96	FY94-2000
EPA	5	\$250 K	\$500 K	\$700 K	\$6.5 m
USDA	35	\$2.0 m	\$2.5 m	\$3.0 m	\$24.5 m

5. Cost-Effectiveness Voluntary program - \$0/MTCe
6. Interaction with Other Options Implementation of the best management practices under AgStar will have the added benefit of reducing run-off of nutrients and BOD loading to surface water. This may lead to a reduction of N₂O emissions that would otherwise result from denitrification of animal waste.
7. Contact EPA: Kurt Roos, (202) 233-9041, fax: 233-9569
USDA: Dennis Child, (301) 504-5896; fax: 504-6231

Option: Improve Ruminant Productivity and Product Marketing**1. Description:**

Dairy and beef cattle are responsible for over 5 Tg (> 30 MMTCE) of methane emissions per year. There are six main options for reducing these emissions through improved management at the farm level. These options are as follows: 1) improved nutrition through mechanical and chemical feed processing, 2) improved nutrition through strategic supplementation, 3) production enhancing agents, 4) improved production through improved genetic characteristics, 5) improved production efficiency through improved reproduction, and 6) controlling disease.

The marketing portion of the option would provide information so that market incentives lead to a reduction in the accretion of excess trimmable fat. The industry estimates that each year over two billion pounds of excess fat is produced, trimmed off, and discarded. This production of fat incurs a methane cost of 0.11 Tg (0.66 MMTCE). Incentives to reduce excess fat production in addition to other incentives for the production of specialized products will result in an increase in the portion of calves that move directly from the cow-calf producers into other grazing systems not dependent on high energy feeds. To accelerate this process, the existing beef grading system could be used by packers and retail beef industry to further discount fatty carcasses.

2. Emission Reduction from Base 2000 2010
- MMTCE: 1.0 - 2.6 1.0 - 3.0
3. Compliance Cost N/A
4. Federal Budget Cost

Agency	FTE	FY94	FY95	FY96	FY94-2000
EPA	4	\$215 K	\$400 K	\$500 K	\$4.5 m
USDA ***	65	\$8.25 m	\$8.5 m	\$8.75 m	\$63.25 m

5. Cost-Effectiveness N/A
6. Interaction with Other Options Was previously two separate options, one for improving productivity and one for redirecting marketing.
7. Contact USDA: Dennis Child (301) 504-5896; fax: 504-6231
 EPA: Mark Orlic (202) 233-9043; fax: 233-9569

*** These FTE and budget figures are shared with option ME-15, "Improve Fertilizer Nitrogen Use Efficiency. They represent 1.25 FTE in each state to carry out programs.

JUL 19 1993

ME9

Option: Expand Natural Gas Star

1. Description: Natural Gas STAR is a public/private partnership that prevents methane emissions by introducing and promoting cost-effective technologies and practices throughout the U.S. natural gas industry. The program was launched in early 1993. This option is for expansion of Natural Gas STAR and anticipates reduction of an additional 13% of methane emissions from the natural gas industry.
2.

<u>Emission Reduction from Base</u>	2000	2010
MMTCE:	1.8 - 3.4	2.1 - 4.1
3. Compliance Cost Minimal costs associated with surveying facilities, preparing implementation plans. The up-front cost to implement best management practices (BMPs) ranges widely across technologies and companies. In most cases, implementing these BMPs are ultimately profitable to the Gas Star partner, with an internal rate of return of 5 to 250%.
4. Federal Budget Cost

Agency	FTE	FY94	FY95	FY96	FY94-2000
EPA	3	\$300 K	\$500 K	\$750 K	\$6.15 m

5. Cost-Effectiveness Voluntary - \$0/MTCe
6. Interaction with Other Options
7. Contact Bruce Craig, EPA (202) 233-9044; fax: 233-9569

JUL 19 1993

ME-12 07/14/93

RD&D for Methane Recovery from Coal Mining

1. **DESCRIPTION:** Fund provisions of Sec. 1306 of The Energy Policy Act of 1992 for three-part program: 1) Studies of barriers and environmental and safety aspects of utilizing coalbed and coal mining methane [Sec. 1306(a)], 2) Commercial demonstration and application of technologies for enrichment and utilization of coal bed and coal mine methane [Sec. 1306(c)], and 3) Information dissemination with regard to recovery and utilization of methane from coal mining. [Sec. 1306(b)]. Underground coal mining operations would use an integrated plan of coal bed pre-degasification, gob gas or seam gas recovery, and utilization of ventilation air to generate electricity or enrich methane to pipeline quality.

	Low implementation Case	High Implementation Case
2. EMISSIONS		
REDUCTIONS: [Methane]		
by 2000	1-3 MMTCE/yr	N/A.
by 2010	4-6 MMTCE/yr.	N/A
3. COMPLIANCE COST		
Zero cost assuming that sales of electricity from recovered methane will repay additional investment beyond that required to meet mine safety requirements.	\$ 0	\$ 0
4. FEDERAL BUDGET		
COST [DOE]	\$2.5 million/yr for 4 fiscal years.	N/A
5. COST		
EFFECTIVENESS: Very high	2000: less than \$1/ton carbon equivalent 2010: less than \$0.50/ton carbon equivalent	N/A

6. **INTERACTION WITH OTHER OPTIONS.** RD&D will be synergistic with proposed Outreach program and Financial Incentives for methane recovery, but total emission reductions may overlap somewhat.

7. **STAFF CONTACTS:** Richard Ball, DOE
Phone (202) 586-5278 Fax (202) 586-2062

ME-13

ME-13 07/14/93

JUL 19 1993

Enhanced CH₄ Generation and Recovery From Landfills

	Low implementation Case--Level 1	High Implementation Case--Level 2
1. DESCRIPTION. A two level, multi-faceted program is proposed. Program will facilitate design of landfills to maximize generation of methane, recover methane as pipeline gas or electricity, and reduce volumes of landfills.	a) Fund a small scale demonstration of leachate recirculation to enhance methane generation at an existing landfill site, and b) Create by Federal executive order a joint State/Federal coordination program to facilitate siting/permitting of enhanced recovery landfills.	c) Expand RD&D and establish technical assistance to optimize, demonstrate, and support implementation of the technology and establish environmental performance; and d) Modify or develop environmental performance standards and regulatory requirements to promote and remove barriers to enhanced recovery technology in landfills.
2. EMISSIONS REDUCTIONS: [CH ₄ +CO ₂]		
by 2000	0.5 MMTCE/yr.	2 MMTCE/yr.
by 2010	2 MMTCE/yr.	5 to 9 MMTCE/yr
3. COMPLIANCE COST		
Zero cost assuming that sales of electricity from recovered methane will repay additional investment beyond that required to control NMOC emissions.	\$ 0	\$ 0
4. FEDERAL BUDGET COST [DOE & EPA]	\$400K/yr for 4 fiscal years	\$1 M/yr for 5 fiscal years
5. COST EFFECTIVENESS: Very high for amortized Federal program costs.	2000 (less than \$1/ton carbon equivalent) 2010 (less than \$0.50/ton carbon equivalent)	2000 (less than \$0.50/ton carbon equivalent) 2010 (less than \$0.20/ton carbon equivalent)
6. INTERACTION WITH OTHER OPTIONS. RD&D and regulatory reform will be synergistic with increased stringency of landfill NMOC regulation and technical outreach options.		
7. STAFF CONTACTS:	William Breed, DOE Phone (202) 586-4763 Fax (202) 586-2062	

ME-14

ME-14 07/14/93

JUL 19 1993

Use low-bleed pneumatics in the natural gas system

	Low implementation Case	High Implementation Case
1. <u>DESCRIPTION.</u> This option can be implemented at two levels. Either would increase the rate of and extent of emission reductions and conservation of an energy resource, accelerating this aspect of the Natural Gas STAR program.	1) Establish a (voluntary) performance standard for valves. When the pneumatics are replaced at the end of a normal lifetime, the replacement is certified to be a low emitter.	2) Mandate replacement of high-emission rate pneumatics at all sites in the US natural gas system by 1998.
2. <u>EMISSION REDUCTIONS.</u> Savings include natural gas that otherwise would have leaked to the atmosphere.	Methane 1 to 2 MMTCE by 2000. 0 MMTCE by 2010.	Methane 3 to 7 MMTCE by 2000. 0 MMTCE by 2010.
3. <u>COMPLIANCE COST.</u> Valves normally replaced after 7 years; low-emitting valves are no more expensive.	Very low (additional investment in valves is negligible)	Low (value of recovered methane will partially repay any early replacement of valves)
4. <u>FEDERAL BUDGET COSTS:</u>	Negligible (Participate in industry certification of valve performance)	\$300K/yr. (Federal inspection and enforcement of regulations.)
5. <u>COST EFFECTIVENESS:</u>	Very High	High
6. <u>INTERACTION WITH OTHER OPTIONS.</u> Extends and accelerates actions in Natural Gas Star program; additional reductions from this option will tend to disappear by 2010.		
7. <u>STAFF CONTACTS:</u>	William Breed, DOE Phone (202) 586-4763 Fax (202) 586-2062	

ME 15

JUL 19 1993

Option: Improve Fertilizer Nitrogen Use Efficiency**(1) Description of option at each level of implementation:**

Spatial and temporal distribution of N₂O and NO_x exchanges between the soil and the atmosphere are highly variable. Uncertainties surrounding the mechanisms that control these exchanges severely limit our capability to predict biosphere-atmosphere interactions. Development of trace gas exchange models, driven by observable variables is imperative. Bacterial processes dominate both nitrification and denitrification processes that contribute to emissions of agricultural N₂O and NO_x. Integration of the effects of temperature, nitrogen and oxygen availability, and other controlling parameters into a useful model(s) will encourage acquisition of required data sets and the information necessary to develop improved management practices.

(2) Emissions reduction from base.

Small (10%)	0.77 Tg in 2000
Medium (20%)	1.54 Tg in 2000
Large (30%)	2.31 Tg in 2000

(3) Compliance cost:

None

(4) Federal budget cost:

Preliminary cost estimates. Public costs would be negligible, modifications of fertilizer and soil management systems are currently evolving, but without knowing their effectiveness. Minimal support for research and educational materials could accelerate the process. \$2 million/year for 3 years.

(5) Cost-effectiveness:

Changes will be profitable to the producers.

(6) Interaction with other options:

JUL 19 1993

ME-16

ME-16 07/15/93

METHANE REDUCTIONS FROM RESIDENTIAL COMBUSTION ACTIONS

[**Note: This is an accounting tool to account for methane reductions that may come from other policy actions for the mitigation plan. The actions accounted for here have no new net cost, having been accounted for in the originating WG.]

1. **DESCRIPTION:** This paper will account for actions by other groups that also achieve methane reductions. Implementation is as in the original WG paper. Methane from stationary sources primarily are emitted from combustion of wood and other biomass fuels. Measures that decrease wood use or increase combustion efficiency will result in decreased methane emissions.

	Low implementation Case	High Implementation Case
2. EMISSIONS REDUCTIONS: [Methane]		
	10-25% reduction [Illustrative ranges only; depends on adoption of options from supply and demand work groups]	40-60% reduction [Illustrative ranges only; depends on adoption of options from supply and demand work groups]
by 2000	1 - 2 MMTCE	3 - 5 MMTCE in 2000.
by 2010	1 - 2 MMTCE	3 - 5 MMTCE in 2010
3. COMPLIANCE COST No additional cost to achieve methane reductions beyond original option.	\$ 0	\$ 0
4. FEDERAL BUDGET COST	\$0K.	\$0K
5. COST EFFECTIVENESS: Increases cost effectiveness of original options.	\$0K/MMTCE	\$0K/MMTCE

6. **INTERACTION WITH OTHER OPTIONS.** This paper relies on and accounts for reductions in methane emissions from options involving residential combustion of biomass, such as high efficiency stoves. Actual computations will be carried out with IAT based on other working group options.

7. **STAFF CONTACTS:**

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ME-17

JUL 19 1993

ME-17 07/15/93

NITROUS OXIDES REDUCTIONS FROM TRANSPORTATION ACTIONS

[**Note: This option is purely an accounting tool to account for methane reductions that may come from other policy actions for the mitigation plan. The actions accounted for here have no new net cost, having been accounted for in the originating WG.]

1. Description: Nitrous Oxide is formed by chemical reaction in the catalytic converter between NOx and atmospheric nitrogen. Newer vehicles create less N₂O. Therefore, options from Personal Transport Vehicles WG #s 9, 17, 18, plus any retirement, I&M (e.g., AT11) or similar options from the transportation working group will reduce N₂O. Retirement or improved I&M programs for extant vehicle population will have greatest impact by 2000, any option directed toward new vehicles will have little impact.

	Low implementation Case	High Implementation Case
2. <u>EMISSIONS REDUCTIONS</u> : [Nitrous Oxide (N ₂ O)]		
by 2000	10-25% reduction [Illustrative ranges only; depends on adoption of options from supply and demand work groups] 1 - 2 MMTCE	40-60% reduction [Illustrative ranges only; depends on adoption of options from supply and demand work groups] 3 - 5 MMTCE in 2000.
by 2010	1 - 2 MMTCE	3 - 5 MMTCE in 2010
3. <u>COMPLIANCE COST</u> No additional cost to achieve methane reductions.	\$ 0	\$ 0
4. <u>FEDERAL BUDGET COST</u>	\$0K.	\$0K
5. <u>COST EFFECTIVENESS</u> : Increases cost effectiveness of original options.	\$0K/MMTCE	\$0K/MMTCE

6. INTERACTION WITH OTHER OPTIONS. This option relies on implementation of Personal transport vehicle options #s 9, 17, 18; and any similar options in the transport area that reduce NOx emissions, retire older vehicles, or reduce vehicle use. Actual computations will be carried out with IAT based on other working group options.

7. STAFF CONTACTS: William Breed, DOE
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TITLE: Conservation Practice

DESCRIPTION: There is a long-term trend toward adoption of conservation practices among US farmers. This has been aided by the cross-compliance provisions in the 1985 and 1990 farm bills which require farmers that have highly erodible land enrolled in farm programs to apply an approved soil conservation system whenever it is planted to a crop. The use of conservation tillage in the US is projected by some to increase from the current level of 27% of total cropland to somewhere between 57% and 76% in 2030.

Conservation practices include conservation tillage, which leaves a large portion of the previous crop's residues on the soil surface, increasing the amount of organic carbon in agricultural soils. Another practice is winter cover cropping, which provides carbon benefits by incorporating additional crop biomass into the soil. Both types of practices reduce soil erosion.

IMPLEMENTATION: Farmers participating in the commodity support programs are subject to the cross-compliance provisions of the 1990 Food, Agriculture, Conservation and Trade Act. These provisions apply to highly erodible land. Cross compliance could be extended to all farm program land. In order to accelerate and extend adoption of conservation practices, Agricultural Conservation Program (ACP) provides cost share for conservation practices; this funding could be increased. States currently have tax incentives for the purchase of conservation tillage equipment. The federal government could also provide tax writeoffs for conservation investments. The federal government could provide capital gains tax breaks for capital improvements to cropland that have positive environmental effects.

GHG REDUCTION: In order to determine the effect that this may have on soil organic carbon (SOC) over time, one needs to look at the expected expansion of conservation tillage practice over tilled acres, the current levels of SOC, and expected increase in SOC over time. The EPA study "The Impact of Conservation Tillage Use on Soil and Atmospheric Carbon in the Contiguous United States" takes this approach. A conservative estimate of the total SOC benefit to the year 2000 would be in the range 1-3 MMTC/y and for 2010, 2-4 MMTC/y. There is also reduced fossil fuel carbon emissions due to fewer tillage operations.

COST: It costs to plant winter cover crops and to plow them under in the spring, and prepare seed beds. Conservation tillage systems require more skilled management and investments in farm equipment. An analysis by Iowa State University researchers show costs of \$13 -\$22 per acre.

If USDA/ASCS were to require enhanced conservation and include a cost share, USDA/SCS would have to develop standards and specs for the practices and disseminate it to the field (i.e., train farmers). This requires staff and administrative time, plus outlays for the cost share.

Tax incentives for the adoption of conservation tillage would result in some decreases in revenues.

COST EFFECTIVENESS: Carbon sequestration is one of the benefits of conservation tillage, but the largest benefit is in reducing soil erosion, one of the most damaging environmental problems in the U.S. Conservation tillage helps to maintain soil tilth and quality, reduces nutrient runoff into waterways, and reduces sedimentation in waterways and dams. In addition to the carbon sequestration benefit is the reduction in fossil fuel use due to the reduced number of farm operations.

Investments in conservation practices will accrue relatively small carbon benefits, but there may be other environmental reasons for proceeding. The carbon benefits should be claimed.

Carbon benefits from conservation tillage appear to be limited to middle and southern latitudes. Federal law (Farm Bill) is not usually limited to specific parts of the country.

AFFECTED STAKEHOLDERS: USDA/SCS, ASCS, and farmers would be affected. Farmers may object to more stringent controls, but react favorably to tax incentives.

STATUS OF ANALYSIS:

TITLE: Wetland Reserve Program

DESCRIPTION: WRP was designed to restore cropped wetlands to their natural state through the USG purchase of long-term easements on the land. The program was authorized for 1 million acres. WRP has finished a pilot signup of 50,000 acres in 9 states. There was a high level of interest in the program. Sixty percent of the land, or 30,000 acres, will be forested. Benefits in addition to carbon storage include habitat restoration for diverse biological species, water quality benefits, and flood control.

IMPLEMENTATION: USDA's authorization is the 1990 Food, Agriculture, Conservation and Trade Act.

GHG REDUCTION:

Reforest alluvial wetlands through WRP, 5 million acres

By 2000, 3–5 MMT C/y sequestered

By 2010, 9–11 MMT C/y sequestered

COST: Total cost of the wetlands program is estimated to be \$2.22.4 billion for easements, restoration and establishment (McCarl & Calloway, 1993; Bouzaher et al., 1993). These analyses all assume harvesting is permitted as trees become merchantable. The recent WRP signup averaged \$742/acre for perpetual easements. SCS believes that in subsequent signups easement costs will decline. For bottom wetlands, costs of planting could be minimal since trees will just move in.

COST EFFECTIVENESS: Cost would be \$7–9/MT.

AFFECTED STAKEHOLDERS: Due to concerns for wetlands and water quality, many wetlands may soon be removed from cropping.

ENERGY DEMAND/COMMERCIAL WORKGROUP OPTION:

Expand Cool Communities Program in Cities and Federal Facilities

7/19/93

Description: Building-scale studies have demonstrated that strategic landscaping to shade residential and commercial buildings can reduce energy use and yield cost savings of 10-35%, when combined with lightening building surface colors to reduce absorption of sunlight. The pilot Cool Communities program was founded by EPA and American Forests in 1991 to mobilize community and corporate resources to plant trees strategically around buildings. Other cooperators include DOE's Lawrence Berkeley Laboratories (LBL), DoD, USDA-Forest Service, and DOE. Seven cities and one Air Force base (in a parallel EPA effort) have signed MOUs with EPA. Electric utilities and corporations have committed to supply trees and monitor benefits. DoD is interested in expanding to 2-4 new bases this year. EPA is evaluating the potential to expand the program to 50 cities. Expansion to DoD's 940 military bases and 1.8 billion sq. ft. of building space and other federal facilities is promising, and could be tied to the Administration's Technology for America's Growth initiative. The program is voluntary, with technical assistance. Executive or administrative orders could implement the program on federal facilities.

Low Implementation: This option proposes to expand the existing public/private Cool Communities demonstration program of EPA and American Forests to 50 cities, and to DoD bases and other federal facilities.

High Implementation: This option proposes to expand the Cool Communities concept nationally through a concerted outreach and education effort similar to the voluntary Green Programs campaign.

GHG Reduction Benefits: The full market penetration potential of this option was estimated to be 10 MT-C/y, possible by fully implementing a national program (LBL analysis in NAS, 1990). However, this may overestimate the potential.

Low Implementation: EPA's preliminary estimate for a 50 city Cool Communities city, DoD and federal facility program is roughly 0.1 MT-C/y in 2000.

High Implementation: Expanding the Cool Communities concept nationally could realize 0.9 MT-C/y through carbon sequestration and energy savings by 2000.

Compliance Costs: Because Cool Communities is a voluntary program, it does not have compliance costs.

Program Costs: Cool Communities builds on voluntary efforts, but requires funding for technical assistance, administration, information transfer, and actions taken on military bases and federal facilities.

Low Implementation: Fully funding a 50 city outreach program will require an average of \$800 K per year for 5 years. (\$4 million total)

High Implementation: The outreach and education effort required to implement a national Cool Communities program will require an average of \$2.5 M per year over 10 years. (\$25 M total). Implementing Cool Communities concepts on federal facilities will be more expensive, because the federal government will incur all implementation costs. However, energy savings will offset these costs. A recent DoD/EPA analysis of opportunities on military bases indicated an average pay-back period of 2-4 years for strategic tree planting investments.

Cost Effectiveness: The estimated cost to the government of the low implementation option averages \$8/tonne C, and the high implementation option average \$0.83/tonne C. Government costs reflect only a portion of overall costs. Federal funds will be heavily leveraged with as much as 80% (?) of the implementation costs coming from private homeowners, municipalities, and utilities. These estimates are preliminary. Cool Communities will have other benefits including: energy savings, air quality improvements, reducing stormwater runoff, increasing property values, providing shading, reducing noise, and enhancing aesthetics.

Interaction With Other Options: This option is a potential demand-side management strategy, it also will enhance the quality of the urban landscape and directly sequester carbon, and should be considered with other forestry options.

TITLE: Take Credit for Decisions to Reduce Timber Harvests on National Forest Land

DESCRIPTION: Annual timber sales volumes for National Forests averaged 10-11 billion board feet through the 1980's. Beginning in 1990, the timber sales program began a decline which is continuing and may amount to 5-6 billion board feet. More and more area on National Forests is being restricted from timber harvest to protect habitat for threatened and endangered species and for protection of other values. These actions will have as an effect the sequestration of carbon. This option assumes that harvest on National Forests declines to the volume in the FY 1994 President's budget and stays at that level--4.6 billion board feet as compared with 10.5 billion board feet in 1989. Until the details of President Clinton's Forest Plan have been finalized, it is not possible to tell how this action might change GHG fluxes.

EMISSIONS REDUCTION FROM BASE:

MMT-C/Y

-in 2000--18-36

-in 2010--27-41

The gain shown from a reduction in timber harvest on National Forest lands includes consideration of harvest response on private lands in the United States: It is the net gain for the United States. The estimate does not consider effects on harvest in Canada and other countries. Higher prices for timber products may increase the use of plastics, metals, and wood-based substitutes that generally require higher energy use in their manufacture. However, it is not now possible to estimate the GHG fluxes resulting from that event.

COMPLIANCE COST: Not applicable

FEDERAL BUDGET COST: There will be no additional cost to the Federal government for any net gain in carbon sequestration--The action has been taken for other reasons.

COST-EFFECTIVENESS: The option is very cost effective. In addition, there are other benefits from these actions including protection of habitat for threatened and endangered species, biodiversity, watershed values, and recreation.

INTERACTIONS WITH OTHER OPTIONS: The reduction in harvest on National Forests is already occurring for reasons other than carbon sequestration. There may be some offset of carbon sequestration through increased harvest in Canada and other countries. In addition, tree planting under the tree planting option could lower prices or at least the rate of increase in timber prices and thus offset any trend to more energy-intensive product substitutes otherwise caused by decreasing National Forest harvest. There could be additional carbon benefits associated with such a change in the national product mix. Increased tree planting could also provide jobs in the short term.

AFFECTED STAKEHOLDERS: Reducing National Forest harvests will have local and regional impacts on timber-dependent communities. It will be disruptive to thousands of people with jobs dependent on National Forest timber harvest. However, the reduction in harvest creates opportunities for owners of private timberland and may create opportunities for recreational and other uses of National Forests. More lumber will be imported from Canada and increase the balance of payments deficit by some \$4 billion. Consumer surplus is reduced 2-3%, producer surplus is reduced approximately 2%, and stumpage producer surplus increases approximately 25% by 2010. Employment in the forest products sector declines around 1-2%. These and other stakeholders will be so affected without regard to considerations of carbon sequestration, however.

TITLE: Improved Management and Harvesting Practices on Nonindustrial Private Timberlands

DESCRIPTION: Currently, 42 million acres (16 percent) of the Nation's nonindustrial private timberlands are in poor condition due, primarily, to overharvesting, which has left these timberlands in a depleted condition (USDA FS 1990). It is estimated also that overharvesting is occurring on an additional 480,000 acres each year. These findings are, of course, significant with respect to the Nation's timber supply. These understocked forested acres are also storing carbon at rates well below their potential.

This proposal has three program components. The first is designed to reduce the incidence of overharvesting that results in depleted stands; the second addresses opportunities to increase carbon sequestration through the restoration of already depleted stands; and the third considers what can be done through timber stand improvement (TSI) practices in still other existing forest stands.

IMPLEMENTATION:

I. Reduction in Stand Depletion

Goal: Reduce forest depletion caused by poor cutting practices by 75 percent--360,000 acres per year--within five years.

USDA would provide: No cost (free) timber evaluations by public and private (consultants) foresters to interested nonindustrial private forest land owners who are considering harvesting timber.

Timber Evaluation: A written plan prepared for the owners that describes the timber stand (tree species composition, age, stocking, growth rate, approximate current merchantable volume and value) and specific recommendations on management options for the next 10 years. If the recommendation is to harvest timber, a harvest prescription would be prepared that would ensure adequate stocking and protection of residual stand and/or regeneration of the stand by natural or artificial means.

Delivery system: USDA Forest Service-State Foresters

GHG REDUCTION: In the without program alternative, overharvesting on nonindustrial private lands often occurs because all trees of merchantable size and value are harvested. This includes not only mature trees of sawtimber size, but also younger fast-growing trees that have just entered the lower end of the sawtimber class, which should be left as crop trees for future harvests.

Trees harvested prematurely do add to the storage of carbon in durable forest products, but not to the extent that they would if they were harvested at mature size. The major loss of carbon results from the loss of net growth of ecosystem carbon due to under-utilization of the growth capacity of the land, an effect that can last for decades.

At the proposed level of 360,000 acres per year, this option could prevent the loss of an estimated 7-9 million metric tons of carbon for each year the program is operational.

COSTS:

USDA cost: \$5 per acre for timber evaluations. This is the current cost for 10-year multi-resource property plans in the Forest Stewardship Program.

Federal cost per metric ton of carbon: \$0.20 to \$0.26. (This is a tentative estimate and a more detailed and fully documented estimate can be prepared. It is clear that this is a low-cost option even with a considerable variation in assumptions due to the low costs involved.)

Private cost: The landowner would be responsible for all costs of actually preparing and conducting any timber sales. Most states currently do refer requests for timber harvesting assistance to consulting foresters.

Various studies, such as those reported by Moulton and Cubbage (1990), have indicated that when foresters assist landowners with timber sales the results are that higher prices--up to 65 percent--are received for the timber, even though less timber is harvested, and the residual stands are left in much condition for future timber harvests.

This program component has an additional advantage: When final timber harvests and regeneration planning are coordinated, reforestation costs can often be greatly reduced as site preparation costs are frequently much lower and planned natural regeneration may be a viable option.

II. Recovery of Existing Abused and Depleted Stands

DESCRIPTION: In some cases, stands have been depleted beyond the point where recovery by working with the existing stand is impractical, and there is little alternative but to start over. That approach is discussed in the proposal, Accelerated Tree Planting on Nonindustrial Private Lands.

Moulton and Richards (1990) have identified depleted forest lands that will recover over time if the abuse, such as overgrazing by livestock or excessive timber cutting, does not again occur as soon as the trees achieve minimum levels of stocking.

COSTS: The federal cost of this program component is estimated at \$0.60 to \$1.60 per metric ton of carbon, depending on stand conditions and the geographic area in which the stand is located. A more detailed analysis of this option can be developed.

III. Timber Stand Improvement (TSI)

DESCRIPTION: Timber stand improvement is the application of various silvicultural practices to increase the quantity, and especially the value, of commercial timber products in existing forest stands by concentrating the growth potential of the land into selected "crop" trees. Timber stand improvement techniques can also be used for other purposes, such as enhancing wildlife habitat by favoring mast producing trees and shrubs, and large trees for dens, nests and roosts for various birds and mammals.

The development of TSI practices to enhance the sequestration of carbon warrants further research. There is, however, sufficient understanding of TSI practices and the underlying parameters to support current recommendations for practices that will increase carbon sequestration.

Control of undesired or less-desired competing vegetation is a mainline TSI practice. The idea here is to concentrate growth on trees of preferred species and form. Hence, a hickory tree may be eliminated to favor a black walnut. Trees with forked and crooked stems are removed to favor trees with single, straight, cylindrical boles. From a carbon point of view, however, the trees removed may have sequestered as much carbon as those that remain, omote

the growth of lower-valued wood products, such as pulpwood. Rather, TSI is used to produce high-valued sawtimber, veneer logs and poles. These products are grown on comparatively long rotations and accumulate high levels of stored carbon. These high valued products also have a high rate of conversion to durable forest products.

Two other TSI practices have the potential to store additional carbon as compared to unmanaged stands: (1) matching the species to the site for higher growth rates, and (2) eliminating deteriorating cull trees, allowing

the growing space they occupy to be filled with younger, faster growing trees.

COSTS:

Federal Cost: TSI practices with 65 percent federal cost sharing, under the Forestry Incentive Program have averaged \$26 per acre with a range of \$14 to \$38 per acre. Costs from Moulton and Richards (1990), adapted to this proposal, yield federal carbon costs of \$2 to \$5.25 per metric ton of carbon.

Delivery system: USDA Forest Service-State Foresters

A more detailed analysis of this option can be provided. The potential is large, as USDA FS data show a current inventory of 24 million acres that would provide economic returns of at least 4 percent from timber stand improvement practices.

TITLE: Stimulate Tree Planting to Sequester Carbon

DESCRIPTION: Five existing USDA programs are fostering increased tree planting: Conservation Reserve Program (CRP), Stewardship Incentives Program (SIP), Agricultural Conservation Program (ACP), the U.S. Tree Planting Initiative (TPI), and Wetland Reserve Program (WRP). Tree planting in addition to these programs would increase carbon storage at a relatively low cost. Several approaches are possible.

CRP participants are required to idle enrolled cropland acres for a minimum of 10 years in return for annual rental payments, and 50% cost-share for planting grasses or trees. Eighty-five to 95% of enrolled tree acres may be expected to remain in trees after rental payments end at the end of the 10-year program period. A program of this type could also be designed to enroll pasturelands.

The Clinton administration's TPI includes provisions for afforestation and reforestation. TPI, also called Trees for the Future, is the successor to the Bush administration's America the Beautiful Program (ATB), and has been proposed at funding of \$243 million over a 4-year period. TPI offers a 50% cost-share for tree planting, but no rental payments. [The current US National Action Plan includes 1.2 MMT-C/y in 2000 and 18.1 MMT-C/y in 2010 as a result of proposed tree planting activities.]

IMPLEMENTATION: USDA's authorization is the 1990 Food, Agriculture, Conservation and Trade Act (Title XIV-Conservation and Title XII-State and Private Forestry).

The government could stimulate tree planting by sharing with private landowners the costs of establishing plantations on marginal crop and pasture land and would rent the land for ten years, or take a long-term easement. The funding could be recycled from energy tax revenues, or redirected from farm commodity subsidies. Alternatively, tree planting could be financed by emitters of CO₂ through a "carbon offset" or similar regulatory program. Programs which stimulate tree planting on private lands can sequester carbon at relatively low costs per ton, offsetting some carbon dioxide emissions from energy and other sources.

The timing and level of sequestration depends heavily on the program design. If stimulated through a carbon offset program, profit-maximizing landowners may wait to accept offers to plant trees until prices per ton of carbon sequestered rise to the expected maximum levels, most likely beyond the year 2000. Federally funded programs would result in more certain timing of planting and sequestration, but could result in lower net social benefit, depending on the level and timing of greenhouse gas reductions required, on the availability and

costs of alternative reduction options, and on the likely efficiency of carbon offset markets, such as the ability of landowners to predict future prices for carbon offsets. Significant increases in the amount of carbon sequestered, perhaps as much as 10-15% of U.S. carbon emissions, could be achieved with a large program.

Because of tree growth patterns, the greatest carbon sequestration for a program begun in 1995 occurs in the decades after 2000. The tree planting program proposed here gives the program options, acres enrolled/proposed, the resulting carbon benefits, and budget requirements. These estimates assume programs beginning in 1994.

GHG REDUCTION:

COST: The cost of planting is about \$100/acre for afforestation and \$367/acre for reforestation, including the cost of preparation. Survivability is good, about 90%, with little maintenance.

Preventing harvest raises the cost of sequestering carbon, as landowners must have additional incentives to maintain the forests if they are not able to expect harvest income in the future. Preventing harvest also increases the carbon benefits associated with each option, and also prevents large losses to stumpage growers associated with the decreases in price experienced when supply of available wood increases. These impacts are not felt until the years past 2010 when planted trees reach merchantable size. Developing alternative markets, such as biofuels, would moderate the effects felt by stumpage producers if harvests are allowed.

In the short run, consumer, producer, and stumpage producer welfare in the forest sector are affected little by large-scale tree planting. As new timber becomes merchantable in the years after 2010, however, consumer welfare and producer surplus would rise. Agricultural producer and consumer welfare is affected negligibly by tree planting programs of this size. Employment in the forest products sector stays relatively constant in the years leading up to 2010, although tree planting will create new jobs. In the out years, jobs in the supply of timber substantially is likely to depress stumpage prices. The magnitude of the decreases depends on the size program and the response of landowners to the economic signals. Additional subsidies or rental payments could be required to stabilize timber prices. Alternatively, expanding traditional uses and developing new uses such as biofuels could help the market handle the extra timber.

COST EFFECTIVENESS: Analyses show that the marginal cost of a tree planting program is small compared with other options. Costs rise with the increasing size of the program. In the ranges considered here, costs are less than \$15/MT although they may be double that or more if constraints are placed on harvests. More specific analyses will be forthcoming.

AFFECTED STAKEHOLDERS: Tree planting programs are popular with the public. In addition, they help remove erodible or sensitive lands from cultivation. The storage of carbon is a bonus.

Two to 3 million acres of trees are normally planted by the private sector each year. The program must be designed so that it does not discourage private investment.

Removing land from economic activities such as farming has negative impacts on local economies. That is, farmers are not purchasing farm inputs (fertilizers, herbicides, seed) or services (custom harvesting, etc.) from local businesses for the set-asides. CRP has been criticized from this standpoint. The negative impact on rural communities must be offset.

ACCELERATED TREE PLANTING ON NONINDUSTRIAL PRIVATE LANDS

Description

In 1992, 2.5 million acres of trees were planted in the United States. Under this proposal, tree planting would be increased to 5 million acres per year over the next five years and then maintained at that level for the next five years. This analysis could readily be extended to maintain tree planting at the expanded level until desired climate change mitigation objectives are achieved.

Based on the pattern of accelerated tree planting under the Soil Bank and the Conservation Reserve Program, it is anticipated that the first increment of 2.5 million acres of tree planting above the current level could be achieved in 5 years according to the following schedule:

<u>Year</u>	<u>Additional Acres of Planting</u>
1	250,000
2	500,000
3	1,000,000
4	2,000,000
5 through year 10	2,500,000

This schedule reflects that 10 percent of the additional acreage would be planted in the first year, 20 percent in the second year, 40 percent in the third year, 80 percent in the fourth year, and 100 percent (2.5 million acres) in the fifth and for five years thereafter. This phase-in is fast but achievable. Over the entire ten year program a total of 18.75 million additional acres would be planted.

In 1988, a record high number of 3.4 million acres of trees were planted in the U.S. using 2.3 billion seedlings. That level of tree planting, which was prompted by high levels of tree planting under the Conservation Reserve Program, stressed the production capacities of tree nurseries, especially in the South, where many went to fence-to-fence seedling production and temporarily suspended good nursery practices, such as rotation (resting, fumigation and enhancement) of seedling beds. Shortages of seedlings did occur in some areas of the country. Under the proposed schedule, the 3.4 million acre level would not be reached until the third year (2.5 million acre base plus 1 million increase), allowing for the orderly expansion of nursery production and other required program infrastructure, including the expansion of foresters (public and private) to provide on-the-ground technical assistance to private landowners.

Components of Tree Planting Program

I. Tree Planting on Forest Land and Idled (Inactive) Agricultural Land

Moulton (USFS) and Richards (PNL)

Goal: Increase to one million acres annually in five years. This is an increase of about 700,000 acres over current program levels.

USDA would provide: Technical assistance and up to 75 percent cost sharing for tree planting, including necessary site preparation. There would be no rental payments for this program component.

Contract period: Participants would be required to protect and maintain the planting for a period of 10 years. This is standard for all current USDA forestry cost share programs.

Delivery system: USDA Forest Service-State Foresters

Federal cost: See attached table and graph.

Carbon sequestered and cost per ton: See attached table and graph, \$3.50 per metric ton of carbon.

Comments: (1) In 1992, 161,767 acres were planted to tree under the Forestry Incentives Program for timber production, 119,223 under the Agricultural Conservation Program to meet soil and water conservation objectives, and 3,636 acres under the multi-resources Stewardship Incentive Program. These are cost share programs that do not provided rental payments to participants. In the past, the size of the program has been constrained by appropriations, not by availability of eligible land.

(2) The proposed Presidential USDA Tree Initiative (Trees for the Future) is also a cost share program, and it would be counted in achieving the goal for this component. The Forestry Incentives Program is scheduled to terminate in 1995 under the terms of the 1990 Farm Bill, and would require an equivalent offset to maintain baseline accomplishments.

(3) It is anticipated that two-thirds of the planting would occur on existing but nonstocked or understocked forest land and one-third on idled agricultural lands.

II. Tree Planting on Economically Marginal and Environmentally-Sensitive Pasture Lands

Goal: 900,000 additional acres of tree planting annually.

USDA would provide: Technical assistance, 50 percent cost sharing to plant trees, and annual rental payments for the contract period.

Suggested contract period: Ten years for softwood tree species in the South, 15 years for softwood species elsewhere, and 15 years for hardwood species in all regions. Contract periods of 15 years are suggested for hardwoods and for softwoods in the North and West because of higher planting costs and comparatively longer period of growth before intermediate products can be harvested, both of which are disincentives to landowner participation.

Delivery system: USDA Forest Service-State Foresters

Federal cost: See attached table and graph.

Carbon sequestered: See attached table and graph.

Carbon cost per ton: \$11.80 per metric ton of carbon.

Comments: (1) There are currently no federal programs specifically designed to encourage tree planting on pasture lands, i.e., the Conservation Reserve Program is limited to certain croplands, while cost share-type programs (FIP, ACP) do not offer sufficient incentive for farmers to convert income-producing pasture land—even though environmentally sensitive—to trees.

(2) Pasture land tree planting is less costly than cropland planting, as rental rates for pastureland usually average one-third to one-half of those for croplands in the same geographic area.

(3) To qualify for this program component, a farmer (producer) would have to document a history of active pasture use, such as use for this purpose in three of the five prior years ending with 1993. This would preclude interested parties from grazing inactive agricultural land in an effort to qualify for this rental payments rather than for only cost share assistance under Program Component I.

III. Tree Planting on Economically Marginal and Environmentally-Sensitive Croplands

Goal: 900,000 additional acres of tree planting

USDA would provide: Technical assistance to plant trees, 50 percent cost sharing for tree planting and annual rental payments during the contract period.

Suggested contract period: Ten years for softwood tree species in the South, 15 years for softwood species elsewhere, and 15 years for hardwood species in all regions. Contract periods of 15 years are suggested for hardwoods and for softwoods in the North and West because of higher planting costs and comparatively longer period of growth before intermediate products can be harvested, both of which are disincentives to landowner participation.

Delivery system: USDA Forest Service-State Foresters

Federal cost: See attached table and graph.

Carbon sequestered and cost per ton: See attached table and graph. \$15.50 per metric ton of carbon.

Comments: (1) This program would expand the existing Conservation Reserve Program concept by relaxing the constraints on the types of land that are eligible. By broadening the definition of eligible land to include all environmentally sensitive and economically marginal cropland, the size of the eligible land base is approximately doubled. Rental costs for this option may be lower than those for the CRP because of the increased competition from a larger pool of applicants and a smaller initial program size. (2) Conversion of CRP acres in tree growing area that are now in grass cover are a possible source of lands for this program component.

Combined Program

The proposed 10-year program could capture 4.3 million metric tons in the year 2000 and 28.5 million metric tons in the year 2010. More important, the long term implications are even greater. The carbon capture rate doesn't peak until the year 2017 when the rate of uptake reaches 48 million metric tons per year. This represents a doubling of current tree planting rates in the U.S. which is both technical feasible and socially acceptable. A total of 18.75 million acres would be planted beyond the baseline projection of 2.5 million acres per year. This is not a sufficient amount to adversely affect food prices, and probably would have a relatively minimal effect on timber values.

Comments:

(1) The costs of carbon sequestration of \$3.50 to \$15.5 per metric ton in this report are significantly lower than the \$5.25 to \$43.33 per short ton reported by Moulton and Richards (1990) and \$8 to \$60 per short ton reported by Richards, Moulton, and Birdsey (1993). These cost, however, are logically consistent; they primarily reflect different accounting stances and points in time. The major reason for the lower costs in the current proposal is that it only includes the Federal costs of the proposed program--which, for example, are limited to a portion of the costs of tree planting and to rental payments (where applicable) for 10 to 15 years, not 40 years or 160 years as assumed in the two referenced reports, respectively. The privately-borne costs in the current proposal would be compensated by the value of the timber which accrues to the landowners. Further, the Moulton and Richards report was extended to much higher levels to demonstrate both the upper limit on potential carbon sequestration and the principles of increasing marginal and total costs associated with increased program size.

Percent completion: 0.1 0.2 0.4 0.8 1.0

Social Discount Rate: 0.05

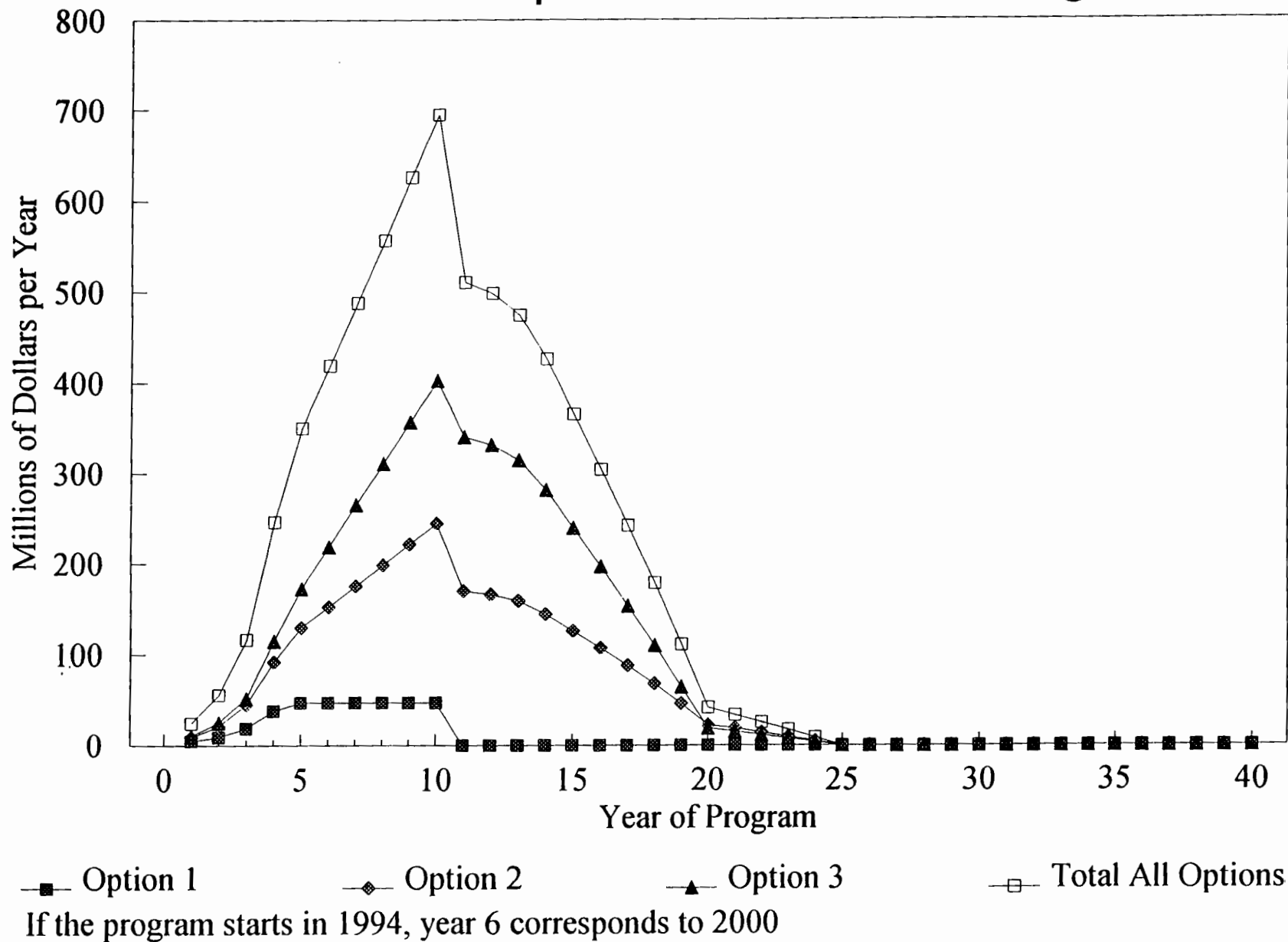
Target increment by option (acres)

Option 1: Expand FIP/SIP/ACP: 700000
Option 2: CRP for pastureland: 900000
Option 3: Liberal CRP-like program: 900000
Total: 2500000

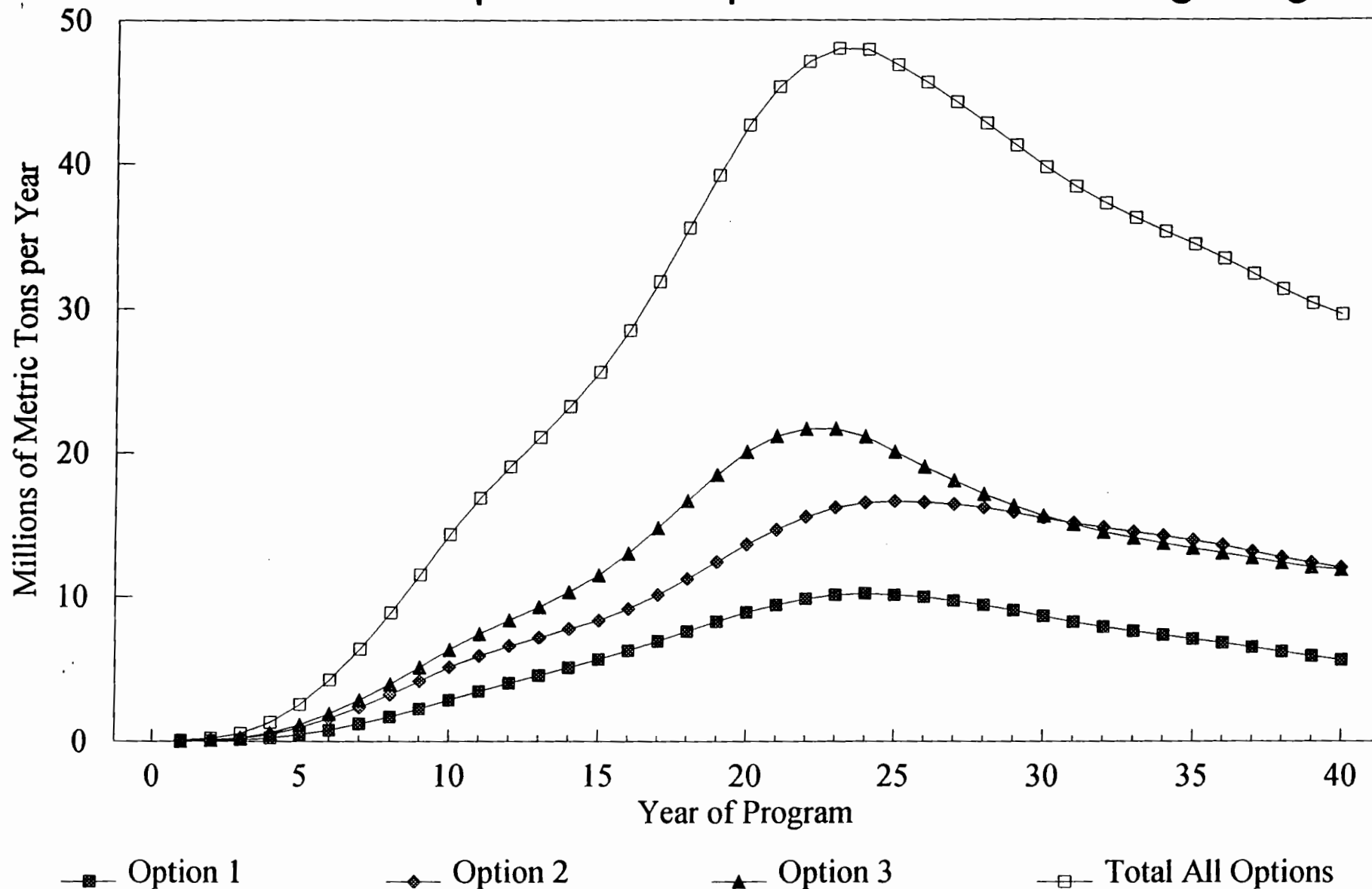
Federal Cost and Increment in Carbon Uptake by Year

Year	Option 1		Option 2		Option 3		Total	
	Carbon (Millions of MT)	Federal Cost (Millions of \$)	Carbon (Millions of MT)	Federal Cost (Millions of \$)	Carbon (Millions of MT)	Federal Cost (Millions of \$)	Carbon (Millions of MT)	Federal Cost (Millions of \$)
0								
1	0.009217866	4.76	0.01846862	9.5355	0.02239196	10.3995	0.05007845	24.695
2	0.036871464	9.52	0.0738745	21.3615	0.08956786	25.3935	0.20031382	56.275
3	0.101396526	19.04	0.20315487	45.0135	0.2463116	52.5735	0.550863	116.627
4	0.239664515	38.08	0.48018423	92.3175	0.58219106	115.3575	1.30203981	245.755
5	0.470111164	47.6	0.94189984	129.7125	1.14199016	172.9125	2.55400116	350.225
6	0.788791084	47.6	1.57106968	152.6175	1.90736586	218.8575	4.26722663	419.075
7	1.191758885	47.6	2.35046177	175.5225	2.85997513	264.8025	6.40219578	487.925
8	1.687739257	47.6	3.2456121	198.4275	3.96313187	310.7475	8.89648323	556.775
9	2.25264291	47.6	4.18759267	221.3325	5.14346393	356.6925	11.5836995	625.625
10	2.878579065	47.6	5.14193948	244.2375	6.36428524	402.6375	14.3848038	694.475
11	3.479173918	0	5.94458585	169.965	7.43741471	340.3755	16.8611745	510.3405
12	4.040237638	0	6.61615134	166.32	8.39859088	331.9515	19.0549799	498.2715
13	4.581687671	0	7.19787511	159.03	9.31929088	315.1035	21.0988537	474.1335
14	5.126743443	0	7.77223541	144.45	10.3424689	281.4075	23.2414478	425.8575
15	5.687014665	0	8.38047137	126.225	11.5396021	239.2875	25.6070881	365.5125
16	6.295710227	0	9.17809431	107.532	13.0394583	196.785	28.5132628	304.317
17	6.949300429	0	10.1482955	88.371	14.787375	153.9	31.884971	242.271
18	7.628536827	0	11.2574576	68.274	16.6740272	110.25	35.5600217	178.524
19	8.294922534	0	12.4383459	46.305	18.4807648	65.07	39.2140331	111.375
20	8.929209108	0	13.6573428	22.5	20.0982627	19.125	42.6848145	41.625
21	9.459308593	0	14.6961519	18.72	21.1713027	15.3	45.3267632	34.02
22	9.867700183	0	15.5426722	14.04	21.7020523	11.475	47.1124247	25.515
23	10.13849414	0	16.1727022	9.36	21.694846	7.65	48.0060423	17.01
24	10.23991097	0	16.5378381	4.68	21.1583533	3.825	47.9361025	8.505
25	10.15606094	0	16.6138785	0	20.0969089	0	46.8668483	0
26	9.996632112	0	16.5742732	0	19.0672754	0	45.6381807	0
27	9.757305953	0	16.4243856	0	18.0795902	0	44.2612817	0
28	9.445822298	0	16.1749419	0	17.154128	0	42.7748923	0
29	9.077660833	0	15.8473948	0	16.3314387	0	41.2564943	0
30	8.660561399	0	15.4524705	0	15.631797	0	39.7448289	0
31	8.279978079	0	15.1042715	0	15.0288241	0	38.4130736	0
32	7.937676905	0	14.7958913	0	14.5178146	0	37.2513828	0
33	7.629291682	0	14.5135172	0	14.0893577	0	36.2321666	0
34	7.346090029	0	14.2295237	0	13.724632	0	35.3002457	0
35	7.083705751	0	13.930098	0	13.4142267	0	34.4280305	0
36	6.803905108	0	13.5742587	0	13.0712937	0	33.4494575	0
37	6.509025468	0	13.1746558	0	12.7103589	0	32.3940402	0
38	6.207896021	0	12.7565897	0	12.3604744	0	31.32496	0
39	5.918175147	0	12.3706606	0	12.079744	0	30.3685798	0
40	5.648692035	0	12.042169	0	11.8972199	0	29.5880809	0

Federal Cost for Expanded Tree Planting Activities



Annual Carbon Capture for Expanded Tree Planting Program



If the program starts in 1994, year 6 corresponds to 2000

TITLE: Take credit for projected increased recycling and increase it even more

DESCRIPTION: The CCM Plan could take credit for increases in carbon sequestration from actions by the states and the paper and paperboard industries to increase recycling. Increased recycling will slow the increase in wood consumption, thereby leading to a build-up in timber inventories as compared with no increase in recycling. There will be substantial increases in recycling without any Federal action. Recycling could be increased even more by providing incentives, information transfer, research, and Federal leadership.

The American Paper Institute in 1990 announced a national goal of 40 percent recovery for recycling by 1995. Establishment of this goal by the industry reflected recognition of opportunities and pressures from state and local governments to keep paper and paperboard out of landfills. Billions of dollars have been invested in recycling facilities and there is every expectation that the goal will be achieved. The recovery rate (the ratio of paper and paperboard recovered for all purposes divided by production) was about 32 percent in 1989.

The recovered paper utilization rate measures the rate of paper recycling in the United States. It is the ratio of recovered paper consumption in paper and board mills to paper and board production. Recovered paper and paperboard that is not recycled is exported, composted, or burned. The recovered paper utilization rate was 26 percent in 1989 and is projected to reach 38 percent by 2000. After the turn of the century, it varies between 40 and 45 percent. Although the recovered paper utilization rate stays relatively stable, the volume of material recycled increases because U.S. paper and paperboard consumption is expected to increase. These trends assume an increase in Federal funding for recycling research. In addition, initiation of research on solid wood recycling and recycling of wood fiber into composite products may lead to further opportunities for carbon sequestration.

If there were to be a national commitment for waste reduction through education, increased research on paper recycling technology, investment tax credits, higher disposal fees, and more efficient use of paper and paperboard, the recovered paper utilization rate might reach 45 percent by 2000 and 60 percent by 2020. Some of the increase in the rate would be due to reduced production of paper and paperboard rather than increased recovery of volume.

EMISSIONS REDUCTION FROM BASE:

MMT-C/y

Compared with 1989, net emissions would be reduced by:

13-17 MMT in 2000
and 15-19 MMT in 2010.

COMPLIANCE COST: Not applicable.

FEDERAL BUDGET COST: To date, recycling has increased through the actions of state and local governments and voluntary actions of the industry. Federal action has been largely through research to make recycling possible. This research is expected to continue and expand modestly. The emissions reduction is projected to be achieved at no other direct cost to the Federal government. Additional emissions could be reduced through relatively minor costs for actions to:

- * Provide public information on the benefits of recycling;
- * Publicize the Administration's Earth Day announcement that the President plans "to sign an Executive Order committing every agency of the national government to do more than ever to buy and use recycled products";
- * Ensure that a clearinghouse exists to link the producers and consumers of recycled fiber;
- * Stimulate the paper industry to invest in recycled fiber technologies such as through investment tax credits and low-interest loans and/or grants; and
- * Set uniform standards, guidelines and definitions for recycled products and the term, "recyclable."

COST-EFFECTIVENESS: The option is highly cost effective compared with other options requiring a large Federal investment. Furthermore, recycling paper reduces material going to landfills which in turn reduces methane emissions from landfills as well. Some 13-30 percent of all carbon in paper is emitted as methane from landfills and 13-30 percent is emitted as carbon dioxide.

INTERACTIONS WITH OTHER OPTIONS: Carbon sequestration is an added benefit from recycling that is occurring mainly because of concerns over landfills. Much of the carbon sequestration occurs through reductions in the rate of increase in timber harvest that would have occurred in the absence of recycling. Timber inventories thus increase faster with recycling than without the projected increase in recycling.

AFFECTED STAKEHOLDERS: Increased recycling is generally favored by the public at large. The trend toward increased recycling of paper products is happening

without Federal intervention. Under this option, revenues to product producers increase slightly (surplus up 1-2%) and consumers are made better off as consumer surplus rises 2-4% by 2040. Some private forest land owners see recycling as a market threat for round pulpwood markets.

TITLE: Expanded use of forest products

DESCRIPTION: We are currently sequestering carbon through use of 160 million tons of solid wood and wood fiber consumer products annually. These products have an average life span ranging from an estimated 67 years for nonresidential construction to about one year for newsprint, tissue paper, and packaging materials. The level of carbon sequestration could be increased significantly if a greater volume of our durable products were made from wood. Forest products are renewable, and have a higher potential to keep carbon from the atmosphere and require less energy to produce than similar products from steel, aluminum, concrete, brick, or plastic.

IMPLEMENTATION: The goal will be to increase use of solid wood and wood fiber by

20 percent by the year 2000 by emphasizing greater life for wood based products and substitution of wood for other more energy consuming products made from nonrenewable resources. Emphasis will be placed in the following areas: (1) develop effective and environmentally acceptable wood preservation systems to extend service life and make wood products more durable; (2) expand structural use of wood in commercial construction, residential housing, and bridges; and (3) utilize wood processing residues and post-consumer solid wood and wood fiber materials to make composite fiber material products. Ways to expand wood use include:

- * More money can be invested in forest products research.

- * Positive steps be made to promote wood utilization for structural purposes. Examples might include:

- 1) Places such as Idaho are promoting wooden bridges where the transportation infrastructure is being upgraded. Such proactive programs at state and federal levels could increase interest and markets for high quality uses.

- 2) It may be possible/desireable to examine carbon addition to atmosphere in product use as part of EIS statements for buildings. This would dramatically promote wood uses.

- * It might be possible to introduce a checkoff program, as currently used for some agricultural commodities, to promote the use of wood products.

EMISSION REDUCTION FROM BASE: Compared with 1992, net emissions would be reduced by:

10-16 MMT carbon/year in 2000
and 18-26 MMT carbon/year in 2010

COMPLIANCE COST: Not applicable

FEDERAL BUDGET COST: Approximately \$25 million will be required per year until the year 2000 for the research, technology transfer, and demonstration for the technologies necessary for the conversion to greater wood products use. Only about \$10 million will be needed by the year 2010, since much of the technology will be implemented by then.

COST-EFFECTIVENESS:

In 2000 = \$1.60-2.50/ton carbon

In 2010 = \$0.38-0.45/ton carbon

Perhaps of greater significance than the direct costs/ton of carbon are collateral benefits that would accrue from improved forestry operations and waste management as a result of investments to achieve greater carbon sequestration. Greater use of wood in product manufacture would also mean reduced use of other more energy-intensive materials and overall energy (fossil fuel) conservation.

INTERACTIONS WITH OTHER OPTIONS: Large-scale tree planting and increasing recycling of paper products will lower the cost of wood products. Lower cost is likely to result in greater substitution of wood products for other more energy intensive substitutes. This substitution will reduce greenhouse gas emissions.

AFFECTED STAKEHOLDERS: Forest landowners, manufacturers of steel, plastic, concrete, bricks, and aluminum, and producers of fossil fuels will all be affected. Use of more wood in products will result in more jobs in rural communities. Wood products, for example, timber bridges, will often lead to consumer benefits such as lower costs and improved aesthetic appearance.

U.S. DEPARTMENT OF AGRICULTURE

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**Office of the Assistant Secretary for
Natural Resources and Environment
Room 217-E, Administration Building
14th and Independence Avenue, S.W.
Washington, D.C. 20250**

Telephone Number _____

Fax Machine Number _____

REMARKS: _____

THE WHITE HOUSE
WASHINGTON

X2 802

7/22

Joe

Look forward to talking
with you about this.

Heather

12 Ennui
(CCMG)

Climate Change Action Plan

1. Goal

- * What path are we on?
 - i) year 2000 commitment--including any follow on benefits of actions taken to meet it
 - ii) continue trend of reductions--take further actions at some future time beyond those required for i). How much further and what timing?
 - iii) stabilization--cap post-2000 emissions at 1990 levels. What steps are under consideration beyond i) to accomplish this.
- * Important to be clear about this
 - to reduce uncertainty and resulting inefficiency
 - to get long lead time mitigation measures started
 - to convey competent grasp of what the President meant in his speech and where he is going with this plan
 - to show credible determination to meet well-defined objective
- * If answer is no decision has been made, need to indicate how decision will be made. What will be considered when, through what process and by whom. Effectively path ii) with particulars to be worked out.

2. Elements

- * Action plan components
 - Working Group/IAT/CCMG selections
 - DOE voluntary initiative
 - sinks, joint implementation
- *These will close year 2000 gap, using upper-end estimate. May in real life fall short
 - over optimism on voluntary adoption of new technology
 - lack of funding for new federal outreach positions
 - slow pace/inaction on utility commitments
- *Signal any other actions?
 - insurance for path i)
 - essential for any other path
 - use opportunity to take worthwhile steps
 - reduce counter productive subsidies: parking cash out
 - rearrange incentives: pay at pump insurance
 - users pay more of cost: gasoline tax

3. Issues

- * Should President get out front on novel/controversial initiatives if not necessary, given press of other key priorities (reconciliation and aftermath, health care, NAFTA)
- * Should President see such options and their cost-effectiveness, if low-key plan seems best.
- * Can low-key plan carry the day: achieve the commitment and not look so easy/thin that legislation triggered.

4. Other plan content

- * Monitoring and reporting provisions--how test and record progress along path
- * Effect of plan on economic performance, generally and in key sectors, eg. utility
- * Implementation steps--how non-federal parties participate

HLRoss/NEC
July 21, 1993



EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS
WASHINGTON, D.C. 20500

F
Answer
(cc: [unclear])

MEMBER

December 16, 1993

TO: DISTRIBUTION

FROM: JOSEPH STIGLITZ, MEMBER, CEA
ROBERT WATSON, ASSOCIATE DIRECTOR FOR ENVIRONMENT, OSTP

SUBJECT: Policy-research Links for Greenhouse Gas Mitigation and
Other Environmental Issues -- Meeting, December 20,
OEOB, Room 324, 11:00 a.m.

We would like to invite you to attend a short meeting on Monday, December 20 from 11:00 - 12:00 in OEOB, Room 324 to develop recommendations for Federally-sponsored research in environmental and socio-economic research related to mitigation of greenhouses gas emissions. We wish to examine the types of information that would have been useful in the design of the recently completed greenhouse gas mitigation action plan, and to use these information needs to guide development of the research programs. It is likely that many of these same information needs are likely to recur in the future when the components of the plan are reviewed periodically and related to development of long-term (beyond 2000) plans to limit future growth in emissions.

If time permits, we would also like to discuss whether a similar process of reflection on information needs for other environmental policy issues would also be useful.

Please indicate whether you will be able to attend this meeting by contacting Ms. Francine Obermiller at (202) 395-5036 by COB Friday, December 17. Provide her with your date of birth for clearance into the building.

We hope that it will be possible for you to attend this meeting.

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October 4, 1993

Ms. Kathleen McGinty
Deputy Assistant to the President and Director
of the Office of Environmental Policy
Office of the Vice President
Old Executive Office Building, Room 360
Washington, D.C. 20506

Dear Katie,

Thank you for meeting with Fred Krupp recently to discuss development of the National Action Plan (NAP) to address greenhouse gas emissions.

As Fred emphasized, we believe that the measure of the President's commitment and the U.S.'s success in meeting it is not the accumulation of a list of government policies and programs "scored" by optimistic computer projections of their efficacy, but the curbing of actual greenhouse gas emissions. For this reason, we have advocated throughout this process a framework that, in the spirit of reinventing government, establishes a comprehensive, competitive framework for fostering innovative government and private sector actions to address the greenhouse challenge.

Attached you will find a package of briefing materials that we shared with your staff and Administration colleagues throughout the summer. In it, we outline a NAP that, founded on a reiteration of the President's pledge and a rigorous emissions accounting system, creates a mechanism that would ensure that continuing emissions reductions are achieved by a dynamic, open-ended process that emphasizes actual emissions reduction efficacy, innovation, and cost-effectiveness. This proposal, combined with appropriate tax and regulatory measures that meet the same criteria, would endow the NAP with the critical, dynamic capacity necessary to foster the kind of continual innovation that is essential to addressing greenhouse gas emissions. In contrast, a NAP that fixes in place a specific set of ideas formulated over a short period of time to govern our nation's policy for years in the future runs the risk of institutionalizing government programs which then would be unable to adapt to changing needs and less effective at achieving emissions reductions.

Whatever the final shape of the NAP, emissions projections must give way to emissions monitoring and tracking. We believe that the NAP will fail the first test of adequacy if it does not include a specific program for tracking and monitoring actual annual greenhouse gas emissions through 2000. Fortunately, the building blocks for such a program already exist. For example, the Energy Information Administration and the Department of Energy compile data on
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128 East Hargett St.
Raleigh, NC 27601
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Austin, TX 78701
(512) 478-5161

fuel use and the Clean Air Act requires utilities to monitor carbon dioxide emissions. The fact that these activities and/or requirements are already in place does not obviate the need for their express inclusion in the NAP.

Existing data-collection and emissions-monitoring efforts must be incorporated in the NAP explicitly along with any provisions to expand the tracking and monitoring that may be necessary to make an ongoing assessment of actual annual greenhouse gas emissions. In this regard, it is particularly important to improve existing methods of assessing and accounting for carbon uptake by sinks, while carefully scrutinizing the emissions reduction performance of each measure adopted under the NAP. This data should be published as part of an annual report open to public comment on the implementation of the National Action Plan, describing and accounting for progress towards greenhouse gas emissions reductions. Consideration should be given to revising the way the greenhouse gas inventory data is aggregated, to maximize its usefulness to policy-makers.

In addition, the NAP must specify a mechanism for evaluating on a biennial basis progress towards returning emissions to 1990 levels by the year 2000, and for increasing emissions reduction efforts based upon these evaluations. For the purposes of these assessments, it is essential that greenhouse gas inventory data be used as the key indicator of the progress of emissions reduction efforts. Evidence that U.S. emissions have begun to decrease should be apparent no later than 1995. Based upon the results of annual emissions inventories, an inter-agency working group should evaluate whether emissions reductions are being achieved, whether the U.S. is likely to return to 1990 emissions levels by 2000, and whether a downward emissions trend is likely to continue thereafter. If these three criteria are not met, the Administration should have a mechanism in place to convene a NAP revision process and adopt additional measures to ensure that U.S. emissions reduction targets, including continuation of the downward emissions trend beyond 2000, will be achieved.

Because of the action plan's sensitivity to extremely uncertain economic conditions, Congressional funding, and the success of voluntary programs, the NAP must place great emphasis on the establishment of credible monitoring, assessment, and mid-course correction mechanisms to ensure that the President's emissions objectives are met. The Environmental Protection Agency should be assigned a leading role in helping to oversee the implementation of the NAP through these mechanisms. We believe that if the Administration postpones consideration of these "process" issues until a later time, the credibility of the entire action plan may be fatally weakened.

In addition to creating these mechanisms for monitoring, evaluating, and strengthening the NAP in the future, the Administration should establish processes adding important elements to the action program in the near-term. Of particular importance are additional efforts in the transportation sector, where we understand the NAP will be weak, addressing both automobile fuel efficiency and vehicle miles travelled, as well as in the residential and commercial buildings sectors.

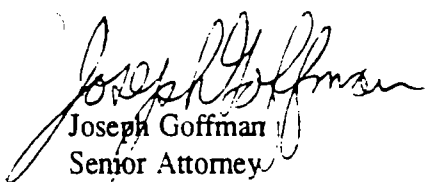
Ms. Kathleen McGinty
October 4, 1993
Page 3

In announcing its plan the Administration should also call for a strengthening of the U.N. Framework Convention on Climate Change at the first Conference of the Parties. At a minimum, such strengthening should include binding commitments for industrialized countries to cap emissions at 1990 levels by the year 2000, and to produce action plans to continue the trend of emissions reductions thereafter. By obtaining commitments from the other industrialized countries to do the same, the Administration can help build confidence that the U.S. is not acting in isolation to limit greenhouse gas emissions. We believe that such a statement would usefully build upon President Clinton's speech before the U.N. this week, where he stated, "We are working to make sure that all nations meet their commitments under the Global Climate Convention."

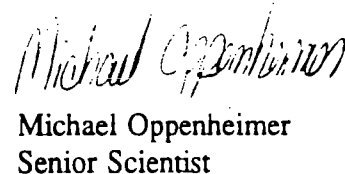
Finally, we hope that the Administration will use the opportunity presented by the NAP's release to emphasize the very real environmental and economic threats posed by anthropogenic climate change, and the need for action in the private sector and at all levels of government. Despite the mainstream scientific community's repeated calls for aggressive measures to limit greenhouse gas emissions, a recent "anti-environmental backlash" in the popular media has used questionable science to skew the public debate on climate change. A clear statement that the United States supports the findings of the Intergovernmental Panel on Climate Change and the goals of the Climate Convention would help bring sound science back into the center of public debate on greenhouse gas emissions reduction policy.

Thank you very much for your time and continuing attention to these issues. We would welcome the opportunity to meet with you and other officials as appropriate to discuss these matters prior to finalization of the plan. When the plan was delayed in August, our expectation was that meaningful opportunities would be provided to consult further with the Administration on the plan. At this point, we are growing concerned that the development of the NAP, initially an open process, has become closed, which has implications for our ability to provide both useful input, and an assessment of the plan's quality.

Sincerely yours,


Joseph Goffman
Senior Attorney


Scott Hajost
International Counsel


Michael Oppenheimer
Senior Scientist

cc: Timothy Wirth
Eileen Claussen
David Gardiner
T.J. Glauthier

Dirk Forrister
Robert Watson
Will Martin
Jonathan Wiener

THE U.S. NATIONAL ACTION PLAN

Greenhouse Gas Reduction Policy or Elbowing at the Budget Trough?

ENVIRONMENTAL DEFENSE FUND

In the spirit of reinventing government, the NAP should establish a comprehensive, competitive framework for fostering innovative actions, by both government and the private sector, to address the greenhouse challenge. Founded on a reiteration of the President's pledge and rigorous emissions accounting, the NAP should create a mechanism that would ensure that the President's pledge is met by a dynamic, open-ended process that emphasizes actual emissions reduction efficacy, innovation, and cost-effectiveness.

Under EDF's proposal, the Federally-funded programs to achieve emissions reductions would not be rigidly prescribed in the NAP. Rather, the NAP would operate through a Greenhouse Gas Reduction Fund (financed from the same sources that otherwise would support prescribed government programs and activities and from a portion of the funding authorized under Title XVI of the National Energy Policy Act). Federal agencies and private parties would submit bids for financing, and bids would be ranked on the basis of cost-effectiveness, quality of reductions, innovation, leveraging of private sector resources, and stimulation of U.S. market opportunities. The President's Council on Sustainable Development could play a role in recommending awards. Funding levels are provided for illustrative purposes only; a further assessment would be needed to determine the actual funding levels necessary to ensure this program's success.

Of course, establishing this system would not detract from the need to pursue appropriate effective, innovative, and cost-efficient changes in the tax and regulatory codes at all levels of government to promote reductions in emissions of greenhouse gases.

KEYS TO GHG STRATEGIES

- ◆ There are many paths between the present and 1990 GHG emission levels by the year 2000
- ◆ The paths vary critically by the policy framework and the nature of the incentives provided
- ◆ The paths vary in the timing and type of energy and control technologies
- ◆ The paths vary in cost, but all hit the target
- ◆ The paths vary in environmental benefits
- ◆ As with Acid Rain, overcontrol through the banking of early reductions substantially boosts environmental performance and lowers cost
- ◆ Early reductions are environmentally superior

IMPLICATIONS FOR THE NATIONAL ACTION PLAN

- ◆ Demonstrate that the Administration will deliver on the President's commitment without harming the U.S. economy
- ◆ Be robust across a range of economic outcomes
- ◆ Illustrate the diversity and breadth of feasible alternative paths
- ◆ Focus on creating a framework building toward an eventual legal and regulatory strategy
- ◆ Keys to Cost-Effectiveness are:
 - ✓ setting the constraint firmly
 - ✓ flexibility, not rigid allocations
- ◆ Competition and potential reward is the key to ingenuity, creativity and innovation
- ◆ Potential for future credit can lead to early reduction and enhance the President's Pledge

GHG Reduction Program

DISADVANTAGES OF RIGID ALLOCATIONS

- ◆ Expectation of legislation and/or funding
- ◆ Agency Turf Battle rather than cooperative consensus
- ◆ Exclusive not Inclusive
- ◆ Multiple sub-targets instead of **ONE GOAL**
- ◆ Many opportunities to fail in meeting expectations

NATIONAL GHG REDUCTION FUND

- ◆ Create a National GHG Reduction Fund
- ◆ Federal Agencies submit bids for National GHG Reduction Fund
- ◆ Bids ranked on the basis of:
 - ✓ cost-effectiveness
 - ✓ quality of reductions
 - ✓ innovation
 - ✓ leverage of private sector resources
 - ✓ stimulation of U.S. market opportunities
- ◆ Bids ^{staged}evaluated by the Director of Climate Protection
- ◆ Award recommendations made by the President's Council on Sustainable Development
- ◆ Initial Funding at \$25,000,000 for FY94

JOINT IMPLEMENTATION GHG REDUCTION FUND

- ◆ Create a Separate Joint Implementation GHG Reduction Fund
- ◆ Allow both private and public sector proposals to the Fund
- ◆ Procedures for review and recommendation same as National GHG Reduction Fund
- ◆ Initial funding at \$25,000,000 (50% of FY94 money for Section 1609)

GHG REDUCTION ACCOUNTING SYSTEM

- ◆ Key to credibility
- ◆ Develop a Double Entry Bookkeeping System
- ◆ Use Section 1605 of the National Energy Policy Act as a building block
- ◆ Use CAA utility CO₂ Monitoring Requirement
- ◆ Utilize existing Energy Information Agency data collection authorities
- ◆ Require annual GHG emission reporting for major source categories patterned after SARA Title III Reports
- ◆ Commit to Annual Progress Reports
- ◆ Encourage the development of independent auditing and certification capabilities for GHG reductions
- ◆ Extend to other nations through Country Studies and as a requirement for partners in Joint Implementation

THE CLIMATE CONSERVANCY

- ◆ Not-for-Profit Organization providing:
 - ✓ reduction auditing and certification
 - ✓ annual reporting to Section 1605
 - ✓ offset portfolio guarantees
 - ✓ offset demonstration projects
- ◆ Board of Directors drawn from Environmental Organizations
- ◆ Membership from Companies Voluntarily Reducing GHG
- ◆ Companies sign a Climate Compact with the Climate Conservancy:
 - ✓ committing to pre-specified reduction targets
 - ✓ annual auditing of performance
 - ✓ guaranteed per ton payment to the Climate Conservancy for any reduction shortfall
 - ✓ Conservancy purchases required reductions
- ◆ Conservancy funded by a per ton registration fee paid by participants
- ◆ Conservancy-facilitated trading among participants allowed

ALTERNATIVE MECHANISMS TO CLOSE ANY REDUCTION SHORTFALL

- ◆ Voluntary Programs - Taking the Pledge
- ◆ National Commitment to a large fund for extra Joint Implementation
- ◆ Require the Offset of Major New GHG Sources constructed after 1990
- ◆ Require the prorata Offset of GHG Emissions Reduction Shortfall by Major Source Category Share
- ◆ Institute a larger Energy-related Tax designed to cover the required GHG reduction gap
- ◆ Administration Commitment to seek Legislation requiring specific GHG Reductions and/or measures
- ◆ Administration Commitment to seek Legislation Capping GHG Emissions

U.S. NOW LEADS ON CLIMATE CHANGE

- ◆ EEC has economic problems
- ◆ Governments rethinking Rio commitments

U.S. SHOULD AGGRESSIVELY PROMOTE COST-EFFECTIVE STRATEGIES AS A FOUNDATION FOR A PROTOCOL

- ◆ Energy Efficiency
- ◆ Environmentally Effective Technology
- ◆ Sinks
- ◆ Joint Implementation

U.S. CAN INCREASE POTENTIAL FOR GLOBAL COOPERATION AND PARTICIPATION

- ◆ Ensure that Section 1605 includes international investments
- ◆ Foster high quality demonstration projects
- ◆ Tie Section 1605 to an Accounting Framework and promote its use in both country studies and for partner countries under Joint Implementation
- ◆ Joint Implementation leverages public funds for sustainable development by unleashing private sector

KEY ELEMENTS OF STRATEGY

- ◆ Firm commitment to Goal
- ◆ Stringent Accounting and Reporting System
- ◆ Robust over Economic Assumptions
- ◆ Flexibility in Alternative Paths
- ◆ Encouragement for Early Reductions
- ◆ Aggressive Leadership in:
 - ✓ Development
 - ✓ Demonstration
 - ✓ Public Outreach

F Envelope (CCMG)

*** SENSITIVE *** DO NOT DISTRIBUTE ***

August 20, 1993

TO: JOSEPH E. STIGLITZ

FROM: RAY SQUITIERI

SUBJECT: Climate Change Action Plan--Warning Flags

The IAT met Wednesday and Thursday to review the entire package of climate change options. This memo flags for you several items that arose in the meeting. To summarize: while I do not anticipate a train wreck, the journey from here to a final Action Plan will be rougher than we believed.

Schedule: The entire package is to be wrapped up by Friday September 3.

Vetting. Several "voluntary" options must be vetted with the affected industries. These options may impose significant costs on industry. Companies may view these programs coercive rather than voluntary, with EPA holding over them the threat of even more burdensome regulation. In any case, the companies must be on board before a public announcement.

HFC3 Aluminum voluntary program. This would reduce emissions of CF_4 and C_2F_6 in aluminum production; it will require cooperation from the aluminum industry.

HFC1 Reduce HFC-23 emissions in HCFC-22 production. Significant quantities of HFC-23, a potent greenhouse gas, are produced during production of HCFC-22.

Budget. We have no assurance that the new money called for in the package will be forthcoming. OMB has acquiesced to \$200 per year million of the \$300 million per year required by the current package, and Jim Mietus, representing T.J. Glautier, continues to do a nice job of working out the OMB side. The proposals will also require agency approval for a rearrangement of their budgets; Bob Sussman of EPA has explicitly cautioned us not to assume that EPA will sign on. Then too Congress must go along as well. A serious challenge by OMB, Congress, or one of the agencies could upset the Plan.

Parking cash out (7.1 MMT). Treasury Tax Policy continues to fret about this one. As of Friday morning, they intend to propose a revision to the existing option. Killing this option would be bad not only for the carbon totals--even with the option, we remain about 20 MMT short of the goal--but for the budget as well. We estimate revenues of \$800 m per year when fully phased in.

Tough options. The CCMG may be presented with a list of tough options to provide further reductions in case the present list does not meet the target, including:

- Elimination of rice subsidies; reduces methane emissions by 0.6 to 4.2 MMT, but wipes out the U.S. rice industry. Proposed by State. Economic agencies would support. EPA would not oppose, and may support. USDA opposes (USDA representative asked, "What good would it do to eliminate one subsidy if we are just going to replace it with another subsidy anyway?", thus establishing the principle of No Net Loss of Subsidies.)
- Hydro reform (0.8 to 1.6 MMT). Rationalizes federal hydro pricing, raises \$600 m to \$2 billion annually. But will encounter fierce opposition from those now benefiting from federal largesse.
- Elimination of tax-free treatment of employer paid parking (17.5 MMT, \$6 billion per year revenue). This is a stronger version of the parking cash-out option now under study by Treasury Tax Policy.
- Higher CAFE standards.

Laugh test. Several features of the package may not pass the straight face test:

Electricity growth rate. The package of options would reduce the annual growth rate in Kwh consumption from about 2% over the last decade--a time of considerable improvements in economy-wide energy efficiency--to 0.7%. Private analysts and forecasters project 1% to 2%, with a median estimate of 1.5%.

Sinks: Reduced harvest on National Forest Service Lands (4.5MMT). Will this produce real carbon reductions worldwide, or will reduced cutting in the U.S. result in more cutting in Canada? The Forest Service modelers claim to have accounted for this carbon leakage, but doubts persist.

Rush Limbaugh test. Several options may fail this test, among them:

Improve ruminant productivity (1 - 2.6MMT). This option aims to reduce methane from cow burps. It will be hard to squelch the laughter from the Junior High School set. Maybe it should be renamed.

K. Emanuel (CCM6)

VIII INTERNATIONAL ASPECTS

A. Geographic Distribution ** To be drafted --1/2 p.**

B. Joint Implementation

Joint implementation refers to two countries working cooperatively to reduce carbon emissions. The concept is most easily illustrated with an example. Suppose country A funds energy efficiency investments in country B and that because of these investments, country B's carbon emissions are reduced. From the perspective of climate change, carbon emissions reductions in country B are just as valuable as reductions in country A. Thus, if it is less costly to reduce carbon emissions in country B than in country A, it is economically efficient to invest in country B.

Country A will be reluctant to invest in B unless it receives some credit for the carbon reductions associated with those investments. If country A is an Annex I country which has accepted an obligation to meet a specified greenhouse gas (GHG) emissions target, it will want to claim all or part of the reduction in country B as counting towards that target. With full credit for the reduction, a 10 ton reduction in country B will allow country A to increase its emissions 10 tons above its original target level.

Before the GHG reduction from joint implementation investments can be credited from one country to another, the international community needs to reach agreement on three key questions.

- What type of projects qualify for JI?
- How should those projects be credited?
- How can the savings from the projects be verified and monitored?

Two factors are key in determining what type of projects qualify for JI credits: 1) whether the project is between two Annex I countries that both have a commitment to reach a specified GHG emissions target; and 2) the type of investment, particularly whether the investment is for planting trees to sequester carbon.

For a JI project between two Annex I countries, the question of why the project was undertaken does not bear on whether JI credits should be granted. If both countries have detailed inventories of carbon emissions and one country claims a 10 ton JI credit, then the other country must be debited 10 tons. Because both countries track GHG emissions and have committed to reach specified targets, there is little danger of bogus counting of tons. The aggregate emissions from the two countries will be the same regardless of whether JI credits are granted. From an economic efficiency perspective, it is preferable to grant credits because it provides flexibility to countries and helps lower the cost of meeting the aggregate emission target.

If the JI project is between an Annex I country and a non-Annex I country, it is more difficult to determine which projects qualify for credits. The difficulty arises

because it might not be possible to track emissions in the non-Annex I country. Even if tracking was possible, that country will probably not have agreed to an emissions reduction target. For a project to qualify for a credit under these circumstances it must be demonstrated that: 1) it reduced emissions in the non-Annex I country; and 2) that the project would not have occurred "but for" the emission reduction target in the Annex I country.

The "but for" test is needed because if a JI credit is granted the Annex I country will be allowed to increase its emissions by the amount of the credit. If the project would have been done even if the credit was not granted, then granting the credit will increase global emissions. The crux of determining which projects qualify for credits lies in sorting out the "but for" test. If the test is interpreted too strictly, then many valuable projects will be rejected; if the test is interpreted too loosely, then bogus credits will be granted.

The type of project sheds light on the "but for" test. If the project is planting trees to sequester carbon, then the "but for" test is almost certainly passed. It is passed because the tree planting program is not done for profit and clearly would not have been done "but for" the emissions target. In other words, planting trees to sequester carbon in non-Annex I countries is not part of the business as usual scenario.

In addition to claiming JI credits for tree planting, Annex I countries might want to claim credit for exporting energy efficient technologies. These technologies hold great promise for reducing global carbon emissions. However, in some instances it might be more difficult to pass the "but for" test. If the projects are part of the normal course of business for the firms exporting the technologies, then it calls into doubt whether real reductions in global emissions will occur if JI credits are granted. On the other hand, if the export involves special outreach by the firm and is not a part of business as usual practice, then the "but for" test is likely passed.

Conventions and rules for deciding how to pass the "but for" test must be decided. Specifying or suggesting what those rules should be is beyond the scope of this paper. Two types of error are possible when any set of rules is adopted and applied: 1) accepting a project for JI credit that in fact does not pass the "but for" test; and 2) rejecting a project that does pass the "but for" test. A sensible set of conventions and rules will balance the benefits and costs of each type of error.

The scoring for JI projects must take into account what GHG emissions would be with and without the project. The amount of the credit should be a function of the difference between the two emission paths. Baseline levels of energy efficiency might need to be established in order to determine the without project emission path. Perhaps one country can be "normed" against another to assist in this task.

Once a project is in place and a JI credit is awarded, the project must be monitored to ensure the actual reductions claimed are in fact realized.

3 International Trade

****Note: This section to be trimmed by 50%****

The scope for impact of climate change and policies to combat climate change is significant. Sectors most likely to be directly affected are climate resource using sectors (agriculture, forestry, fishing, tourism), fossil fuel (and alternative energy) industries, and greenhouse gas using industrial sectors particularly if emission control policies are unevenly implemented across the world. An additional channel of international trade impact may be created under some control instruments; a tradeable permits scheme or a control scheme that allows side payments among international participants could lead to substantial financial flows if the (implicit or explicit) allocation of emission restrictions differs significantly from the allocation that would generate the least cost reduction without trade or side payments.

Recent analyses of the potential impact of climate change on agriculture (Fisher, et.al., Reilly and Hohmann, Reilly, et. al. Tobey, et.al. and Kane et. al.) have emphasized the role of international trade in determining the net economic effect of climate change on a nation and have explored potential changes in comparative advantage and trade flows. Even in cases where the net global economic impact is negligible or even beneficial, there are countries that suffer significant losses and benefits. Tropical areas are generally net losers in the Reilly and Hohmann analysis even when the world as a whole benefits. (Table from Reilly and Hohmann.)

Table 1: Welfare Effects by Country Group (millions of 1989 US Dollars)

	With CO ₂ and Adaptation			With CO ₂ , No Adaptation			No CO ₂ , No Adaptation		
Region\GCM	GISS	GFDL	UKMO	GISS	GFDL	UKMO	GISS	GFDL	UKMO
Developing;									
<\$500/capita	-210	-2573	-14588	-2070	-5322	-19827	-56692	-66110	-121083
\$500-\$2000/capita	-429	-2927	-10669	-1797	-5135	-15010	-26171	-27839	-48095
>\$2000/capita	-603	-534	-1021	-818	-878	-328	-6661	-4351	-3870
East.	2423	-125	-4875	1885	-2048	-10959	-12494	-28854	-57471
Europe/USSR									
OECD	5822	25	-6470	2674	-3644	-15101	-13453	-21485	-17606
Total	7003	-6135	-37623	-126	-17028	-61225	-115471	-148640	-248124

Source: Reilly, et. al., forthcoming

****Note: Table is probably too detailed for this chapter ****

Major exporting countries can benefit, however, if the prices of agricultural products they export rise substantially. Reilly et. al. conclude:

****Note: This quote to be shortened****

"First, trade is able to play a significant adaptive role, allowing farmers in countries less severely affected by climate change to profit by selling

production to consumers in the more severely affected regions. In this way, markets act to pool the risk of locally severe effects. Even with highly uncertain scenarios, regionally differentiated effects are highly likely. Can markets continue to play this risk pooling role? One scenario that could arise that would prevent markets from operating as effective risk pooling mechanisms would be if countries intervened to prevent adjustment in trade flows. Why would countries do this? Producer groups are relatively well organized political forces. A growing loss of comparative advantage suggesting that a country's agricultural resources should shift to other activities could easily generate pressure for import restrictions or domestic subsidies to maintain the domestic agricultural industry. Sometimes the protection of domestic agriculture is cast as supporting national food security. To maintain a national "comfort level" in food security, whether that comfort level is 120 percent, 100 percent, 80 percent or 25 percent of domestic consumption, trade restrictions would have to increase if the country's basic ability to produce is degrading relative to the rest of the world. Whether couched as food security or domestic industry protection, one policy implication resulting from significant changes in regional comparative advantage could be increased pressure for trade barriers, even though this would lead to larger economic losses overall. These pressures depend on relative, not absolute, changes in productivity, and hence, could operate equally strongly even when worldwide productive capacity is increasing.

Second, the changing and uncertain comparative advantage among countries suggests that one should, if some type of national agricultural climate adjustment policy is considered, view the policy in the terms of strategic trade policies—Is it a good strategic investment based on the ability to compete in the future or is it costly support that will prolong an industry that will only grow less competitive? If deteriorating agricultural conditions were predicted for a nation, a reasonable strategy may be to expand research into improved crops, and cropping techniques, develop irrigation resources, and expand cropped area. If, however, these adaptations represent public funded responses that occur while the rest of world's agriculture is doing quite well, this country would be throwing good money after bad. A better use of the funds would be to develop new skills among the rural population so that they might not labor indefinitely without hope of overcoming the worsening relative agricultural position. With export earnings from new industries the country could import food for less than producing it domestically. If the same climate conditions face the country, but now the rest of the world is more severely affected by climate change the conclusion is reversed. The country cannot only produce food more cheaply itself but may find itself with a growing and profitable agricultural export industry. In a broad context, cultural values and environmental policy goals need to be considered."

The issue of "carbon leakages" from sub-global policies was first identified by Edmonds and Reilly, 1983 recognizing that significant reduction in fossil fuel demand would lower world prices for fuels and spur consumption in uncontrolled regions. A part of this response to price could involve energy intensive industry relocating to regions without controls. The location of, for example, aluminum and chemical production has historically been quite sensitive to energy prices. The result is that part of the carbon reductions in the

controlling region are offset by increases in carbon emissions elsewhere. Succeeding analyses (Whalley, OECD, McKibben and Wilcoxon) have used more sophisticated models to estimate the extent of such leakages and the importance of different channels of leakages. the extent of leakages and the importance of different channels depends on fairly uncertain parameterizations of international trade relations and have sometimes been limited by structural aspects of the model used. For example, the OECD GREEN model does not model international capital flows as endogenous which restricts the relocation of industry. Aggregation of industries into broad groupings have also led to the modeling of international trade using so-called Armington assumptions. The Armington trade assumptions tend to retain status quo production shares unless Armington elasticities are very high. Greater disaggregation of industries and better analysis of the forces that contribute to industry location decisions over the longer run are needed to better resolve these issues. Econometric estimation of elasticities could help but, typically, there has been skepticism that econometrically estimated trade elasticities can estimate long run responses. Instead time series data may show highly inelastic trade demand elasticities stemming from longer term contracts and delayed shipment. (E.g. the case of agriculture, Gardner, JEL, ?)

Owners of energy resources or intellectual property rights to alternative energy production technologies stand to be most affected if stringent control policies are implemented. OPEC countries, for example, could be significantly affected by fossil fuel taxes and differentially affected depending on whether they levy taxes on production or consuming countries levy taxes on consumption. The resulting effect on trade flows would be the same but the distributional implications would be quite different. (See Edmonds, et. al. 1993). More generally, countries with significant coal and oil resources would suffer comparative advantage (and absolute) losses. Countries with tradeable alternative energy resources (biomass, uranium) could benefit. Also countries positioned with advanced conservation technology and highly energy-efficient production techniques could benefit through trade in the technology. Countries with renewable resources that are difficult to trade (wind, solar) may become more desirable industrial or residential locations.

The flow in financial resources could become quite large under some schemes to allocate emissions rights. Edmonds et.al. find flows ranging from about \$50 billion in the year 2000 up to \$2 trillion by 2100 under some schemes for allocating emissions permits. Essentially controls create a property right on atmospheric carbon disposal that may become quite scarce and valuable with significant incentive for global trade in these rights.

IX. DEVELOPING NATIONAL ACTION PLANS

For Developed countries

****To be drafted --1 p.****

For LDCs

**** Xie (China) to draft --1p.****

The Need for coordination of national action plans

****To be drafted --1/2 p.****

Scope for regional, international cooperation

****To be drafted --1/2 p.****

X. Basic Taxonomies of Emissions

****To be drafted --1 p.****

****Note: this Section on Kaya identity to be moved earlier****

IPCC SECOND ASSESSMENT REPORT
WORKING GROUP 3
SCOPE OF THE ASSESSMENT

Contributors: Howard Gruenspecht, John Reilly, Ray Squitieri, Tom Teisberg, Rodney Weiher

Notes:

1. Page length estimates below are for *this format*, i.e. single spaced.
2. Headings have not yet been standardized (e.g. section headings in 12 pt. bold caps). I'll fix that.
3. This draft consists of several pieces separately written and lashed together. Several sections, noted below, are still to be written. Others, also noted, must be condensed, simplified, or clarified. The flow of the argument is necessarily still rough. We will work on that.

I. OVERVIEW OF CLIMATE CHANGE ISSUES

**** To be drafted by Ray--2 pages****

Regional changes and sources
Relation to consumption and development
Disparity in consumption in North (development) vs. South (survival)
Awareness of issues

II SUSTAINABLE DEVELOPMENT

****Material for several sections here has been drafted by Roger Dower but not yet incorporated into this copy. Still awaiting material from Joel Scheraga ****

Basic concept and implications for limiting climate change
Equity and social aspects with respect to development
Distribution effects (from Chapter III)

Special role of LDCs in climate change

**** Will be drafted by Ruby Saha, Mauritius --1 p.****

Expected population change
Fuel efficiency
Reliance on fossil fuels
Rapid changes in output per capita

What can developed countries do to reduce first 3?

Need and scope for joint actions (public goods problem)
Role of joint implementation

Special policy instruments for mitigating and adapting

**** Scheraga to draft --1/2 p.****

Is fossil fuel usage consistent with sustainable development?

**** To be drafted ****

Forestry

**** To be drafted ****

Implications of climate change for sustainable development

**** To be drafted ****

Discounting problems **** Scheraga to draft --1/2 p.****

Distribution effects **** Scheraga to draft --1/2 p.****

Importance of International Agreements

**** To be drafted ****

Computers
 Advisory
 (1-75)
 Computers
 Profith - 1-1-1
 LR structure & structure superstructure
 M. to do - separate
 Interaction flow as
 entire flow
 convergence

[DBS
 Arbats Regional production
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] Comm carrier
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 100. wireless
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Prod. ad. Apt

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 Comm
 1-1-1
 Local loop
 Aberdeen

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL OF ECONOMIC ADVISERS

DATE: 10/6/93

TO:

Joe Stiglitz

FROM:

Jonathan Wiener

Re: EDF letter on Climate Plan

Joe - I was cc'd on this letter from EDF. It arises from a meeting EDF had with Katie last week, similar to your meeting with EDF earlier this summer.

I think the Plan already incorporates most of what EDF is urging - monitoring, tracking progress, reassessing & adjusting - thanks in part to CEA. —



→ JES - JW
F CMC

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October 4, 1993

Ms. Kathleen McGinty
Deputy Assistant to the President and Director
of the Office of Environmental Policy
Office of the Vice President
Old Executive Office Building, Room 360
Washington, D.C. 20506

Dear Katie,

Thank you for meeting with Fred Krupp recently to discuss development of the National Action Plan (NAP) to address greenhouse gas emissions.

As Fred emphasized, we believe that the measure of the President's commitment and the U.S.'s success in meeting it is not the accumulation of a list of government policies and programs "scored" by optimistic computer projections of their efficacy, but the curbing of actual greenhouse gas emissions. For this reason, we have advocated throughout this process a framework that, in the spirit of reinventing government, establishes a comprehensive, competitive framework for fostering innovative government and private sector actions to address the greenhouse challenge.

Attached you will find a package of briefing materials that we shared with your staff and Administration colleagues throughout the summer. In it, we outline a NAP that, founded on a reiteration of the President's pledge and a rigorous emissions accounting system, creates a mechanism that would ensure that continuing emissions reductions are achieved by a dynamic, open-ended process that emphasizes actual emissions reduction efficacy, innovation, and cost-effectiveness. This proposal, combined with appropriate tax and regulatory measures that meet the same criteria, would endow the NAP with the critical, dynamic capacity necessary to foster the kind of continual innovation that is essential to addressing greenhouse gas emissions. In contrast, a NAP that fixes in place a specific set of ideas formulated over a short period of time to govern our nation's policy for years in the future runs the risk of institutionalizing government programs which then would be unable to adapt to changing needs and less effective at achieving emissions reductions.

Whatever the final shape of the NAP, emissions projections must give way to emissions monitoring and tracking. We believe that the NAP will fail the first test of adequacy if it does not include a specific program for tracking and monitoring actual annual greenhouse gas emissions through 2000. Fortunately, the building blocks for such a program already exist. For example, the Energy Information Administration and the Department of Energy compile data on
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Ms. Kathleen McGinty

October 4, 1993

Page 2

fuel use and the Clean Air Act requires utilities to monitor carbon dioxide emissions. The fact that these activities and/or requirements are already in place does not obviate the need for their express inclusion in the NAP.

Existing data-collection and emissions-monitoring efforts must be incorporated in the NAP explicitly along with any provisions to expand the tracking and monitoring that may be necessary to make an ongoing assessment of actual annual greenhouse gas emissions. In this regard, it is particularly important to improve existing methods of assessing and accounting for carbon uptake by sinks, while carefully scrutinizing the emissions reduction performance of each measure adopted under the NAP. This data should be published as part of an annual report open to public comment on the implementation of the National Action Plan, describing and accounting for progress towards greenhouse gas emissions reductions. Consideration should be given to revising the way the greenhouse gas inventory data is aggregated, to maximize its usefulness to policy-makers.

In addition, the NAP must specify a mechanism for evaluating on a biennial basis progress towards returning emissions to 1990 levels by the year 2000, and for increasing emissions reduction efforts based upon these evaluations. For the purposes of these assessments, it is essential that greenhouse gas inventory data be used as the key indicator of the progress of emissions reduction efforts. Evidence that U.S. emissions have begun to decrease should be apparent no later than 1995. Based upon the results of annual emissions inventories, an inter-agency working group should evaluate whether emissions reductions are being achieved, whether the U.S. is likely to return to 1990 emissions levels by 2000, and whether a downward emissions trend is likely to continue thereafter. If these three criteria are not met, the Administration should have a mechanism in place to convene a NAP revision process and adopt additional measures to ensure that U.S. emissions reduction targets, including continuation of the downward emissions trend beyond 2000, will be achieved.

Because of the action plan's sensitivity to extremely uncertain economic conditions, Congressional funding, and the success of voluntary programs, the NAP must place great emphasis on the establishment of credible monitoring, assessment, and mid-course correction mechanisms to ensure that the President's emissions objectives are met. The Environmental Protection Agency should be assigned a leading role in helping to oversee the implementation of the NAP through these mechanisms. We believe that if the Administration postpones consideration of these "process" issues until a later time, the credibility of the entire action plan may be fatally weakened.

In addition to creating these mechanisms for monitoring, evaluating, and strengthening the NAP in the future, the Administration should establish processes adding important elements to the action program in the near-term. Of particular importance are additional efforts in the transportation sector, where we understand the NAP will be weak, addressing both automobile fuel efficiency and vehicle miles travelled, as well as in the residential and commercial buildings sectors.

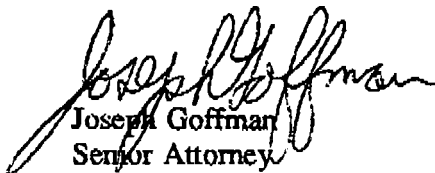
Ms. Kathleen McGinty
October 4, 1993
Page 3

In announcing its plan the Administration should also call for a strengthening of the U.N. Framework Convention on Climate Change at the first Conference of the Parties. At a minimum, such strengthening should include binding commitments for industrialized countries to cap emissions at 1990 levels by the year 2000, and to produce action plans to continue the trend of emissions reductions thereafter. By obtaining commitments from the other industrialized countries to do the same, the Administration can help build confidence that the U.S. is not acting in isolation to limit greenhouse gas emissions. We believe that such a statement would usefully build upon President Clinton's speech before the U.N. this week, where he stated, "We are working to make sure that all nations meet their commitments under the Global Climate Convention."

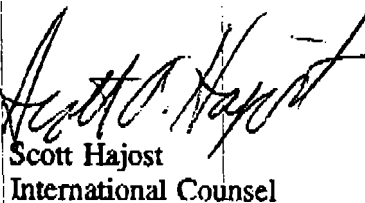
Finally, we hope that the Administration will use the opportunity presented by the NAP's release to emphasize the very real environmental and economic threats posed by anthropogenic climate change, and the need for action in the private sector and at all levels of government. Despite the mainstream scientific community's repeated calls for aggressive measures to limit greenhouse gas emissions, a recent "anti-environmental backlash" in the popular media has used questionable science to skew the public debate on climate change. A clear statement that the United States supports the findings of the Intergovernmental Panel on Climate Change and the goals of the Climate Convention would help bring sound science back into the center of public debate on greenhouse gas emissions reduction policy.

Thank you very much for your time and continuing attention to these issues. We would welcome the opportunity to meet with you and other officials as appropriate to discuss these matters prior to finalization of the plan. When the plan was delayed in August, our expectation was that meaningful opportunities would be provided to consult further with the Administration on the plan. At this point, we are growing concerned that the development of the NAP, initially an open process, has become closed, which has implications for our ability to provide both useful input, and an assessment of the plan's quality.

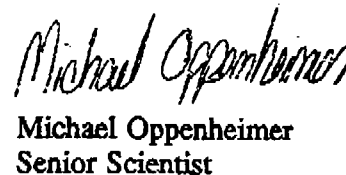
Sincerely yours,



Joseph Goffman
Senior Attorney



Scott Hajost
International Counsel



Michael Oppenheimer
Senior Scientist

cc: Timothy Wirth
Eileen Claussen
David Gardiner
T.J. Glauthier

Dirk Forrister
Robert Watson
Will Martin
Jonathan Wiener

THE U.S. NATIONAL ACTION PLAN

Greenhouse Gas Reduction Policy or Elbowing at the Budget Trough?

ENVIRONMENTAL DEFENSE FUND

In the spirit of reinventing government, the NAP should establish a comprehensive, competitive framework for fostering innovative actions, by both government and the private sector, to address the greenhouse challenge. Founded on a reiteration of the President's pledge and rigorous emissions accounting, the NAP should create a mechanism that would ensure that the President's pledge is met by a dynamic, open-ended process that emphasizes actual emissions reduction efficacy, innovation, and cost-effectiveness.

Under EDF's proposal, the Federally-funded programs to achieve emissions reductions would not be rigidly prescribed in the NAP. Rather, the NAP would operate through a Greenhouse Gas Reduction Fund (financed from the same sources that otherwise would support prescribed government programs and activities and from a portion of the funding authorized under Title XVI of the National Energy Policy Act). Federal agencies and private parties would submit bids for financing, and bids would be ranked on the basis of cost-effectiveness, quality of reductions, innovation, leveraging of private sector resources, and stimulation of U.S. market opportunities. The President's Council on Sustainable Development could play a role in recommending awards. Funding levels are provided for illustrative purposes only; a further assessment would be needed to determine the actual funding levels necessary to ensure this program's success.

Of course, establishing this system would not detract from the need to pursue appropriate effective, innovative, and cost-efficient changes in the tax and regulatory codes at all levels of government to promote reductions in emissions of greenhouse gases.

KEYS TO GHG STRATEGIES

- ◆ There are many paths between the present and 1990 GHG emission levels by the year 2000
- ◆ The paths vary critically by the policy framework and the nature of the incentives provided
- ◆ The paths vary in the timing and type of energy and control technologies
- ◆ The paths vary in cost, but all hit the target
- ◆ The paths vary in environmental benefits
- ◆ As with Acid Rain, overcontrol through the banking of early reductions substantially boosts environmental performance and lowers cost
- ◆ Early reductions are environmentally superior

IMPLICATIONS FOR THE NATIONAL ACTION PLAN

- ◆ Demonstrate that the Administration will deliver on the President's commitment without harming the U.S. economy
- ◆ Be robust across a range of economic outcomes
- ◆ Illustrate the diversity and breadth of feasible alternative paths
- ◆ Focus on creating a framework building toward an eventual legal and regulatory strategy
- ◆ Keys to Cost-Effectiveness are:
 - ☑ setting the constraint firmly
 - ☑ flexibility, not rigid allocations
- ◆ Competition and potential reward is the key to ingenuity, creativity and innovation
- ◆ Potential for future credit can lead to early reduction and enhance the President's Pledge

GHG Reduction Program

DISADVANTAGES OF RIGID ALLOCATIONS

- ◆ Expectation of legislation and/or funding
- ◆ Agency Turf Battle rather than cooperative consensus
- ◆ Exclusive not Inclusive
- ◆ Multiple sub-targets instead of **ONE GOAL**
- ◆ Many opportunities to fail in meeting expectations

NATIONAL GHG REDUCTION FUND

- ◆ Create a National GHG Reduction Fund
- ◆ Federal Agencies submit bids for National GHG Reduction Fund
- ◆ Bids ranked on the basis of:
 - ☒ cost-effectiveness
 - ☒ quality of reductions
 - ☒ innovation
 - ☒ leverage of private sector resources
 - ☒ stimulation of U.S. market opportunities
- ◆ *skipped* Bids ~~evaluated~~ by the Director of Climate Protection
- ◆ Award recommendations made by the President's Council on Sustainable Development
- ◆ Initial Funding at \$25,000,000 for FY94

JOINT IMPLEMENTATION GHG REDUCTION FUND

- ◆ Create a Separate Joint Implementation GHG Reduction Fund
- ◆ ~~Allow both private and public sector proposals to the Fund~~
- ◆ Procedures for review and recommendation same as National GHG Reduction Fund
- ◆ Initial funding at \$25,000,000 (50% of FY94 money for Section 1609)

GHG REDUCTION ACCOUNTING SYSTEM

- ◆ Key to credibility
- ◆ Develop a Double Entry Bookkeeping System
- ◆ Use Section 1605 of the National Energy Policy Act as a building block
- ◆ Use CAA utility CO₂ Monitoring Requirement
- ◆ Utilize existing Energy Information Agency data collection authorities
- ◆ Require annual GHG emission reporting for major source categories patterned after SARA Title III Reports
- ◆ Commit to Annual Progress Reports
- ◆ Encourage the development of independent auditing and certification capabilities for GHG reductions
- ◆ ~~Extend to other nations through Country Studies and as a requirement for partners in Joint Implementation~~

THE CLIMATE CONSERVANCY

- ◆ Not-for-Profit Organization providing:
 - ✓ reduction auditing and certification
 - ✓ annual reporting to Section 1605
 - ✓ offset portfolio guarantees
 - ✓ offset demonstration projects
- ◆ Board of Directors drawn from Environmental Organizations
- ◆ Membership from Companies Voluntarily Reducing GHG
- ◆ Companies sign a Climate Compact with the Climate Conservancy:
 - ✓ committing to pre-specified reduction targets
 - ✓ annual auditing of performance
 - ✓ guaranteed per ton payment to the Climate Conservancy for any reduction shortfall
 - ✓ Conservancy purchases required reductions
- ◆ Conservancy funded by a per ton registration fee paid by participants
- ◆ Conservancy-facilitated trading among participants allowed

ALTERNATIVE MECHANISMS TO CLOSE ANY REDUCTION SHORTFALL

- ◆ Voluntary Programs - Taking the Pledge
- ◆ National Commitment to a large fund for extra Joint Implementation
- ◆ Require the Offset of Major New GHG Sources constructed after 1990
- ◆ Require the prorata Offset of GHG Emissions Reduction Shortfall by Major Source Category Share
- ◆ Insitute a larger Energy-related Tax designed to cover the required GHG reduction gap
- ◆ Administartion Commitment to seek Legislation requiring specific GHG Reductions and/or measures
- ◆ Administration Commitment to seek Legislation Capping GHG Emissions

U.S. NOW LEADS ON CLIMATE CHANGE

- ◆ EEC has economic problems
- ◆ Governments rethinking Rio commitments

U.S. SHOULD AGGRESSIVELY PROMOTE COST-EFFECTIVE STRATEGIES AS A FOUNDATION FOR A PROTOCOL

- ◆ Energy Efficiency
- ◆ Environmentally Effective Technology
- ◆ Sinks
- ◆ Joint Implementation

U.S. CAN INCREASE POTENTIAL FOR GLOBAL COOPERATION AND PARTICIPATION

- ◆ Ensure that Section 1605 includes international investments
- ◆ Foster high quality demonstration projects
- ◆ Tie Section 1605 to an Accounting Framework and promote its use in both country studies and for partner countries under Joint Implementation
- ◆ Joint Implementation leverages public funds for sustainable development by unleashing private sector

KEY ELEMENTS OF STRATEGY

- ◆ Firm commitment to Goal
- ◆ Stringent Accounting and Reporting System
- ◆ Robust over Economic Assumptions
- ◆ Flexibility in Alternative Paths
- ◆ Encouragement for Early Reductions
- ◆ Aggressive Leadership in:
 - ☒ Development
 - ☒ Demonstration
 - ☒ Public Outreach

ENVIRONMENTAL DEFENSE FUND

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Tel: 202-387-3500 Fax: 202-234-6049
Internet: todd@edf.org EcoNet: edfclimate

URGENT—PLEASE DELIVER TO ADDRESSEE

TO:	AT FAX #:
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Timothy Wirth, DOS	647-0953
Eileen Claussen, NSC	395-1590
David Gardiner, EPA	260-0275
T.J. Glauthier, OMB	395-4639
Dirk Forrister, DOE	586-7644
Robert Watson, OSTP	395-3719
Will Martin, NOAA	482-4307
Jonathan Wiener, CEA	395-6947

DATE: October 4, 1993

PAGES (total): 10

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GPO (CNS)

Summary of Advantages of JI

Credible Joint Implementation actions:

- are specifically encouraged in the Climate Convention;
- would help reduce the buildup of global concentrations, which is the environmental issue of concern;
- could dramatically assist developing countries toward sustainable development and lower-emissions growth paths;
- could help spread American environmental technology in growing overseas markets;
- could make a real difference in protecting threatened forests, a most serious and immediate global environmental crisis;
- would face up to the global challenge with American leadership and partnership, not isolationism
- and, last but not least, would improve cost-effectiveness, thereby:
 - fulfilling the President's directive;
 - doing the most to protect the climate with our limited resources; and
 - easing costs and reducing opposition, thus increasing the prospects that the Administration's climate protection plan will be applauded, not rejected as a dead-on-arrival, high-cost embarrassment.

Advantages of including JI in US NAP

1. More cost-effective climate protection

Greenhouse gases mix globally and have global effects, so reductions obtained anywhere on the planet are of global significance. International cooperation affords the opportunity to find the most cost-effective actions worldwide.

Likely cost savings: Costs of emissions abatement vary considerably across countries, so cost savings would be substantial.

- Cost savings from allowing JI under the proposed EC carbon tax have been estimated at over a factor of 50 -
- marginal cost savings of over 95% (Barrett, cited in Jones 1993).
- U.S. electric utilities are currently investing in emissions reduction actions overseas at a cost of \$1-\$5 per metric ton of CO₂, cost savings of over 90% compared to the cost of abatement (or state 'adder' rules) here.
- Total costs to meet a more stringent target (a Toronto-type target, in which OECD member countries must reduce their emissions by 20% below the 1990 level by 2010): allowing JI cuts total costs by over 50% (Bruniaux et al., OECD 1992).

Cost-effectiveness means:

- Protecting the climate most with limited resources
- Saving resources for investment in other social goals, including more climate protection
- Easing opposition to the Action Plan and climate protection generally, as the cost burden on domestic constituencies is reduced; thus increasing the prospects for effective climate protection.
 - Without the opportunity for JI, business and labor are sure to oppose the Action Plan; with JI, progressive industry members will endorse it. Major electric utilities and the United Mine Workers have been explicit on this point.
 - Key Democrats in Congress, including Phil Sharp and Robert Byrd, have said the Action Plan is a non-starter without JI.

2. Resource flows for cleaner development

- Best hope for helping developing countries make the transition to sustainable development; establishes private capital flows for lower-emissions development path
- Helps address largest future share of greenhouse gas emissions (developing countries)
- Gives developing country tangible incentive to participate in reducing global emissions; worth more to climate protection than symbolic action by industrialized countries

3. Environmental side benefits

- Forest & Biodiversity conservation. JI investments are the largest likely source of resources to protect the world's forests, which cover less than ten percent of the earth's land area but harbor half its species. Forest loss is ongoing at high rates; barring JI until after 2000 would write off much forest biodiversity to permanent loss.
- Local air pollution. Reducing GHG emissions in developing and Eastern European countries through energy efficiency programs and methane recovery can help reduce other air pollutants, such as SOx, NOx, and urban ozone.
- Gains for local populations. JI projects can contribute to prosperity, education and advancement for local populations in project host countries.

4. Global leadership on global issue

The Climate Convention specifically encourages JI activities.

In the post-Cold War world, a central organizing principle of our national security must be protection of the global environment. A Climate Action Plan that adopts a self-focused Fortress America approach would be unconscionable.

Excluding JI would be tantamount to environmental isolationism in the midst of a global challenge.

Disadvantages of including JI in the US NAP ?

1. "Reductions overseas may be uncertain" (risks of project failure, fraudulent claims, etc.)
 - Although there are some uncertainties, they are not unacceptably high. Measurement techniques can do a reasonable job of discerning credible reductions. Moreover, the cost of improving measurement is far lower than the cost (in environmental as well as financial losses) of excluding JI altogether.
 - Any uncertainties in JI projects apply equally to domestic actions; all actions face uncertainty, and all need to be credible (the only difference with JI is co-financing).
 - Uncertainty can be addressed through criteria, monitoring, crediting rules, insurance, etc. (Again, these tools apply to uncertainty in all actions, e.g. domestic voluntary/green efficiency programs.)
 - For example, policies can be designed to encourage improved measurement, such as by assigning benchmark credit for certain types of actions and putting the burden of proof on the project proponent to demonstrate greater effectiveness.
 - For example, credit for reductions can be recognized annually rather than "all up front," to avoid the risk of project failure after credit is claimed.
 - Ignoring emissions overseas will not make them go away. JI starts to help reduce global emissions.
 - Can't say "precautionary approach: uncertainty is no excuse for inaction on climate change," and then object to action because of some uncertainty!
2. Appearance that US is not achieving its own reductions; "disincentive to technical change in the US"; "escape from responsibility"
 - The US would be responsible for all the reductions in the NAP. US entities would finance the JI actions for which they are credited. There is no escape or free lunch.
 - Global reductions are what count to the climate. If the goal is protecting the climate, the issue is not whose pain, but how much emissions reduction.
 - Fundamentally shaping technical change in developing

countries toward a lower-emissions path will do far more to protect the climate than somewhat accelerated technical change in the US. The issue is emissions reduction, not using climate as a vehicle to engineer an agenda for social change.

- In persuading developing countries to reduce emissions, financial assistance matters more than symbols. Does anyone expect developing countries to start adopting targets just because the US acted alone? US action with some JI will do far more to reduce the future path of global emissions than will the symbol of US action without JI.

3. "It'll buy up all the developing countries' cheap reductions"

- All transactions need to be informed and voluntary. Developing countries will only invite JI projects and offer emissions reduction credits if they believe the investment offer is worth it. If they think the price is too low, they'll ask a higher price. The Convention negotiations show that the developing countries are intelligent, careful and effective bargainers, not pushovers.

- Developing countries will receive payment (in financial assistance, technology, etc.) for reduction credits, making them richer and better off. Emissions reductions they make in the future may actually be easier for them as they grow richer.

- Spending now to obtain low-cost reductions helps the climate. Early reductions are worth more environmentally than are later reductions. Barring JI would forestall climate protection.

4. "No agreed international criteria"

- The US can proceed with JI under its criteria for its NAP, while proposing these criteria to the INC/COP.

- Once international criteria are established, some JI projects might be partially disqualified, but that is a risk firms always take; indeed right now firms are starting to invest in JI even under the risk of total disqualification. Insurance and mutual funds can spread some of this risk.

- US leadership will help shape the international criteria and build a body of experience.

- Other countries are doing the same.

5. "Monitoring and verification raise issues of sovereignty."

- All actions, domestic or JI, require monitoring and verification. If Country A claims to reduce its emissions by some amount through a domestic action, other countries will want proof. Any international body conducting verification would want to investigate all actions, not just JI actions. JI simply adds the element of international co-financing.

6. "JI projects may result in 'leakage' (shifts in emissions to other locations, e.g. protecting one forest means more cutting elsewhere)."

- "Leakage" applies to all actions bearing on internationally traded commodities, not just JI actions. Emissions reduction actions in the US, for example, may shift emissions-intensive activities overseas.

- If protecting foreign forests would shift cutting elsewhere, so would protecting US forests (e.g. Pacific Northwest) -- with offsetting biodiversity losses as well as carbon losses. What real evidence of such shifts exists? Presumably the propensity for such shifts would depend on the characteristics of the specific project.

- "Leakage" seems more likely to result from reductions in US energy consumption, which reduces world fuel prices and thus increases consumption overseas, than from protecting forests. Hence, e.g., Green Lights' claimed emissions reduction estimates would have to be reduced by the increase in fuel consumed elsewhere.

7. "JI project emissions reductions need to be real reductions, compared to where the world would have been; we can't be sure the reductions obtained are real; host countries need baselines."

- JI reductions do need to be real reductions. So do all reduction actions, domestic and JI.

- Baselines can in many cases be established for each project, without a strict necessity of a national baseline. One can forecast where the facility/land and related areas would have been without the JI project. That is effectively what Green Lights does domestically, and what one country, e.g. the US, does when it limits national emissions without requiring both an agreed global baseline and monitoring of the effect of US actions on others' emissions.

- The Country Studies initiatives can help establish baselines for developing countries.
- The option of JI gives potential host countries an incentive to adopt credible baselines. Without JI, developing country emissions would still continue to affect the climate, but without good inventory and forecasting.
- Can't say "precautionary approach: uncertainty is no excuse for inaction on climate change," and then object to action because of some uncertainty!



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Quarles & Brady
Chairman

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North Carolina
Vice Chairman

Ned Helme
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Wyoming

Governor Tommy Thompson
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*Executive committee member

444 North Capitol Street
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202/624-7709

TO: Interagency Analysis Team, Global Change Mitigation Group
FROM: Ned Helme, Executive Director, Center for Clean Air Policy
DATE: July 5, 1993

RE: NEW REPORT ON OPTIONS AND COSTS FOR CUTTING CO₂
EMISSIONS IN THE UTILITY SECTOR

As a member of the Interagency Analysis Team, I thought you would be interested in the Center for Clean Air Policy's most recent publication, ***Cooling the Greenhouse Effect: Options and Costs for Reducing CO₂ Emissions from the American Electric Power Company.***

This two-year study investigated the options and costs of cutting carbon dioxide emissions of one of the nation's largest investor-owned electric utilities -- American Electric Power Company (AEP) -- by 20 percent below 1989 levels by 2015. The study evaluated the role that a wide range of supply-side, demand-side, and offset alternatives would play in a least-cost strategy for meeting the emissions limit. The modeling was completed using ICF Resource's Integrated Planning Model. The characterization of all mitigation options was based on published sources and was guided by our National Dialogue Group -- which includes representatives from federal and state energy and environmental agencies, environmental groups, utilities and energy companies, and others.

The study found that:

- ❖ Energy conservation is the least-cost strategy for reducing CO₂ emissions. Because AEP has made only very limited investments in demand-side management measures (DSM), cost-effective DSM programs would yield a 15-18 million ton per year (CO₂) cut in projected emissions. This is about one third of the cut needed to meet the 20% reduction limitation.
- ❖ If tree planting, improved forest management (enhancing sinks) and coalbed methane recovery are credited where cost-effective, their use significantly reduces the cost of compliance with the emission limits. Compliance costs were one-tenth as high when these options were used.
- ❖ Global climate change policies should ensure flexibility is allowed in molding compliance strategies. Flexibility to choose among a wide range of supply-side, DSM, and offset alternatives recognizes the important differences between utility systems and dramatically reduces the potential costs of achieving significant CO₂ emissions cuts.

We hope that the results of this study prove helpful to you as you continue work on revising the National Action Plan. Please feel free to call me at (202) 624-7709 if you have any questions about this or any of the Center's other projects.



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COOLING THE GREENHOUSE EFFECT

Environ
(CCM)

F. Enron (CCM 6)

Climate Change Action Plan

Timing

Basic policies agreed

Draft still being refined

Announcement: Oct. 4

President's April 21 commitment

"... commitment to reducing our emissions of greenhouse gases to their 1990 levels by the year 2000. I am instructing my administration to produce a cost-effective plan ... that can continue the trend of reduced emissions. This must be a clarion call, not for more bureaucracy or regulation or unnecessary costs, but instead for American ingenuity and creativity..."

Institutional components of cost-effectiveness

Low-cost actions selected: yes
(optimistic calculations)
(role of Working Groups, IAT, DOE)

All greenhouse gases (CO₂, CH₄, N₂O, HFCs): yes

Sinks as well as sources: yes

Joint Implementation: prospectively

Achieving the commitment

Base year emissions

Baseline forecast for 2000

Needed to return to 1990 level: 116 or so

Issues re Actions:

- cost/effectiveness
- uncertainties
- discounting
- jobs impact

Monitoring & evaluation

Beyond 2000

DRAFT

Emissions
(CCMB)

28-Sep 11:41 AM

Projected Greenhouse Gas Emissions

(Million Metric Tons of Carbon Equivalent)

Methane Benchmark	1990	2000	2010
Methane	165.5	150.5	156.3
Adder	7.9	7.9	7.9
EIA Benchmark	173.4	158.4	164.2

Nitrous Oxide Benchmark	1990	2000	2010
Nitrous Oxide	20.0	16.4	17.9
Adder	5.0	5.0	5.0
EIA Benchmark	25.0	21.4	22.9

Total Greenhouse Gases	1990	2000	2010
Administration Baseline			
Carbon	1,237.0	1,343.8	1,521.0
Methane	173.4	158.4	164.2
Nitrous Oxides	25.0	21.4	22.9
HFC's	20.0	45.0	70.0
Total GHGs	1,455.4	1,568.6	1,778.1

Combined Policy Case	1990	2000	2010
Carbon	1,237.0	1,265.1	1,410.6
Methane	173.4	142.1	142.0
Nitrous Oxides	25.0	19.9	21.4
HFC's	20.0	33.5	?
Total GHGs	1,455.4	1,460.6	?

Reductions from Baseline	1990	2000	2010
Carbon		78.7	110.4
Methane		16.3	22.2
Nitrous Oxides		1.5	1.5
HFC's		11.5	?
Total GHGs		108.0	?

Amount Needed to Stabilize (Combined Policy - 1990 Emissions)	1990	2000	2010
Carbon		28.1	173.6
Methane		(31.3)	(0.1)
Nitrous Oxides		(5.1)	1.5
HFC's		13.5	?
Total GHGs		5.2	?

28-Sep 11:41 AM

Projected Carbon Emissions for Domestic Actions Only*
(Million Metric Tons)

Model Outputs			
Plan	1990	2000	2010
Administraton Baseline	1,338.0	1,444.8	1,591.0
Combined Policy Case	1,338.0	1,382.6	1,496.1
Difference	0.0	62.2	94.9
Adjustments for Feedstocks and Cement			
Plan	1990	2000	2010
Administraton Baseline	29.0	29.0	29.0
Combined Policy Case	29.0	29.0	29.0
Difference	0.0	0.0	0.0
Sinks			
Administraton Baseline	(130.0)	(130.0)	(99.0)
Combined Policy Case	(130.0)	(146.5)	(114.5)
Difference	0.0	16.5	15.5

Total Carbon

	1990	2000	2010
Administraton Baseline	1,237.0	1,343.8	1,521.0
Combined Policy Case	1,237.0	1,265.1	1,410.6
Difference	0.0	78.7	110.4
Amount Needed to Reduce to 1990 Levels		28.1	173.6

* Excludes Methane, Nitrous Oxides, and HFC's

9/28/93
1-pagers will be
fixed to match this table.

Option Summary Sheet

DRAFT

					(1)	(2)	(3)	(4)	(5)	(6)
Plan Element Number	Policy	Title	Approx. Carbon Reductions in 2000 (MMT) (will round up) model	Need to scale this back to = Cumulative Carbon Reductions Through 2010 due to investments through 2000	Cost in \$1991 (Millions)					
					Cum. Federal 1994-2000 over FY94 baseline	Undiscounted Cum. Non-Federal Capital Outlay 1994-2000 need to define - not really greater than Invest from baseline macro sense some shifting in Fed footnote.	Undiscounted Cumulative Value of Energy Savings: 1994 - 2000 for Investments through 2000	Undiscounted Cumulative Value of Energy Savings: 2001 - 2010 for Investments through 2000		
ENERGY SUPPLY OPTIONS										
Enhanced Natural Gas Utilization										
1	ES3	Climate Challenge/Commercialized High-Efficiency Gas Technologies	0.6	32.0	\$62	\$140	\$68	\$626		
2	ES29	Climate Challenge/Seasonal Gas Use	2.8	50.0	\$0	(\$925)	(\$463)	(\$942)		
Improved Energy Efficiency										
3	ES73	Climate Challenge/Reduces Electric Generation Losses Through Transmission Pricing Reform	0.8	7.0	\$0	(\$5)	\$276	\$1,037		
3a		Federal Electric Power Reforms (PMA in NPR)	0.8	11.0	(\$3,900)		(-) TK	(-) TK		
4	ES47	Climate Challenge/Efficiency Standards for Electric Transformers	0.8	11.0	\$7	\$486	\$278	\$595		
5	ES74	Climate Challenge/Energy Star Transformers								
Enhanced Renewable Commercialization										
6	ES9/10	Climate Challenge/Renewable Energy Market Mobilization Collaborative	0.8	146.0	\$116	\$52	\$280	\$1,114		
7	ES8	Climate Challenge/Expanded IRP EPA new prog. to intervene in state IRP hearing	1.4 +	18.0	\$46	\$39				
Improve Performance of Existing Zero Emissions Tech.										
8	ES4	Climate Challenge/Retain/Improve Hydro Generation	2.0	16.0	Leasing (\$597)	\$1,500	\$554	\$2,510		
Combined Results					9.3	261.0	(\$4,266)	\$1,287	\$994	\$4,940

Quantity
this is due
to investments
over 1994-2000 -
not comparable to
rest of table.

Approx.
Carbon
Reductions
in 2000
(MMT)

(will
round
up)

model

Range?

(revise to track
back-calculate col. 6)

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define -
not really
greater
than Invest
from
baseline
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Do not always =
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chart of "Heavy Hitters" or
"Extra-Base Hts" - actions
with big (750-7) over constant
return) impact after 2000.

Option Summary Sheet

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					Cost in \$1991 (Millions)			
Plan Element Number	Policy	Title	Approx Carbon Reductions in 2000 (MMT)	Cumulative Carbon Reductions Through 2010	Federal 1994-2000	Non-Federal Capital Outlay 1994-2000	Undiscounted Cumulative Value of Energy Savings: 1994 - 2000 for Investments through 2000	Undiscounted Cumulative Value of Energy Savings: 2001 - 2010 for Investments through 2000
			model					
RESIDENTIAL DEMAND OPTIONS								
		<u>Home Improvements</u>	4.4	90.0		<i>aggregate</i>		
9	RD12	Climate Challenge/Energy Efficiency and Housing Technology Centers	(approx)		\$105	\$2,392	\$1,381	\$5,959
10	RD7	Climate Challenge/Home Energy Rating Systems and Energy Efficient Mortgages			\$9	\$4,784	\$1,779	\$5,959
11	RD1	Building Standards			\$72	\$2,392	\$1,723	\$5,959
12	CD11	Cool Communities			\$14			
		<u>Appliance Improvements</u>	5.4	150.0				
13	RD2	Appliance Standards			\$0	\$5,163	\$4,150	\$22,864
14	RD4	Climate Challenge/Market Pull Incentives			\$60	\$14,342	\$5,300	\$17,862
		Combined Results	9.8	242.0	\$260	\$29,073	\$14,334	\$58,602
COMMERCIAL DEMAND OPTIONS								
		<u>Development, Commercialization, and Training</u>	5.1	71.0				
15	CD17	Expanded Cost-Shared Demonstration of Emerging Technologies			\$50	\$4,964	\$1,604	\$6,912
16	CD18	Climate Challenge/National EE Education and Training Program			\$25	\$7,197	\$2,444	\$10,532
17	CD19	Climate Challenge/National EE and Renewable Information Program			\$12	\$4,467	\$1,604	\$6,912
		<u>State Option</u>						
18	CD23	State Revolving Funds	1.1		\$50	\$4,268	\$1,741	\$7,505
		<u>Voluntary Commitment Programs</u>						
20	CD6	Climate Challenge/Expanded Green Lights	2.5	28.0	\$98	\$3,289	\$1,940	\$8,093
21	CD7	Climate Challenge/Coordinated DOE & EPA Buildings Programs	3.1	40.0	\$100	\$3,905	\$1,717	\$7,397
		Combined Results	10.8	142.0	\$335	\$28,090	\$11,050	\$47,350

Option Summary Sheet

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Plan Element Number	Policy	Title	Carbon Reductions in 2000 (MMT)	Cumulative Carbon Reductions Through 2010	Cost in \$1991 (Millions)			
					Federal 1994-2000	Non-Federal Capital Outlay 1994-2000	Undiscounted Cumulative Value of Energy Savings: 1994 - 2000 for Investments through 2000	Undiscounted Cumulative Value of Energy Savings: 2001 - 2010 for Investments through 2000
			model					
INDUSTRIAL DEMAND OPTIONS								
		Accelerated Efficiency						
23	ID5	Climate Challenge/Accelerate Adoption of Energy Efficient Technologies	1.8	31	\$34	\$179	\$234	\$1,813
24	ID32	Climate Challenge/Industrial Golden Carrots			\$14	\$192	\$421	\$1,371
25	ID10	Energy Analysis and Diagnostic Centers	0.6	13	\$31	\$154	\$281	\$954
26	ID13	Broad-Based Recycling <i>supermarket only - consistent w/ paper EO?</i>	4.2	83	\$25	n/a		
27	ID9	Testing/Labeling	9.0	145	\$6	\$55	\$63	\$431
28	ID19	Climate Challenge/Motor Challenges (modeled with ID9)			\$30	\$4,004	\$5,329	\$16,769
22	ID21	Climate-wise Companies (Green companies)			\$56			
29	ID?	Reduces Use of Pesticides and Fertilizers <i>- consistent w/ new USG policy?</i>	2.7	38				
	ID?	One-Stop Shop (in VP's NPR)	2.9	110?				
		Combined Results	18.2	307.0	\$140	\$4,584	\$6,329	\$21,339
TRANSPORTATION DEMAND OPTIONS								
30	AT9	End Federal Preemption of State Programs <i>not potato</i>	0.2	6.0	\$0	\$2,157	\$888	\$2,195
31	AT19	Fuel Economy Labels for Tires <i>too high?</i>	1.5	26.0	\$0	\$1,977	2805.8	\$11,934
32	AT_A	Parking Reform - Treasury's slimmed down city option - try to increase?	8.2	40	GAIN			
33	AT_B	Transportation System Efficiency Strategy <i>beef up write up</i>	5.6		\$36			
34	AT_A+B**	Parking Reform and Transportation System Efficiency Strategy	11.2	172.0	GAIN			
35	AT25	Telecommuting	0.2	5.0	\$0			
		Combined Results	13.1	208.0	\$36	\$4,134	\$3,694	\$14,129

** Not included in transportation combined results

Option Summary Sheet

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Plan Element Number	Policy	Title	Carbon Reductions In 2000 (MMT)	Cumulative Carbon Reductions Through 2010	Cost in \$1991 (Millions)			
					Federal 1994-2000	Non-Federal Capital Outlay 1994-2000	Undiscounted Cumulative Value of Energy Savings: 1994 - 2000 for Investments through 2000	Undiscounted Cumulative Value of Energy Savings: 2001 - 2010 for Investments through 2000
		FORESTRY CARBON SINK OPTIONS	off-line estimate					
36	SK1	Reduced Harvest, National Forest Service Lands	4.5	86.0	\$0	\$0		
37	SK20	Ecosystems Management	2.5	32.5	\$0	\$0		
38	SK7	Reduced Depletion of Nonindustrial Private Land	4.0	28.0	\$4	\$0		
39	SK2	Accelerated Tree Planting	0.4	15.0	\$71	\$36		
40	CD11	Cool Communities	0.1	9.5	see CD11			
41	ID13/SK3	Broad-Based Recycling - <i>Forest carbon sink</i>	5.0	142.3	see ID13			
		Combined Results	16.5	313.3	\$75	\$36	\$0	\$0
		HFC/Other Gases Options						
42	HFC1	Reduce HFC-23 Emissions in HCFC-22 Production	5.0	65.0	\$4	n/a	n/a	n/a
43	HFC2	Narrow Uses of High GWP Chemicals Under Sec. 612 of the Clean Air Act + <i>Product Stewardship</i>	<i>4.0</i> 5.0	n/a	\$7	n/a	n/a	n/a
44	HFC3	Voluntary Program to Reduce By-Product Emissions in the Aluminum Industry	<i>2.0</i> 1.8	12-24	\$4	n/a	n/a	n/a
		Combined Results	11.0	83.0	\$15	n/a	n/a	n/a

Option Summary Sheet

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Plan Element Number	Policy	Title	Carbon Reductions in 2000 (MMT)	Cumulative Carbon Reductions Through 2010	Cost in \$1991 (Millions)			
					Federal 1994-2000	Non-Federal Capital Outlay 1994-2000	Undiscounted Cumulative Value of Energy Savings: 1994 - 2000 for Investments through 2000	Undiscounted Cumulative Value of Energy Savings: 2001 - 2010 for Investments through 2000
		AGRICULTURE METHANE OPTIONS (CH ₄ GWP = 22)	off-line estimate					
45	ME1	Increase Stringency of Landfill Rule	3.4-5.0	37-55	\$0	n/a	n/a	n/a
46	ME2	Landfill Outreach Program	0.9-1.3	13-18	\$6	\$174	\$135	\$275
47	ME3a	Coalbed Methane Outreach Program	1.6-2.7	28-43	\$9	\$80	\$89	\$158
48	ME4	Expanded AgStar	1.0-2.0	15-28	\$26	\$135	\$118	\$178
49	ME5,6,7,8	Improve Ruminant Productivity and Product Marketing	1.0-2.6	14-37	\$27	n/a	n/a	n/a
50	ME9	Expanded Natural Gas Star (ME14 included here)	2.6-3.4	37-50	\$6	\$66	\$97	\$112
51	ME12	R&D for Methane Recovery from Coal Mining	1.0-1.8	22-40	\$15	\$200	\$120	\$810
52	ME13	R&D for Methane Recovery from Landfills	0.5-1.5	14-36	\$8	\$200	\$85	\$415
		Combined Results	12.0-20.3	180-307	\$97	\$855	\$644	\$1,948
		NITROUS OXIDES OPTION (N ₂ O GWP = 16.3)						
53	NO1	Improve Fertilizer Use Efficiency	1.5		\$21			
		Total for Energy Sectors *	62.5	1124.0	(\$3,495)	\$67,168	\$36,400	\$146,360
* Total reductions may not equal the sum of sectoral reductions due to synergistic effects.								
		Total for Non-Energy Sectors	45.3	656.3	\$209	\$891	\$644	\$1,948
		GRAND TOTAL	107.8	1780.3	(\$3,287)	\$68,059	\$37,044	\$148,308



F Enron (CCMG) MJB

American Public Power Association

2301 M Street NW
Washington, D.C. 20037-1484
202-467-2900

July 21, 1993

Laura Tyson
Chairwoman
Council of Economic Advisors
Old Executive Office Building, Room 314
Washington, DC 20500

Dear Chairwoman Tyson:

The American Public Power Association (APPA), the national service organization representing more than 2,000 local, publicly owned not-for-profit electric utilities throughout the country, applauds the administration's effort to return U.S. greenhouse gas emissions to their 1990 levels by the year 2000 through the use of voluntary efforts rather than command-and-control measures. While the causes and effects of human induced global climate change are still subject to debate and uncertainty, it is important to pursue national energy policies that are sound public policy irrespective of the final outcome of global climate change research.

To that end, APPA believes that the U.S. National Action Plan now undergoing revision should support the implementation of those national energy policies that make environmental and economic sense, including such plans that would:

- consider demand-side as well as supply-side measures in utility resource planning;
- promote the use of energy-efficient equipment and processes;
- accelerate research, development, demonstration and market commercialization of non-fossil electricity supply technologies; and
- promote the development of alternative fuel vehicles.

In addition to the above-cited principles drawn from APPA's global climate resolution, we urge the administration to consider a series of detailed options designed to minimize net U.S. greenhouse gas emissions through voluntary and cost-effective technology and efficiency improvement programs. These options are listed on the attached document.

Laura Tyson
July 21, 1993
Page Two

Thank you for your consideration. APPA looks forward to working with the administration on the inclusion of these and other strategies in the U.S. National Action Plan for minimizing greenhouse gas emissions.

Sincerely,

A handwritten signature in black ink, appearing to read "Larry Hobart", with a horizontal line extending to the right.

Larry Hobart
Executive Director

LH/mb
enclosure

cc: Jonathan Wiener
Joseph Stiglitz

AMERICAN PUBLIC POWER ASSOCIATION

Options for Greenhouse Gas Emissions Reductions

- **Fully fund the EPACT Renewable Energy Production Incentive.** Sec. 1212 of the Energy Policy Act of 1992 gives authorization for a federal production payment of 1.5 cents/kilowatt-hour to consumer-owned (3,000 publicly and cooperatively owned) electric utilities who build renewable energy capacity. Renewable energy tax credits and incentives available to private entities are not available to not-for-profit consumer owned electric utilities.

An APPA survey of publicly owned utilities found that funding of the provision could spur at a minimum 2,000 megawatts of new renewables by 2003. Sustained, predictable funding of the production incentive would likely spur needed cost reductions for renewables, thus leading to even much greater market penetration. For FY95, funding of \$13 million is suggested. If consistently funded over the authorized ten year period, the production incentive will directly provide a conservative 2 million metric tons of carbon emissions equivalent reduction by 2000. Additional reductions are likely from the spurring of additional interest in renewable energy by consumer owned electric utilities, as well as resulting cost reductions that will increase interest in renewable energy by all sectors of the utility industry.

- **Assist implementation of integrated resource planning in the consumer-owned electric utility sector.** Many of the 3,000 consumer owned (publicly and cooperatively owned) electric utilities that reach one in four Americans already conduct integrated resource planning, but others do not. Efforts by the Department of Energy and the Environmental Protection Agency to work with state public utility commissions to encourage greater use of integrated resource planning and energy efficiency normally only reach investor owned utilities.

A coalition of the two national trade associations (APPA and the National Rural Electric Cooperative Association), federal power marketing administrations and the Tennessee Valley Authority have agreed to work together on a national effort to achieve maximum use of integrated resource planning and cost effective energy efficiency at the nation's 3,000 consumer owned electric utilities. Assistance by the federal government through the Department of Energy and the Environmental Protection Agency is needed to help develop and promote the tools and programs needed to carry out the ambitious goal.

Annual greenhouse gas reductions of 6 to 12 million metric tons of carbon emissions equivalent are possible by 2000 if an additional 1-2 percent of electricity is saved as a result.

- **Promotion of increased transmission access in the electric utility industry.** In order to reduce costs to the consumer and the nation through the promotion of increased competition in the heavily concentrated electric utility industry, Congress in the Energy Policy

Act of 1992, gave the Federal Regulatory Energy Commission clear authority to order an electric utility to provide access to its transmission lines to a third party. Increased "transmission access" will allow more competitive bulk power markets, with greater efficiencies and lower costs resulting. Transmission access will assist non-CO₂ emitting technologies such as renewable energy and demand side management programs. Utilities that experience loss of sales due to demand side management now have a greater chance of being able to sell Demand Side Management-idled capacity through increased transmission access, thus reducing a financial disincentive to utility-sponsored energy efficiency programs. Renewable energy is aided by allowing projects to be developed in areas that are resource-rich but are located far from population centers.

Through the Department of Energy, the Federal Energy Regulatory Commission should be encouraged to promote more efficient wholesale electric power markets, including the issuance of transmission orders by FERC to aid in effective movement of power.

- **Promote development and adoption of better electric transmission technology.** Increased economic growth and greater interconnection of electric utility power grids will stretch existing electricity delivery systems to their limits and create new requirements for flow control, system stability, and capacity enhancement. Development of non-CO₂ emitting renewable energy projects in remote areas, where much of the potential exists, will be aided by better technical means of getting power to where the people are. Flexible ac transmission systems (FACTS), based on advanced solid state controllers, have the capabilities that are needed, in contrast to today's mechanical switching devices. With FACTS technology, larger power flows can flow over longer distances without compromising system reliability.

Working with industry, the Department of Energy should co-fund development of FACTS technology, as well as promote its market acceptance. Currently, the Bonneville Power Administration, Tennessee Valley Authority, and the Western Power Administration all are planning to or are presently hosting demonstrations of early FACTS technology.

- **Increase renewable hydroelectric capacity and generation at existing federal and non-federal dams.** Hydropower resources have the potential to provide a greater portion of the nation's electric power needs without any additional emissions of carbon. This potential exists for two reasons. First, estimates indicate that hydropower output from existing projects can be increased as much as ten percent, or 8,000 megawatts, through efficiency improvements and operational changes. Secondly, at least 2,400 megawatts of hydropower potential exists at non-power dams that could be harnessed as new resources for electric utilities. Combined, development of these additional resources could offset carbon emissions 6 million metric tons per year by the year 2000.

Another method of increasing hydropower resources is to accelerate the relicensing process for non-federal hydroelectric projects at the

Federal Energy Regulatory Commission. Projects up for relicensing between now and 2010 represent 25,600 megawatts of hydropower capacity.

- **Assist accelerated market commercialization of fuel cells.** Natural gas-burning electrochemical fuel cells offer a 70-80 percent reduction in CO₂ emissions compared to today's fossil electric generation. Fuel cells are relatively small, modular devices that directly convert natural gas into electricity with minimal emissions. Their small size allow placement in a range of industrial, and commercial buildings, often allowing use of the waste heat for heating and cooling, as well as reducing electric line losses. Fuel cells also offer the potential of a large export market, with a large need for U.S. primary manufacturing. Prototype and demonstration fuel cells are being made by a number of U.S. and Japanese manufacturers, though additional demonstrations are needed to assure buyers of cost and performance.

Recognizing the fuel cell potential, a group of 40 utilities has formed the Fuel Cell Commercialization Group as an organization of potential fuel cell buyers. This utility-led group presently is several years into a commercialization plan that will result in the commercial market introduction of molten-carbonate fuel cells by 2000.

The Department of Energy should be directed to continue necessary funding levels over the next several crucial years to assist the fuel cell industry with successful market entry, as well as fund additional demonstrations to look at other fuel sources such as biomass. Cost-sharing by the federal government can help guarantee the development of a viable market by 2000 for a fossil generation technology that has very high CO₂ reduction capability.

- **Assist accelerated market commercialization of solar photovoltaics.** Photovoltaics are a renewable electric generation option that emit no CO₂. However, costs are still too high for widespread adoption by electric utilities, although niche markets are being developed. As a high tech technology suitable to mass production, photovoltaic costs will remain high until sufficient production volumes are achieved. But electric utilities and their consumers will not commit to major continued high cost. In response, a group of electric utilities representing one third of U.S. retail electric sales has formed the Utility Photovoltaic Group to provide a market-led pull to commercialize photovoltaics for cost-effective utility use. The Department of Energy should be directed to fully support with sufficient federal cost-sharing the effort by utilities and suppliers to jointly work toward cheap solar photovoltaics for electric generation by 2000.
- **Recognize the environmental benefits of the use of electricity as a transportation fuel and promote the commercialization of electric vehicles.** A significant environmental advantage of electric vehicles is their potential to reduce the emissions of greenhouse gases and improve air quality. Studies have shown that significant net emissions reductions will result when electric vehicles are substituted for gasoline vehicles. Based on the anticipated power mix in the year 2000, an electric vehicle would produce 28 percent less carbon dioxide

than a comparable gasoline-powered vehicle. One study showed that when the electricity is generated based on an overnight charging power mix predominantly reliant on natural gas, greenhouse gas reductions per electric vehicle would be 36 percent and nearly 100 percent if hydro, wind, nuclear or solar electric energy is used.

- Direct the Department of Energy to conduct a feasibility study for a regional Renewables Power Marketing Administration for the midwest and west. Just as the rationale for the creation of the Tennessee Valley Authority and the Bonneville Power Administration was regional economic development and job creation, a new Renewables Power Marketing Administration would develop job-intensive renewables. Wind and biomass are particularly suited to agricultural areas such as the midwest. This section of the country is rich in biomass and wind, yet faces more economic problems with the suggested reduction or elimination of various types of agriculture subsidies. Solar is suitable in the near term for areas in the west, such as the federally-owned Nevada Test Site.

Like the creation of the Tennessee Valley Authority and the Bonneville Power Administration, federal leadership can help revive a section of the country using an abundant local energy resource. A Renewables Power Marketing Administration could be established as a new organization or by expanding the authority of the Western Area Power Administration. The development of thousands of megawatts of renewable resources have the potential to displace between 1560 tons of CO₂/megawatt per year to 6480 tons of CO₂/megawatt per year.

- Improve utility distribution systems. Efficiency improvements not only improve the economics of power delivery to customers, they have significant potential to reduce carbon emissions. Overall distribution system losses dissipate approximately 5 to 8 percent of all electricity produced. The two components of all electric power distribution systems that contribute the greatest proportion of total system losses are distribution transformer cores, which account for approximately 40 percent of the distribution system losses, and high voltage primary conductors, which also account for approximately 40 percent of the distribution system losses.

Distribution transformer core losses can be reduced by optimally sizing transformers and/or switching to amorphous metal core transformers. Using these techniques it is possible to reduce core losses by 67 percent. High voltage primary conductor losses can be reduced by power factor correction, phase balancing, circuit conversion to higher primary voltages and reconductoring. Through these combined measures, primary conductor losses could be reduced by one-third. A "Green Distribution" or "Green Transformer" program, similar to existing Environmental Protection Agency programs, can be established by the Department of Energy or the Environmental Protection Agency to encourage utility distribution system efficiency improvements. Assuming an industry average distribution system loss factor of 6 percent, the estimated impact of distribution system loss reduction measures on carbon emissions is a decrease of approximately 14.1 million metric tons of carbon emissions per year.

- **Promote increased use of electrotechnologies.** Substitution of electric technologies for certain end uses can improve U.S. productivity, increase energy efficiency, and also reduce CO₂ emissions. Examples of familiar electrotechnologies include computers, fax machines, microwave ovens, cordless electric lawn mowers, lasers, and robotics. Faxing a 20 page document instead of overnight courier saves 2 pounds of CO₂. Less familiar CO₂-beneficial technologies available now or under development include microwave clothes dryers, infrared paint dryers, electric steel manufacturing, geothermal heat pumps, electronic mufflers, toxic waste disposal using vitrification. In all cases, these technologies substitute a more energy efficient electric technology for a less efficient conventional technology. For example, infrared and ultraviolet paint dryers can substitute for less energy efficient fuel-fired paint dryers.

To spur greater use of electrotechnologies, the federal government can (1) work with industry to accelerate development of electrotechnologies; (2) encourage increased market availability of appropriate environmentally-friendly electrotechnologies; and (3) increase national awareness of electrotechnologies. A program similar to the Environmental Protection Agency's Green Lights program can be used to promote greater usage of appropriate electrotechnologies. CO₂ reductions from greater use of electrotechnologies could reach 40 million metric tons of carbon emissions equivalent by 2000 and 100 million metric tons of carbon emissions equivalent by 2010.

- **Explore the role forestry offsets can play in strategies to reduce net CO₂ emissions.** As part of an overall reduction plan, forestry offsets offer a cost-effective and efficient means to sequester carbon for long periods of time and they provide utilities the time needed for development of new and less polluting methods of producing electricity. For nearly two years, APPA has assisted its members with community tree-planting activities to help meet environmental concerns of their consumers. Through its TREE POWER program, APPA encourages public power systems to implement tree-planting programs, with the goal of planting one tree for every customer served. With 100 percent participation, we can reach our national goal of planting 16 million trees, or one tree for every public power customer in the country.
- **Commercialize biomass for electric generation.** Biomass fuels result in zero net CO₂ emissions when grown on a sustainable basis. Use of biomass energy crops for baseload electric generation would significantly reduce CO₂ emissions, while at the same time creating many jobs in the depressed rural economy.

What is needed for utilities to commit to biomass are demonstrations of appropriate combustion technologies and methods together with assurance of reliable fuel supplies at an economic cost. A combination of changes to federal crop subsidy programs, joint industry/government demonstrations such as for biomass gasifiers, full funding of and changes to existing utility production incentives (Secs. 1212, 1914, and 1916 of the Energy Policy Act of 1992), and technical assistance would provide the necessary stimulus to obtain biomass market penetration.

High levels of biomass market penetration needed to achieve significant CO₂ reductions can only ever be achieved at the present level of low competing energy prices if existing United States Department of Agriculture support programs are reoriented to support energy crops. For example, subsidies paid to keep marginal land out of production (United States Department of Agriculture's \$2 billion Conservation Reserve Program) can be shifted to energy crops for electric power generation and transportation fuels for zero CO₂ emissions. The potential exists in many cases to even replace federal crop subsidies with revenue streams from private biomass energy crops, thus spurring economic development in farming communities and at the same time reducing the federal deficit.

- **Expand "Green Technology" voluntary programs.** Funding of an additional \$150 million should be provided to expand and create new federal programs that promote voluntary manufacture of energy efficient products and installation of energy efficiency measures. Currently, the Environmental Protection Agency Global Change Division sponsors a set of these voluntary programs, including Green Lights, Energy Star Computers, and the Golden Carrot Super-Efficient Refrigerator Program. The Green Technology programs concentrate on increasing the efficiency of electricity use, where cost-effective energy savings of 30-70 percent are possible. In addition to expansion of the Environmental Protection Agency's programs, where appropriate, other federal agencies should begin their own Green programs, or work jointly with the Environmental Protection Agency. If successful, expanded Green Technology programs could lead to 54 million metric tons of carbon emissions equivalent by 2000.
- **Establish a voluntary program with utilities, states, and the wind industry to accelerate installation of wind generating capacity.** Wind generating costs have fallen from 30 cents per kilowatt-hour in 1980 to 5-7 cents per kilowatt-hour today, with the potential to fall to a very attractive 3-4 cents per kilowatt-hour by 2000. Much of the remaining cost reduction will come by achieving the economies of mass production.

A voluntary collaborative commercialization effort can be used to aggregate a sufficient market to allow the wind industry to scale up manufacturing, thus lowering costs. The Department of Energy would serve as a catalyst, supplying technical assistance and ten percent cost-sharing of the projects. An 8,000 megawatt increase in wind capacity by 2000 would generate 18 billion kilowatt-hours, displacing 5-6 million metric tons of carbon emissions equivalent.

- **Expand development of very high efficiency gas turbines for electric generation.** Currently, gas turbine systems represent over 50 percent of new electric capacity installed, with a total of 7 gigawatts of capacity manufactured in the U.S. By 2000, the Department of Energy estimates that a market for 15 gigawatts annually of gas turbines may alone exist in the U.S. In addition, already substantial exports of gas turbines can be increased if super-efficient machines can be developed.

Funding should be provided for a proposed Department of Energy-led initiative to work with industry and utilities to commercialize gas combustion turbines by 2000 that are much more efficient than currently used. The proposed program aggressively speeds up turbine research and development, which to now has been largely dependent on military spin-offs. The payoff is a combustion turbine that is at least 60 percent efficient (simple cycle), in contrast to today's 30-35 percent (simple cycle) for gas turbines the 35-40 percent for a traditional coal plant. At a Department of Energy-forecasted market for utility-based turbine systems of 15 gigawatts annually after 2000, a CO₂ reduction potential of 3 million metric tons of carbon emissions equivalent annually exists. Such an estimate is conservative, as it is likely that very efficient gas turbines will take market share from new coal-fired electric generation.

- Develop "calorie counter" educational material to allow utilities and industry to adopt voluntary greenhouse gas reduction goals. Simple to use tools that list cost-effective voluntary measures and their greenhouse gas reducing equivalents are needed to encourage voluntary adoption of individual utility and industry goals.
- Accelerate research, development and demonstration on improved equipment efficiency. Over the past fifteen years a number of energy efficient products have come out of federally-funded RD&D, including electronic ballasts, low-e windows, heat pump water heaters, and better refrigeration compressors. It would be useful to expand the Department of Energy's RD&D program on building technologies, particularly shorter-term work jointly funded by private industry and the federal government. Many energy saving technologies have been partially developed by manufacturers, but work to complete their development is proceeding slowly due to cutbacks in private R&D budgets and market concerns. About 5.3 million metric tons of carbon emissions equivalent is possible in reductions.
- X ● Continue the development, and promote the export of clean coal technologies for industry, particularly those technologies designed to curb CO₂ and other greenhouse gas emissions. Given that coal remains the nation's most abundant and cheapest energy resource, it is likely that the U.S. and the world will continue its reliance on coal as a primary energy source. Clean coal technologies are an important option to promote the continued use of coal in a more efficient and environmentally sound manner both domestically and abroad. Many clean coal technologies near commercialization can boost generating efficiencies to the 40 to 45 percent range, resulting in significant CO₂ reductions. The U.S. National Action Plan should include a commitment to implement the Innovative Clean Coal and Renewable Technology Transfer Program authorized in the Energy Policy Act of 1992. It is noteworthy that 6.9 percent of the 14.6 percent anticipated overall CO₂ reductions achieved through the Energy Policy Act are achieved by the use of clean coal technologies world wide.
- Accelerate the issuance of energy efficiency standards. Under the Energy Policy Act, the Department of Energy must issue energy efficiency standards covering a range of products and buildings.

Energy efficiency standards are often the most cost-effective method to rapidly induce greater energy efficiency, bypassing the time delay and administrative cost of voluntary programs. The Department of Energy should be directed to aggressively develop and issue standards ahead of the statutory deadlines.

- **Retain existing nuclear capacity and continue research and development of advanced nuclear energy technologies.** Since nuclear plants emit no greenhouse gases, the federal government should take appropriate actions to keep existing nuclear capacity in operation through remainder of normal licensed life and support life extensions when appropriate for plants with good operating and safety histories. It is estimated that each thousand megawatts of installed nuclear energy capacity offsets 1.4 million metric tons of carbon emissions per year for fossil fuels.
- **Aggressively support implementation of energy efficient building codes by states and localities.** About 30 states have mandatory statewide codes, while another 20 leave the decision on code adoption to localities. Many codes have not been updated since the 1970s. Upgrade to the current CABO Residential Model Energy Code results in energy savings of 15-20 percent compared to earlier versions. New residential standards now under development will give another 20 percent improvement if adopted into building codes. Substantial energy can be saved if states adopt up-to-date codes. About 6 million metric tons of carbon emissions equivalent per year is possible if building codes are brought up-to-date and enforced.