ENVIRONMENTAL IMPACT DETERMINATION

Based on

The State Energy Conservation Plan and
Environmental Assessment

Submitted to the FEA by

The State of California for Approval and
Funding under the Provisions

of

Title III, Part C of the Energy Policy and Conservation Act;
State Energy Conservation Program

Prepared by

The Office of Energy Conservation
Federal Energy Administration

I. Introduction

Title III, Part C of the Energy Policy and Conservation Act (EPCA) establishes the State Energy Conservation Program (SECP). The SECP will provide up to $22.5 million to the States and Territories in FY 1977 and up to $50 million in FY 1978 for implementation of State developed and State administered programs. Under the FY 1977 funding formula, California is eligible for an award of $1,734,000. The objective of the SECP is to promote the conservation of energy and to reduce the rate of growth of energy demand.

An Environmental Assessment (EA) of the probable nationwide impacts of the SECP was under taken by FEA. On the basis of said EA, a Determination was published in the Federal Register, Vol. 41. No. 117 (June 16, 1976) as follows:

> In accordance with FEA's obligations under the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.), an evaluation of the potential environmental impacts of the program for State energy conservation plans has been prepared by FEA. While certain adverse environmental impacts have been identified, they were found not to be "significant" as that term is used under NEPA. The overall impacts of the various program measures taken either separately or in combination are clearly beneficial.
>
> The nature and degree of environmental benefit will vary, however, among State energy conservation plans and from program measure to program measure. In the final analysis, the content of any particular State energy conservation plan will be determined by many factors peculiar to that individual State; these include local economic, employment, environmental, social, geographic and climatic conditions.
>
> The FEA evaluation, therefore, in addition to describing the environment to be affected by the plans, the impact of alternative measures likely to be included in the various State plans, and the maximum probable environmental impacts from the implementation of plans in all States, provides formulas for the use of the States which will allow them to compute the environmental residuals likely to flow from measures they propose. This information will be included in the plan reports submitted by the Governors. Prior to approving any plan or making any grants, FEA will review each State's submission of environmental data to determine whether it entails any significant effects on the

environment. In any case in which
ficant effects, based on the infor-
d any supplemental information
nformed judgment, an environmental
ll be undertaken by FEA. In cases
termined to be no significant effects,
egative determination of environ-
ing the State's submission in lieu of
ntal assessment pursuant to 10 CFR

II. Findings

A review of California's proposed conservation plan has been completed, by FEA, with the following results and observations:

- o No significant adverse environmental impacts are expected to result from plan implementation;

- o Beneficial environmental impacts from plan implementation are expected to have results that substantially outweigh any adverse impacts - but which are, themselves, not considered to be "significant" within the meaning of NEPA;

- o The nature of the process by which California's plan has been developed has been such that the environmental factors have been identified and considered at each stage of development for each program measure.

III. Program Description

The objective of the SECP is the wise and efficient use of energy. That is:

- o To conserve energy - especially non renewable fossil fuels;

- o To increase the number of output units per BTU of energy input, e.g., miles per gallon of gasoline, square feet of building space illuminated, heated or cooled per kilowatt hour, therm or gallon, etc.; and, in general,

- To eliminate waste and inefficiency and, thereby, to promote economic, social, environmental and other benefits.

The program presently does not encompass, provide funding for, or otherwise encourage such actions as:

- Fuels switching;
- Changes in pollution control efforts, air or water quality standards, etc.

In other words, the program is designed to operate within existing social, economic, environmental, political, legal, etc. constraints. The most tangible environmental effects, therefore, are likely to be the changes in environmental residuals which result from the changes in specific fuel consumption. These changes in all cases are net reductions in fuel use and are calculated by subtracting any small increase in energy use that may be occasioned by a program measure from the larger savings. For example:

- Increased use of commuter vanpools, carpools, or mass transit will reduce vehicle miles travelled by removing a number of commuter automobiles from the road. Additional fuel consumed by vans, buses, remaining commuter autos with higher occupancy rates and by autos left at home as a result of the program must be subtracted in order to arrive at a net savings estimate.
- Reduced lighting levels in some buildings will, during the heating season in some climates, slightly increase fuel requirements for heating and decrease them for cooling. These changes have been shown to be insignificant in terms of environmental impact. The net impact is beneficial.

Because the most tangible environmental effects are the residuals changes resulting from the reductions in fuel use, the most reasonable approach to an environmental analysis, here, is to stress these first order (residuals) changes. This is best done by specific fuel use within each energy use sector.

IV. Impacts

A. General

The impact of the California plan, as a whole, will be - if successful - to reduce the State's 1980 energy end use consumption by 386.71 trillion (10^{12}) BTU; of this, 313.2 x 10^{12} BTU will be non-electrical and 73.51 x 10^{12} BTU will come from the electrical sector. Total savings will amount to 542.71* trillion BTU (313.2 non-electrical and 229.51 in fuels used to generate electricity). This, measured against the FEA 1980 baseline projection for California of 6896.58 trillion BTU, equals a 7.7 percent savings.

These savings, measured across end use sectors, result in an absolute decrease in every environmental residual measured from each fuel consumed within each sector. The method of assessing the reduction in residuals was to compare the changes resulting from California's projected fuel savings with a set of residuals calculated (by sector, by fuel) against the baseline consumption forecast. A summary of these calculations is appended. The reductions range from highs of 14.7 percent and 14 percent for occupational man days lost and SOx emissions, respectively, to 1.2 percent and 1.3 percent for CO emissions and solid waste.

The residuals changes reflect the energy use sector groupings and the fuel mixes of California's targeted energy savings. The energy savings, in turn, reflect:

- Current and projected energy consumption patterns (sector and fuel distribution) and
- Energy conservation opportunities based on other (than consumption patterns) State specific factors.

The residuals changes are, in all cases, beneficial but not judged to be significant.

In addition to the reduced environmental residuals, California's plan is expected to be mildly deflationary and to create a small number of additional jobs (these will result principally from the buildings insulation measures and the industrial and commercial audits).

* This figure is based on the numbers found in California's EA (appended). It is at slight variance with the 541 trillion BTU figure shown in Section IV-B of the California plan. This difference is insignificant and is due to rounding errors in the conversion from BTU/program area to a fuel specific breakdown by energy use sector.

While certain potential adverse impacts can be postulated, none are expected to be significant.

- Where quantification has been attempted of an adverse impact (as with CO emissions incident to new lighting standards in the nationwide case), it has been found that residuals changes are well within the margin of error associated with the projections against which they are measured and the impacts are insignificant.

- In many cases, small adverse impacts have been accounted for and subtracted out in the process of computing the benefit, e.g., fuels used by vans and cars left at home (as a result of carpooling and vanpooling) are subtracted from fuels saved prior to computing residuals changes.

- An inflationary impact statement for the program was prepared and filed, in June 1976, with the Council on Wage and Price Stability. It stated that certain program measures, e.g., buildings insulation, vans, etc., may have an initial adverse economic impact in that the costs are front-end loaded (borne entirely at the time of purchase/installation) and the benefits are spread over a period of years. Over the life span of the improvement, however, all such investments identified were expected to produce beneficial economic impacts.

Table I and II, below, provide a graphic summary of California's energy consumption and savings by energy sector and relate program measures to sectoral impact.

TABLE I

Comparison of California Energy Use and Proposed Savings (1980)
(By End-Use Sector)

Sector	Consumption		Planned Savings			
	Direct	Dir.&Ind	Dir.Fuel Use		Direct&Indirect	
	%	%	BTU	%	BTU	%
Residential	12.9	22.8	97.49*	18.0	142*	26.2
Commercial	5.3	9.3				
Industrial	21.7	38.4	190	35.1	316	58.4
Transport	29.5	29.5	24	4.4	24	4.4
Utilities	30.5		229.51	42.4	59	10.9
Total	99.9	100	541	99.9	541	99.9

TABLE II

Program Measures by Sector Impacted

Program Measures	Sector Impacted			
	Res.&Comm. Bldg.	Industrial	Transpor.	Utilities
Building Standards	X			X
Retrofit Insulation	X			X
Bldg. Oper.&Audits	X			X
Procurement	X		X	X
Transportation Measures			X	
R. T. O. R.*			X	X
Indust.& Comm. Audits	X	X		
Pilot light turn-off	X			
Process Heat Efficiency		X		
Load Management				X
Rate Design Research				X
Resource Recovery		X		
Local Government	X		X	
Marketing	X	X	X	X
Energy Conserv.Licensing	X	X		
Education	X		X	

* Right-Turn-On-Red

B. Specific Impacts

Allowing for the fact (as discussed below) that transportation program measures offer the least opportunity for savings within the SECP constraints, then California's planned savings (and, therefore, the reduction in environmental residuals) correspond closely with its energy consumption patterns.

Of proposed savings, 126 trillion BTU are attributable to required program measures and about 415 trillion BTU to optional. Of the former, 102 trillion BTU result from measures to improve building thermal and lighting efficiency, 24 from transportation measures; right-turn-on-red and procurement practices savings cannot be estimated because of insufficient data but are judged to be insignificant.

Of the optional measures, 316 trillion BTU in savings result from industrial audits; this amounts to 76 percent of savings in this (optional measures) category and about 58.5 percent of overall estimated savings. Gas furnace pilot light turn-off produces an additional 40 trillion BTU or about 7.5 percent of total savings. The remaining 59 trillion BTU are the result of increased efficiencies within the utilities sector.

The major energy impacts, therefore, have been grouped into three categories (buildings, industry, and utilities) for purposes of describing potential environmental impacts. The quantifiable impacts are listed in the appended residuals tables and are, in all cases, beneficial. These are the result of reduced extraction, transport, processing, and burning of fossil fuels.

Additional, less tangible and less quantifiable, benefits which can be expected are reduced fuel bills resulting from lighting and thermal efficiency improvements in buildings, reduced capital investment in the utilities and fuels producing sectors as a result of all measures as well as reductions in employment related commutation costs. These impacts, on the whole, are expected to be mildly anti-inflationary. Reductions in highway congestion will be insignificant.

1. Residential and Commercial Buildings

California's major potential for energy savings under the SECP is through program measures impacting the residential and commercial buildings and the industrial sectors. The residential and commercial sectors combined

account (directly or indirectly) for about 32 percent of all fuels burned and about 18 percent of direct fuels input. Industry accounts (directly or indirectly) for about 38 percent of the State's energy use.

Of the total energy savings anticipated in 1980 from the implementation of California's plan, 26 percent can be attributed to program measures directly affecting residential and commercial buildings, such as mandatory lighting and thermal standards.

Improvements in lighting and thermal efficiency involve some additional potential impacts as discussed below.

o Manufacture and Installation of Weatherization Materials

The impact of the actual installation of improvements and repair work will be insignificant. The aggregate environmental impacts can be divided into two major effects: environmental benefits associated with reduced fuel consumption, and small but possibly adverse environmental effects associated with the production of materials to retrofit the structures specified. The important consideration here is that while any adverse environmental effects will terminate when the program expenditures terminate, the environmental benefits will continue to accrue as long as the subject buildings are consuming heating fuel at a rate below their pre-retrofit levels.

Increased costs to building owners - either residential or commercial - resulting from increased insulation, more energy efficient equipment, fenestration, etc., whether in the case of new construction or retrofit, appear to be negligible. In fact, all information, to date, indicates that, over a very short (5 to 10 year) payback period, these measures are extremely cost beneficial, i.e., the investment is more than offset by reduced fuel bills.

o Other Conservation Devices and Materials

The manufacture of devices such as clock thermostats may result in minor, but unquantifiable, emissions, but certainly far less than the reduced emissions attributable to their use.

- o Reduced Levels of Lighting and Heating

  The nationwide case (Programmatic EA) referenced above makes note of the potential for minor, seasonal, increases (on the order of 0.01 percent) in CO as a result of increased heating needed in some buildings to offset heat loss when lighting levels are reduced. However, California's method of assessment was to account for net fuel changes resulting from all program measures (and their interactions) within this area (lighting and heating). The environmental residual calculations which followed - based on these net fuel use changes - showed no quantifiable adverse impacts.

  Health effects from reduced heating and cooling levels are negligible - and presumed to be, on the whole, beneficial, i.e., in most cases heating, cooling, and lighting levels with the proposed standards are thought to be more healthful than existing levels; in addition, the reduction in pollutants is beneficial.

2. Industrial

In California, opportunities for conservation in the industrial sector are comparatively large. Expected impacts include the residuals changes (appended) which are beneficial but judged not to be significant. Impacts on the efficiency of industrial processes are diverse and industry and site specific; they include health benefits, e.g., improved air and water quality, reduced injuries, deaths, days lost, etc., in the production of fuels and economic benefits as well as improvements in buildings efficiency - discussed elsewhere.

Fifty-seven trillion BTU of residual oil are saved through commercial-industrial audits. This is 35.6 percent of the baseline estimate of 159.98 trillion BTU for these sectors in 1980.

To the extent that the industrial sector may experience adverse environmental impacts as an indirect result of increased demand, for example, for insulation materials or for vans attributable to other program measures, these impacts are discussed in the sector where these program measures have their direct impact. The economic impact of such factors, of course, is beneficial to industry.

3. Transportation

While a significant amount of energy is consumed in the transportation sector in California (see Table I), major changes in transportation fuels use will occur only with infrastructure and vehicle efficiency changes which are (compared to other savings opportunities) slower, more capital intensive, and/or inter-rather than intrastate in character and therefore outside the scope of the SECP.

From the implementation of the required transportation program measures, California expects to realize and energy savings of 24 trillion BTU's in 1980, about 4.4 percent of the total savings expected from plan implementation. While relatively small, this reduction in fuel consumption and thus in environmental residuals will have a beneficial impact.

The comparatively small changes noted in residuals such as CO reflect the more limited opportunities for savings in sectors and fuels which are the major contributors, such as Transportation. This is due partly to:

- o California's already stringent emission controls; and
- o The fact that major changes will occur only with infrastructure changes which are slower and, therefore, outside the timeframe of the SECP.

The promotion of vans and carpools in California may have small adverse secondary impacts:

- o The fuel used by vans, as well as the increased consumption per auto when the number of occupants is increased, has been subtracted from fuel savings prior to estimating residuals changes. The net change is, in all cases, beneficial, but not significant.
- o The increased emissions from the manufacture of the vans have not been determined but are judged to be negligible when compared to reduced operating emissions from autos. This impact is likely as well to be offset by reduced auto manufacture.

4. Utilities

As mentioned in Section IV-A, the residuals changes (reductions) in California's case are somewhat skewed (greater- or more beneficial - for some residuals than for others).

These reductions accurately reflect the fuel mix of the proposed savings. Where percent changes in residuals are highest, this reflects disproportionate savings of particular fuels in particular sectors, specifically:

- o 229.51 trillion BTU are saved in fuels for electrical generation.
  - This amounts to about 11 percent of California's projected 1980 fuel use in this sector;
  - California estimates that 34 percent of its electrical demand is supplied by hydroelectric generation;
  - Because of relative cost effectiveness among generation fuels and plants, 100 percent of its savings will be in fossil fuels, with residual oil and coal being the major contributors.

The fuel mix of utilities savings combined with the 57 trillion BTU of residual oil saved in the industrial sector (see above) account for the greater decrease in some residuals, such as SOx, than is the case for others. It should be noted further that California's electrical purchases come from power generated both in and out of State. Imports come both from the Pacific Northwest grid and from the Four Corners (New Mexico) area. While the residuals change is based on total fuel mix for all electricity purchased, environmental benefits will be felt by the exporting States or, put another way, the reductions will not all be in-State.

5. Economic Impact

An inflationary impact statement of the program was prepared and filed, in June 1976, with the Council on Wage and Price Stability. Certain program measures, e.g., buildings insulation, vans, etc., may have an initial adverse economic impact in that the costs are front-end loaded (borne entirely at the time of purchase/installation) and the benefits are spread over a period of years. Over the life span of the improvement, however, all such investments identified produce beneficial economic impacts.

One measure which may have small adverse impacts is the pilot program to reduce electrical system voltage levels (from 125-126 volts at feeder stations to 120). Low voltage could, under certain circumstances, cause damage to appliances and consumer inconveniences. The liklihood of this happening is small becuase the program will be carefully monitored on a pilot scale. Potential environmental impacts are judged to be insignificant.

V. Alternatives

Under EPCA, there are no alternatives to the five mandatory program measures other than a State's non-participation in the SECP. The "no-participation" alternative, in all cases, is adverse when compared to the implementation of any mix of these five measures.

There is little room within the SECP timeframe for major structural changes affecting the way energy is used. Nor does an individual state have much say over the energy intensity or efficiency of many products used within its borders but produced and sold on a national basis. Rather, the emphasis of the SECP is on greater efficiency of energy use within the short term constraints imposed by presently in place infrastructure, capital investment, land-use patterns, buildings, motor vehicle stock, and the like. Given this situation as well as current State-specific fuel distribution and use patterns, the reduction in residuals for any State program, including California's, will not be uniform across all residuals but will tend to be skewed in such fashion as to conform to current fuel uses and specific savings opportunities and the particular characteristics of the fuels affected. In all cases the net result will be beneficial.

VI. Conclusions

In summary, it is the determination of the FEA that California's Environmental Assessment of this program complies with the requirements of both NEPA and the SECP Guidelines as promulgated by FEA.

Based upon our review of this EA, the FEA has determined that actions now required to be taken to implement California's proposed energy conservation plan under Title III, Part C of the EPCA will not be "major Federal actions significantly affecting the quality of the human environment." (Section 102(2)(C), National Environmental Policy Act, 42 U.S.C. 4332 (2)(C)). Consequently, no EIS preparation is contemplated for this action.

Appendices

I. Baseline Residuals Case and Residuals Changes

II. Abstracts from the California Plan

STATE ENERGY CONSERVATION PROGRAM (SECP)
ENVIRONMENTAL REVIEW
RESIDUALS TALLY SHEET
(AIR)

STATE NAME CALIFORNIA

Sector	Particulates	NO_x	SO_x	HC	CO	CO_2	Aldehydes
Transportation	3.11 E05	1.39 E06	1.94 E05	8.79 E05	4.97 E06	2.55 E08	3.43 E04
Industrial	3.53 E04	3.00 E05	1.46 E05	3.45 E04	7.11 E04	9.77 E07	3.85 E03
Commercial	8.74 E03	6.45 E04	2.69 E04	4.57 E03	7.28 E03	2.50 E07	2.30 E03
Residential	9.29 E03	1.13 E05	4.58 E03	4.62 E03	9.09 E03	5.58 E07	4.59 E03
Utilities	4.53 E04	4.79 E05	4.98 E05	3.22 E04	1.40 E04	1.13 E08	6.68 E03
Total Baseline Residuals	4.10 E05	2.35 E06	8.69 E05	9.55 E05	5.07 E06	5.45 E08	5.17 E04
Reduction	17956.3	142543.0	125627.1	15534.7	58390.9	41,414,430	3128.5
% Reduction	4.3%	6%	14%	1.6%	1.2%	7.6%	6%

Footnotes:
Entries given in scientific notation, e.g., 3.86 E04 equals 3.86×10^4 or 38,600; ( ) denotes minus value.
Unit values are:
- For Air, Water, and Solid Waste: tons per year;
- For Thermal Rejection: BTU per year; and
- For Deaths, Injuries, and Man-Days Lost: individual (single) occurances.

STATE ENERGY CONSERVATION PROGRAM (SECP)
ENVIRONMENTAL REVIEW
RESIDUALS TALLY SHEET
(WATER)

STATE NAME CALIFORNIA

Sector	Acids	Bases	Dis. Solids	Sus. Solids	Non-Deg. Org.	Bio. O.D.	Chem. O.D.
Transportation	———	———	1.33 E03	2.55 E03	8.06 E03	2.55 E03	1.55 E04
Industrial	———	2.14 E02	6.70 E03	1.45 E03	6.44 E02	3.00 E03	1.19 E03
Commercial	———	———	3.73 E01	7.14 E01	2.32 E02	7.14 E01	4.38 E02
Residential	———	———	9.33 E00	1.79 E01	6.95 E01	1.79 E01	1.09 E02
Utilities	4.54 E03	3.46 E02	2.67 E04	4.07 E03	2.47 E03	6.36 E02	1.24 E03
Total Baseline Residuals	4.54 E03	5.6 E02	3.48 E04	8.16 E03	1.15 E04	6.28 E03	1.85 E04
Reduction	595.5	49.1	3,117.4	532.3	353.0	90.1	552.2
% Reduction	13.1%	8.8%	8.9%	6.5%	3.1%	1.4%	3.0%

Footnotes:
Entries given in scientific notation, e.g., 3.86 E04 equals 3.86×10^4 or 38,600; ( ) denotes minus value.
Unit values are;
- For Air, Water, and Solid Waste: tons per year;
- For Thermal Rejection: BTU per year; and
- For Deaths, Injuries, and Man-Days Lost: individual (single) occurances.

STATE ENERGY CONSERVATION PROGRAM (SECP)

ENVIRONMENTAL REVIEW

RESIDUALS TALLY SHEET

(OTHER)

STATE NAME CALIFORNIA

Sector	Thermal Rejection	Occup. Deaths	Occup. Inj.	Occup. M.Days.Lost	Solid Waste		
Transportation	———	2.34 E00	1.64 E02	8.43 E03	1.61 E05		
Industrial	1.11 E12	1.74 E01	3.31 E02	2.73 E04	1.08 E06		
Commercial	2.48 E11	1.17 E(01)	1.30 E01	2.60 E04	4.51 E03		
Residential	7.75 E11	1.96 E(01)	2.77 E01	8.63 E02	1.53 E03		
Utilities	5.58 E11	2.74 E01	5.53 E02	3.77 E04	4.86 E06		
Total Baseline Residuals	2.69 E12	4.75 E01	1.09 E03	1.00 E05	6.11 E06		
Reduction	12588.1	4.06	94.30	14745.6	81794.4		
% Reduction	Insignificant	8.5%	8.6%	14.7%	1.3%		

Footnotes:

Entries given in scientific notation, e.g., 3.86 E04 equals 3.86×10^4 or 38,600; ( ) denotes minus value.

Unit values are:

- For Air, Water, and Solid Waste: tons per year;
- For Thermal Rejection: BTU per year; and
- For Deaths, Injuries, and Man-Days Lost: individual (single) occurances.

SUMMARY OF EPCA CONSERVATION PLAN

MEASURE	ESTIMATED ANNUAL ENERGY SAVINGS IN 1980	MEASURE COST		
	10^{12} BTU	EPCA	STATE	TOTAL
ATORY				
ASSISTANCE IN ADMINISTERING AND ENFORCING NEW BUILDING STANDARDS	21	$ 69,474	$ 129,552	$ 199,026
PRESCRIPTIVE AND PERFORMANCE STANDARDS FOR NON-RESIDENTIAL BUILDINGS	37	225,000	553,532	778,532
NEW PASSIVE BUILDING STANDARDS	—(1)	187,321	—	187,321
RETROFIT CEILING INSULATION	44	121,042	—	121,042
IMPROVEMENT IN STATE BUILDING OPERATIONS	—	100,000	66,422	166,422
PUBLIC BUILDING AUDITS	(0-1)(2)	—	—	—
STATE AND LOCAL GOVERNMENT PROCUREMENT	—	91,203	—	91,203
RIDESHARING	24	131,200	1,718,850	1,850,050
TRANSPORTATION SYSTEM MANAGEMENT	—	48,720	—	48,720
TRANSPORTATION AND LAND-USE PLANNING & IMPLEMENTATION	—	70,327	131,725	202,052
RIGHT-TURN-ON-RED	—	—	—	—
SUBTOTAL MANDATORIES	126	$ 1,044,287	$2,600,081	$3,644,368
NAL				
INDUSTRIAL AND COMMERCIAL AUDITS	316	$ 96,042	$ 283,907	$ 379,949
GAS FURNACE PILOT LIGHT TURN-OFF	40	38,388	—	38,388
SUBSTATION FEEDER VOLTAGE REDUCTION	56	38,388	—	38,388
COMMERCIAL AND INDUSTRIAL PROCESS HEAT EFFICIENCY IMPROVEMENT	(0-1)	164,769	—	164,769
LOAD MANAGEMENT STANDARDS DEVELOPMENT	3 (.35)	84,327	429,664	513,991
RATE DESIGN-RESEARCH	—	32,480	137,581	170,061
RESOURCE RECOVERY	(3)	79,978	411,038	491,016
LOCAL GOVERNMENT TECHNICAL ASSISTANCE TEAMS	—	64,807	—	64,807
CONSERVATION MARKETING	—	50,000	109,236	159,236
ENERGY CONSERVATION LICENSING	—	26,500	—	26,500
EDUCATION	—	47,853	—	47,853
STAFF FOR PROGRAM PLANNING, COORDINATION, EVALUATION AND MONITORING	—	126,369	305,329	432,698
SUBTOTAL OPTIONALS	415	$ 849,901	$ 1,677,755	$ 2,527,656
TOTALS	541	$ 1,894,188	$ 4,277,836	$ 6,172,024

SH INDICATES INSUFFICIENT DATA TO ESTIMATE SAVINGS, OR CANNOT HAVE SIGNIFICANT IMPACT BY 1980.

UMBERS IN PARENTHESES INDICATE ESTIMATED SAVINGS ARE ALREADY INCLUDED IN ANOTHER MEASURE,

M = MANDATORY, O = OPTIONAL, FIGURE IS MEASURE NUMBER.

OTENTIAL SAVINGS ARE 22 x 10^{12} BTU/YR; HOWEVER, MUCH OF THE SAVINGS WILL BE REGISTERED AT OUT-OF-STATE PRIMARY PROCESSING PLANTS.

VII. DECREASE IN ENVIRONMENTAL RESIDUALS

An additional benefit of implementing this energy conservation plan is the reduction of environmental degradation that results from the conversion, distribution, and use of energy. This section makes a quantified estimate of these benefits. The method used is contained in the Federal Energy Administration Program Guidelines.

The estimated reduction of environmental residuals depends on the change in energy use by primary fuel type. The estimation begins by summarizing energy savings and then relates these savings to change in fuel use by type. The reduction in environmental residuals is calculated directly from the change in fuel use.

A. Energy Savings From the Proposed Program

Non-Electrical:

Transportation - 23.5×10^{12} Btu reduction in gasoline, no increase in other fuels use.

Commercial - Space Heat: Overall non-electrical savings from commercial-industrial audits = 190×10^{12} Btu's. These were disaggregated by apportioning the savings in the STRAWMAN forecasts in each fuel sector, and by staff estimates.

Savings assigned each fuel:

Natural Gas	95	x	10^{12} Btu's
Residual Oil	57	x	10^{12} Btu's
Distillate Oil	38	x	10^{12} Btu's

Note: The conversion factor for gallons of fuel oil to Btu's takes into account that savings are both distillate and residual oils.

Residential - Residential standards will save 173×10^{6} therms/year of natural gas

Ceiling retrofit insulation will save 424×10^{6} therms/year of natural gas

Gas furnace pilot light turn-off will save 40×10^{12} Btu's/year of natural gas

$= 99.7 \times 10^{12}$ Btu's of natural gas

Electrical Savings:

The conservation measures outlined in this paper which affect electrical consumption can be divided into two general groups: those affecting existing consumption of electrical generation fuels, and those which will only affect the generation facilities added between now and 1980, and the fuels these facilities will consume. Retrofit measures such as ceiling insulation and commercial-industrial audits will affect existing power sources while measures like new building standards impact new power sources. For this reason, electrical savings have been separated into current and future groups to determine fossil fuel savings at generation facilities.

The current 1976 California generation mix is as follows:

	% of Supply	% of Fossil Fuels
Coal	8%	15%
Residual Fuel Oil	40%	72%
Distillate Fuel Oil	1%	2%
Natural Gas	6%	11%
Hydroelectric	20% + (14% interstate transfer)	
Nuclear	8%	
Miscellaneous	3%	

1980 additions to the mix will be as follows:

	% of New Supply
Coal	43%
Residual Fuel Oil	43%
Distillate Fuel Oil	13%

Any savings in electrical usage will apply directly to the fossil fuel categories but not to the hydroelectric or nuclear categories, as the latter will continue to operate at full capacity.

The combined electrical savings are as follows:

Residential Standards	=	345×10^6 kWh/yr (new mix)
Residential Ceiling Retrofit	=	123×10^6 kWh/yr (existing mix)
Non-Residential Building Standards	=	$3,494 \times 10^6$ kWh/yr (new mix)
Commercial-Industrial Audits	=	$12,380 \times 10^6$ kWh/yr (existing mix)
Load Management	=	11.7×10^6 kWh/yr (existing mix)
Substation Voltage Reduction	=	$5,226.3 \times 10^6$ kWh/yr (existing mix)

TOTAL Affecting New Mix = $3,839 \times 10^6$ kWh/yr

Coal	F.O.	$43\% \times 3839 \times 10^6$	= $1,650 \times 10^6$ kWh/year
Residual	F.O.	$43\% \times 3839 \times 10^6$	= $1,650 \times 10^6$ kWh/year
Distillate	F.O.	$13\% \times 3839 \times 10^6$	= 499.1×10^6 kWh/year

Distillates are considered to be used as a peaking fuel for gas turbines.

TOTAL Affecting Existing Supply = $17,729 \times 10^6$ kWh/year

+ 11.7×10^6 kWh/year (from Load Management)

Coal	$15\% \times 17,729 \times 10^6$	=	$2,659.4 \times 10^6$ kWh/year
Residual F.O.	$72\% \times 17,729 \times 10^6$	=	$12,764.9 \times 10^6$ kWh/year
Distillate F.O.	$2\% \times 17,729 \times 10^6$	=	354.6×10^6 kWh/year
Natural Gas	$11\% \times 17,729 \times 10^6$	=	$1,950.2 \times 10^6$ kWh/year

Distillates are all considered as peaking fuel for oil-fired gas turbines. $1,000 \times 10^6$ kWh/year of electrical generation savings from natural gas is considered to be at peak, the remaining portion is baseload operation (excluding load management savings).

Load management affects only the system peaks and achieves savings only through the greater efficiency of baseload operations. The 0.35×10^{12} Btu savings quoted for Measure 04 are due to this greater operation efficiency, but only 40 percent of the savings affects fossil fuel use.

40% of peak x 0.35×10^{12} Btu $\div$ 12,000 Btu/kWh = 11.7×10^{6} kWh/year is fossil fuel (natural gas).

Combined Savings

Gas Turbine (natural gas)	1,011.7	x 10^6	kWh/year
Gas Turbine (distillate)	853.7	x 10^6	kWh/year
Steam (natural gas)	950.2	x 10^6	kWh/year
Steam (residual)	14,414.9	x 10^6	kWh/year
Steam (coal)	4,309.4	x 10^6	kWh/year

NOTE: The commercial-industrial audit program includes a de-lamping effort which will increase the heating requirements of buildings; however, in the California climate, the corresponding reduction in air conditioning loads will more than offset this increase. For this reason, no energy additions are calculated. It is believed they are insignificant.

CALIFORNIA

VII. DECREASE IN ENVIRONMENTAL RESIDUALS

An additional benefit of implementing this energy conservation plan is the reduction of environmental degradation that results from the conversion, distribution, and use of energy. This section makes a quantified estimate of these benefits. The method used is contained in the Federal Energy Administration Program Guidelines.

The estimated reduction of environmental residuals depends on the change in energy use by primary fuel type. The estimation begins by summarizing energy savings and then relates these savings to change in fuel use by type. The reduction in environmental residuals is calculated directly from the change in fuel use.

A. Energy Savings From the Proposed Program

Non-Electrical:

Transportation - 23.5×10^{12} Btu reduction in gasoline, no increase in other fuels use.

Commercial - Space Heat: Overall non-electrical savings from commercial-industrial audits = 190×10^{12} Btu's. These were disaggregated by apportioning the savings in the STRAWMAN forecasts in each fuel sector, and by staff estimates.

Savings assigned each fuel:

Natural Gas	95	x	10^{12} Btu's
Residual Oil	57	x	10^{12} Btu's
Distillate Oil	38	x	10^{12} Btu's

Note: The conversion factor for gallons of fuel oil to Btu's takes into account that savings are both distillate and residual oils.

Residential - Residential standards will save 173×10^{6} therms/year of natural gas

Ceiling retrofit insulation will save 424×10^{6} therms/year of natural gas

Gas furnace pilot light turn-off will save 40×10^{12} Btu's/year of natural gas

$= 99.7 \times 10^{12}$ Btu's of natural gas

SUMMARY OF EPCA CONSERVATION PLAN

MEASURE	ESTIMATED ANNUAL ENERGY SAVINGS IN 1980	MEASURE COST		
	10^{12} BTU	EPCA	STATE	TOTAL
MANDATORY				
1. ASSISTANCE IN ADMINISTERING AND ENFORCING NEW BUILDING STANDARDS	21	$ 69,474	$ 129,552	$ 199,026
2. PRESCRIPTIVE AND PERFORMANCE STANDARDS FOR NON-RESIDENTIAL BUILDINGS	37	225,000	553,532	778,532
3. NEW PASSIVE BUILDING STANDARDS	—(1)	187,321	—	187,321
4. RETROFIT CEILING INSULATION	44	121,042	—	121,042
5. IMPROVEMENT IN STATE BUILDING OPERATIONS	—	100,000	66,422	166,422
6. PUBLIC BUILDING AUDITS	(O-1)(2)	—	—	—
7. STATE AND LOCAL GOVERNMENT PROCUREMENT	—	91,203	—	91,203
8. RIDESHARING	24	131,200	1,718,850	1,850,050
9. TRANSPORTATION SYSTEM MANAGEMENT	—	48,720	—	48,720
10. TRANSPORTATION AND LAND-USE PLANNING & IMPLEMENTATION	—	70,327	131,725	202,052
11. RIGHT-TURN-ON-RED	—	—	—	—
SUBTOTAL MANDATORIES	126	$ 1,044,287	$2,600,081	$3,644,368
OPTIONAL				
1. INDUSTRIAL AND COMMERCIAL AUDITS	316	$ 96,042	$ 283,907	$ 379,949
2. GAS FURNACE PILOT LIGHT TURN-OFF	40	38,388	—	38,388
3. SUBSTATION FEEDER VOLTAGE REDUCTION	56	38,388	—	38,388
4. COMMERCIAL AND INDUSTRIAL PROCESS HEAT EFFICIENCY IMPROVEMENT	(O-1)	164,769	—	164,769
5. LOAD MANAGEMENT STANDARDS DEVELOPMENT	3 (.35)	84,327	429,664	513,991
6. RATE DESIGN RESEARCH	—	32,480	137,581	170,061
7. RESOURCE RECOVERY	(3)	79,978	411,038	491,016
8. LOCAL GOVERNMENT TECHNICAL ASSISTANCE TEAMS	—	64,807	—	64,807
9. CONSERVATION MARKETING	—	50,000	109,236	159,236
10. ENERGY CONSERVATION LICENSING	—	26,500	—	26,500
11. EDUCATION	—	47,853	—	47,853
12. STAFF FOR PROGRAM PLANNING, COORDINATION, EVALUATION AND MONITORING	—	126,369	306,329	432,698
SUBTOTAL OPTIONALS	415	$ 849,901	$ 1,677,755	$ 2,527,656
TOTALS	541	$ 1,894,188	$ 4,277,836	$ 6,172,024

(1) DASH INDICATES INSUFFICIENT DATA TO ESTIMATE SAVINGS, OR CANNOT HAVE SIGNIFICANT IMPACT BY 1980.

(2) NUMBERS IN PARENTHESES INDICATE ESTIMATED SAVINGS ARE ALREADY INCLUDED IN ANOTHER MEASURE, M = MANDATORY, O = OPTIONAL, FIGURE IS MEASURE NUMBER.

(3) POTENTIAL SAVINGS ARE 22 x 10^{12} BTU/YR; HOWEVER, MUCH OF THE SAVINGS WILL BE REGISTERED AT OUT-OF-STATE PRIMARY PROCESSING PLANTS.

Electrical Savings:

The conservation measures outlined in this paper which affect electrical consumption can be divided into two general groups: those affecting existing consumption of electrical generation fuels, and those which will only affect the generation facilities added between now and 1980, and the fuels these facilities will consume. Retrofit measures such as ceiling insulation and commercial-industrial audits will affect existing power sources while measures like new building standards impact new power sources. For this reason, electrical savings have been separated into current and future groups to determine fossil fuel savings at generation facilities.

The current 1976 California generation mix is as follows:

	% of Supply	% of Fossil Fuels
Coal	8%	15%
Residual Fuel Oil	40%	72%
Distillate Fuel Oil	1%	2%
Natural Gas	6%	11%
Hydroelectric	20% + (14% interstate transfer)	
Nuclear	8%	
Miscellaneous	3%	

1980 additions to the mix will be as follows:

	% of New Supply
Coal	43%
Residual Fuel Oil	43%
Distillate Fuel Oil	13%

Any savings in electrical usage will apply directly to the fossil fuel categories but not to the hydroelectric or nuclear categories, as the latter will continue to operate at full capacity.

The combined electrical savings are as follows:

Residential Standards	=	345×10^6 kWh/yr (new mix)
Residential Ceiling Retrofit	=	123×10^6 kWh/yr (existing mix)
Non-Residential Building Standards	=	$3,494 \times 10^6$ kWh/yr (new mix)
Commercial-Industrial Audits	=	$12,380 \times 10^6$ kWh/yr (existing mix)
Load Management	=	11.7×10^6 kWh/yr (existing mix)
Substation Voltage Reduction	=	$5,226.3 \times 10^6$ kWh/yr (existing mix)

TOTAL Affecting New Mix = $3,839 \times 10^6$ kWh/yr

Coal	F.O.	$43\% \times 3839 \times 10^6$	= $1,650 \times 10^6$ kWh/year
Residual	F.O.	$43\% \times 3839 \times 10^6$	= $1,650 \times 10^6$ kWh/year
Distillate	F.O.	$13\% \times 3839 \times 10^6$	= 499.1×10^6 kWh/year

Distillates are considered to be used as a peaking fuel for gas turbines.

TOTAL Affecting Existing Supply = $17,729 \times 10^6$ kWh/year

+ 11.7×10^6 kWh/year (from Load Management)

Coal	$15\% \times 17,729 \times 10^6$	=	$2,659.4 \times 10^6$ kWh/year
Residual F.O.	$72\% \times 17,729 \times 10^6$	=	$12,764.9 \times 10^6$ kWh/year
Distillate F.O.	$2\% \times 17,729 \times 10^6$	=	354.6×10^6 kWh/year
Natural Gas	$11\% \times 17,729 \times 10^6$	=	$1,950.2 \times 10^6$ kWh/year

Distillates are all considered as peaking fuel for oil-fired gas turbines. $1,000 \times 10^6$ kWh/year of electrical generation savings from natural gas is considered to be at peak, the remaining portion is baseload operation (excluding load management savings).

Load management affects only the system peaks and achieves savings only through the greater efficiency of baseload operations. The 0.35×10^{12} Btu savings quoted for Measure 04 are due to this greater operation efficiency, but only 40 percent of the savings affects fossil fuel use.

40% of peak x 0.35×10^{12} Btu $\div$ 12,000 Btu/kWh = 11.7×10^{6} kWh/year is fossil fuel (natural gas).

Combined Savings

Gas Turbine (natural gas)	1,011.7	x 10^{6}	kWh/year
Gas Turbine (distillate)	853.7	x 10^{6}	kWh/year
Steam (natural gas)	950.2	x 10^{6}	kWh/year
Steam (residual)	14,414.9	x 10^{6}	kWh/year
Steam (coal)	4,309.4	x 10^{6}	kWh/year

NOTE: The commercial-industrial audit program includes a de-lamping effort which will increase the heating requirements of buildings; however, in the California climate, the corresponding reduction in air conditioning loads will more than offset this increase. For this reason, no energy additions are calculated. It is believed they are insignificant.

NON-ELECTRICAL CONSERVATION MEASURES

1. Estimate 1980 Energy Savings (Direct Effects from Measure) By Fuel Types

2. Convert these Energy Savings to Units of 10^{12}Btu using conversion Table VII-1 (Care to be taken on proper conversion factor)

188	x 10^6 Gallons of Gasoline	X	0.125 x 10^6	=	23.5
810	x 10^6 Gallons of Fuel Oil	X	0.1173 x 10	=	95.0 (57.0 Residual + 38.0 Distillat
189	x 10^6 MCF of Natural Gas	X	1.031 x 10^6	=	194.7
	Therms of Natural Gas	X		=	
	Barrels of Oil	X		=	
	Tons of Coal	X		=	$\leq$ 313.2 x 10^{12} Btu

3. Estimate 1980 Energy Additions (Indirect Effect from Measure) By Fuel Types (i.e., if car transportation is reduced reasonably, some form of public transportation could increase)

4. Convert these Energy Additions to units of 10^{12}Btu using conversion Table VII-1

Gallons of Gasoline	X		=
Gallons of Fuel Oil	X		=
MCF of Natural Gas	X		=
Therm of Natural Gas	X		=
Barrels of Oil	X		=
Tons of Coal	X		=

5. Where Additions and Savings are of like fuels, then results should be used. In instance of unlike fuels (i.e., gasoline and diesel), then impacts shall be secured separately.

6. Using Results from 2 and possibly 4 obtain corresponding set of environmental impacts, using Table VII-2 through VII-9. Fuel savings (or additions) in 10^{12}Btu are multiplied by entries in appropriate tables to obtain each impact.

WORKSHEET NO. 9

ELECTRICAL CONSERVATION MEASURE

1. Estimate Electrical Savings (Consult utilities if necessary)

2. In Consultation with Regional Power Pool determine savings due to decrease (10^{12}Btu)

1011.7	x 10^6 Kwh	Gas-fired Gas Turbine	x	12,000 Btu/kWh	=	12.14
853.7	x 10^6 Kwh	Oil-fired Gas Turbine	x	12,000 Btu/kWh	=	10.24
950.2	x 10^6 Kwh	Gas-fired Steam	x	10,025 Btu/kWh	=	9.53
14,414.9	x 10^6 Kwh	Oil-fired Steam	x	10,300 Btu/kWh	=	148.47
4,309.4	x 10^6 Kwh	Coal-fired Steam	x	11,400 Btu/kWh	=	49.13 Σ 229.51 Btu

3. Estimate 1980 Energy Additions (Indirect effect from Measure) By Fuel Type (i.e, if lighting is reduced, then additional heating in buildings is required)

4. Convert these Energy Additions to units of 10^{12}Btu using conversion Table VII-1

Gallons of Gasoline	X		=	
Gallons of Fuel Oil	X		=	
MCF of Natural Gas	X		=	
Therm of Natural Gas	X		=	
Barrels of Oil	X		=	
Tons of Coal	X		=	

5. Where additions and savings are of like fuels, then resultant should be used. In instance of unlike fuels (i.e, residual oil and distillate oil) then impacts shall be secured separately.

6. Using results from 2 and possibly 4 obtain corresponding set of environmental impacts using Table VII-11 through VII-15. Fuel savings (or additions) in 10^{12} Btu are multiplied by entries in appropriate table to obtain each impact.

TABLE VII-2

TITLE: DIRECT EMISSIONS FROM AUTOMOBILE OPERATION
(Environmental Impact per 10^{12} Btu of Gasoline)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids			
Bases			
Dissolved Solids, Mis.			
Suspended Solids			
Non-Degradable Org.			
Biological Oxygen Dem.			
Chemical Oxygen Demand			
AIR (TONS)			
Particulates	62	23.5	1,457.0
Oxides of Nitrogen	298	23.5	7,003.0
Sulfur Dioxide	15	23.5	352.5
Hydrocarbons	201	23.5	4,723.5
Carbon Monoxide	2,120	23.5	49,820.0
Carbon Dioxide	74,500	23.5	1,750,750.0
Aldehydes			
OTHER			
Thermal Rejection (Btu)			
Occupational Death (Men)			
Occupational Injuries (Men)			
Occupational Person Day Lost (Person Day)			
Solid Waste Tons			

TABLE VII-3

TITLE: DIRECT EMISSION FROM DIESEL BUS OPERATION
(Environmental Impact per 10^{12} Btu of Diesel Oil)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids	-		
Bases	-		
Dissolved Solids, Mis.	-		
Suspended Solids	-		
Non-Degradable Org.	-		
Biological Oxygen Dem.	-		
Chemical Oxygen Demand	-		
AIR (TONS)			
Particulates	45.7		
Oxides of Nitrogen	1296		
Sulfur Dioxide	94.8		
Hydrocarbons	127		
Carbon Monoxide	787		
Carbon Dioxide	85000		
Aldehydes	20.7		
OTHER			
Thermal Rejection (Btu)	-		
Occupational Death (Men)	-		
Occupational Injuries (Men)	-		
Occupational Man Day Lost (Man-day)	-		
Solid Waste Tons	-		

TABLE VII-4

TITLE: EMISSIONS FROM PRODUCTION AND DISTRIBUTION OF VEHICLE FUELS
(Environmental Impact per 10^{12} Btu of Vehicle Fuels)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids			
Bases			
Dissolved Solids, Mis.	0.4	23.5	9.4
Suspended Solids	0.76	23.5	17.86
Non-De:radable Org.	2.41	23.5	56.64
Biological Oxygen Dem.	0.76	23.5	17.86
Chemical Oxygen Demand	4.66	23.5	109.51
AIR (TONS)			
Particulates	3.2	23.5	75.2
Oxides of Nitrogen	26	23.5	611.0
Sulfur Dioxide	23.5	23.5	552.25
Hydrocarbons	26	23.5	611.0
Carbon Monoxide	3	23.5	70.5
Carbon Dioxide	-		
Aldehydes	4.15	23.5	97.53
OTHER			
Thermal Rejection (Btu)	-		
Occupational Death (Men)	0.0007	23.5	0.016
Occupational Injuries (Men)	.05	23.5	1.175
Occupational Man Day Lost (Man-day)	2.5	23.5	58.75
Solid Waste Tons	48	23.5	1,128.0

TABLE VII-5

TITLE: SPACE HEAT, COMMERCIAL, NATURAL GAS
(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids	-		
Bases	-		
Dissolved Solids, Mis.	-		
Suspended Solids	-		
Non-Degradable Org.	.02	95.0	1.90
Biological Oxygen Dem.	-		
Chemical Oxygen Demand	-		
AIR (TONS)			
Particulates	9.25	95.0	878.75
Oxides of Nitrogen	152.06	95.0	14,445.70
Sulfur Dioxide	.314	95.0	29.83
Hydrocarbons	3.95	95.0	375.25
Carbon Monoxide	9.72	95.0	923.40
Carbon Dioxide	61,000	95.0	5,795,000
Aldehydes	4.9	95.0	465.50
OTHER			
Thermal Rejection (Btu) X 10^9	.89	95.0	84.55
Occupational Death (Men)	.0002	95.0	0.0190
Occupational Injuries (Men)	.03	95.0	2.85
Occupational Man Day Lost (Man-day)	92.8	95.0	8,816
Solid Waste Tons	-		

TABLE VII-6

TITLE: SPACE HEAT, COMMERCIAL, DISTILLATE OIL

(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids	-	-	-
Bases	-	-	-
Dissolved Solids, Mis.	.4	38	15.20
Suspended Solids	.76	38	28.88
Non-Degradable Org.	2.4	38	91.20
Biological Oxygen Dem.	.76	38	28.88
Chemical Oxygen Demand	4.66	38	177.08
AIR (TONS)			
Particulates	57.26	38	2,175.88
Oxides of Nitrogen	242.98	38	9,233.24
Sulfur Dioxide	137.45	38	5,223.10
Hydrocarbons	37.17	38	1,412.46
Carbon Monoxide	75.00	38	2,850.00
Carbon Dioxide	85,000	38	3,230,000
Aldehydes	11.4	38	433.20
OTHER			
Thermal Rejection (Btu)	-	38	
Occupational Death (Men)	.0007	38	0.0266
Occupational Injuries (Men)	.05	38	1.90
Occupational Man Day Lost (Man-day)	2.5	38	95.00
Solid Waste Tons	48	38	1,824.00

TABLE VII-7

TITLE: SPACE HEAT, COMMERCIAL, RESIDUAL OIL
(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids	-		-
Bases	-		-
Dissolved Solids, Mis.	0.39	57	22.23
Suspended Solids	0.76	57	43.32
Non-Degradable Org.	2.41	57	137.37
Biological Oxygen Dem.	0.76	57	43.32
Chemical Oxygen Demand	4.66	57	265.62
AIR (TONS)			
Particulates	80.06	57	4,563.42
Oxides of Nitrogen	226.9	57	12,933.30
Sulfur Dioxide	540.5	57	30,808.50
Hydrocarbons	36.4	57	2,074.80
Carbon Monoxide	3.47	57	197.79
Carbon Dioxide	85,000	57	4,845,000
Aldehydes	7.5	57	427.50
OTHER			
Thermal Rejection (Btu)	-		
Occupational Death (Men)	.0007	57	0.0399
Occupational Injuries (Men)	.049	57	2.793
Occupational Man Day Lost (Man-day)	2.52	57	143.64
Solid Waste Tons	48.02	57	2,737.14

TABLE VII-8

TITLE: SPACE HEAT, COMMERCIAL, COAL (26.2×10^6 Btu/ton) (1% Sulfur)
(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
ATER (TONS)			
Acids	-		
Bases	.99		
Dissolved Solids, Mis.	26.7		
Suspended Solids	5.77		
Non-Degradable Org.	-		
Biological Oxygen Dem.	-		
Chemical Oxygen Demand	-		
R (TONS)			
Particulates	443.9		
Oxides of Nitrogen	125.8		
Sulfur Dioxide	755.4		
Hydrocarbons	48.34		
Carbon Monoxide	206.1		
Carbon Dioxide	111.000.		
Aldehydes	1.33		
ER			
Thermal Rejection (Btu)	-		
Occupational Death (Men)	.07		
Occupational Injuries (Men)	1.22		
Occupational Man Day Lost (Man-day)	92.2		
Solid Waste Tons	8,696		

TABLE VII- 9

TITLE: SPACE HEAT, RESIDENTIAL, NATURAL GAS
(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids	-		
Bases	-		
Dissolved Solids, Mis.	-		
Suspended Solids	-		
Non-Degradable Org.	.02	99.7	1.99
Biological Oxygen Dem.	-		
Chemical Oxygen Demand	-		
AIR (TONS)			
Particulates	9.24	99.7	921.23
Oxides of Nitrogen	127.5	99.7	12,711.75
Sulfur Dioxide	.31	99.7	30.91
Hydrocarbons	3.96	99.7	394.81
Carbon Monoxide	9.68	99.7	965.10
Carbon Dioxide	61,000	99.7	6,081,700
Aldehydes	4.86	99.7	484.54
OTHER			
Thermal Rejection (Btu) X 10^9	.890	99.7	88.73
Occupational Death (Men)	.0002	99.7	0.0199
Occupational Injuries (Men)	.03	99.7	2.99
Occupational Man Day Lost (Man-day)	.90	99.7	89.73
Solid Waste Tons	-		

TABLE VII-10

TITLE: SPACE HEAT, RESIDENTIAL, DISTILLATE OIL
(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids	-		
Bases	-		
Dissolved Solids, Mis.	.4		
Suspended Solids	.76		
Non-Degradable Org.	2.41		
Biological Oxygen Dem.	.76		
Chemical Oxygen Demand	4.66		
AIR (TONS)			
Particulates	39.16		
Oxides of Nitrogen	69.18		
Sulfur Dioxide	136.45		
Hydrocarbons	37.17		
Carbon Monoxide	20.80		
Carbon Dioxide	85,000		
Aldehydes	11.34		
OTHER			
Thermal Rejection (Btu)	-		
Occupational Death (Men)	.0007		
Occupational Injuries (Men)	.05		
Occupational Man Day Lost (Man-day)	2.5		
Solid Waste Tons	48		

TABLE VII-11

TITLE: ELECTRIC GENERATION, GAS TURBINE (GAS-FIRED)
(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids	-		
Bases	-		
Dissolved Solids, Mis.	-		
Suspended Solids	-		
Non-Degradable Org.	-		
Biological Oxygen Dem.	-		
Chemical Oxygen Demand	-		
AIR (TONS)			
Particulates	46	12.14	558.44
Oxides of Nitrogen	450	12.14	5,463.00
Sulfur Dioxide	6.4	12.14	77.70
Hydrocarbons	7.9	12.14	95.91
Carbon Monoxide	17.7	12.14	214.88
Carbon Dioxide	53000	12.14	643,420.00
Aldehydes	?	12.14	-
OTHER			
Thermal Rejection (Btu) X 10^9	0.89	12.14	10.80
Occupational Death (Men)	0.0002	12.14	0.00243
Occupational Injuries (Men)	0.024	12.14	0.291
Occupational Man Day Lost (Man-day)	0.90	12.14	10.93
Solid Waste Tons	-		

TABLE VII-12

TITLE: ELECTRIC GENERATION, GAS TURBINE (OIL-FIRED)
(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids	-		
Bases	-		
Dissolved Solids, Mis.	-		
Suspended Solids	-		
Non-Degradable Org.	-		
Biological Oxygen Dem.	-		
Chemical Oxygen Demand	-		
AIR (TONS)			
Particulates	35	10.24	358.40
Oxides of Nitrogen	330	10.24	3,379.20
Sulfur Dioxide	126	10.24	1,290.24
Hydrocarbons	31	10.24	317.44
Carbon Monoxide	174	10.24	1,781.76
Carbon Dioxide	74000	10.24	757,760
Aldehydes	4	10.24	40.96
OTHER			
Thermal Rejection (Btu)			
Occupational Death (Men)	0.0007	10.24	0.00717
Occupational Injuries (Men)	0.05	10.24	0.512
Occupational Man Day Lost (Man-day)	2.5	10.24	25.60
Solid Waste Tons	48	10.24	491.52

TABLE VII-13

TITLE: ELECTRIC GENERATION, STEAM (NATURAL GAS-FIRED)
(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids			
Bases			
Dissolved Solids, Mis.			
Suspended Solids			
Non-De:radable Org.			
Biological Oxygen Dem.			
Chemical Oxygen Demand			
AIR (TONS)			
Particulates	7.4	9.53	70.52
Oxides of Nitrogen	294	9.53	2,801.82
Sulfur Dioxide	0.3	9.53	2.86
Hydrocarbons	19.7	9.53	187.74
Carbon Monoxide	0.2	9.53	1.91
Carbon Dioxide	61,000	9.53	581,330.0
Aldehydes	3.4	9.53	32.40
OTHER			
Thermal Rejection (Btu) x 10^9	0.89	9.53	8.48
Occupational Death (Men)	0.0008	9.53	0.0076
Occupational Injuries (Men)	0.08	9.53	0.76
Occupational Man Day Lost (Man-day)	3.3	9.53	31.45
Solid Waste Tons			

TABLE VII-14

TITLE: ELECTRIC GENERATION, STEAM (RESIDUAL OIL-FIRED)
(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids			
Bases			
Dissolved Solids, Mis.			
Suspended Solids			
Non-Degradable Org.			
Biological Oxygen Dem.			
Chemical Oxygen Demand			
AIR (TONS)			
Particulates	(30.4)*	148.47	4,513.49
Oxides of Nitrogen	383	148.47	56,864.01
Sulfur Dioxide	(557)*	148.47	82,697.79
Hydrocarbons	33.2	148.47	4,929.20
Carbon Monoxide	2.9	148.47	430.56
Carbon Dioxide	85000	148.47	12,619,950
Aldehydes	7.5	148.47	1,113.53
OTHER			
Thermal Rejection (Btu) X 10^9	0.89	148.47	132.14
Occupational Death (Men)	0.0013	148.47	0.193
Occupational Injuries (Men)	0.109	148.47	16.18
Occupational Man Day Lost (Man-day)	5.02	148.47	745.32
Solid Waste Tons	48	148.47	7,126.56

*Local utilities must be consulted to take account of abatement factors for particulates and sulfur emissions.

TABLE VII-15

TITLE: ELECTRIC GENERATION, STEAM (COAL-FIRED)
(Environmental Impact per 10^{12} Btu)

Impact	Col. A Coefficient for Reduction	Col. B Energy Reduction	Col. C Resultant Emission Reduction
WATER (TONS)			
Acids	12.1	49.13	594.47
Bases	1.0	49.13	49.13
Dissolved Solids, Mis.	62.5	49.13	3,070.63
Suspended Solids	9.0	49.13	442.17
Non-Degradable Org.	1.3	49.13	63.87
Biological Oxygen Dem.			
Chemical Oxygen Demand			
AIR (TONS)			
Particulates	(66.2)*	49.13	3,252.41 2384.02
Oxides of Nitrogen	348	49.13	17,097.24
Sulfur Dioxide	(409)*	49.13	20,094.17 +561.38
Hydrocarbons	8.4	49.13	412.69
Carbon Monoxide	23.1	49.13	1,134.90
Carbon Dioxide	104000	49.13	5,109,520
Aldehydes	0.68	49.13	33.41
OTHER			
Thermal Rejection (Btu) X 10^9	249	49.13	12,233.37
Occupational Death (Men)	0.0759	49.13	3.73
Occupational Injuries (Men)	1.32	49.13	64.85
Occupational Man Day Lost (Man-day)	96.26	49.13	4,729.25
Solid Waste Tons	1394	49.13	68,487.2

*Local utilities must be consulted to take account of abatement factors for particulates and sulfur emissions.

TABLE SHEET

OF REDUCTIONS IN EMISSIONS, ETC.

(OTHER)

		Thermal Reject	Occupational Death	Occupational Injury	Occupational Man-day Lost	Solid Waste
1	TOTAL €	12,558.1	4.06	94.30	14,745.6	81,794.4
2	GASOLINE VEH.	--	--	--	--	--
3	DIESEL BUS	--	--	--	--	--
4	REFINERY, VEH. FUEL	--	0.016	1.18	58.8	1,128.0
5	S.H. COMMERCIAL GAS	84.55	0.019	2.85	8,816.0	--
6	S.H. COMMERCIAL D. OIL	--	0.027	1.90	95.0	1,824.0
7	S.H. COMMERCIAL R. OIL	--	0.040	2.79	143.6	2,737.1
8	S.H. COMMERCIAL, COAL	--	--	--	--	--
9	S.H. RESIDENTIAL, GAS	88.73	0.020	2.99	89.7	--
10	S.H. RESIDENTIAL, D. OIL	--	--	--	--	--
11	ELEC. GEN - GAS T. - GAS	10.8	0.002	0.29	10.9	--
12	ELEC. GEN - GAS T. - OIL	--	0.007	0.51	25.6	491.5
13	ELEC. GEN - STEAM - GAS	8.48	0.008	0.76	31.5	--
14	ELEC. GEN - STEAM - OIL	132.14	0.193	16.18	745.3	7,126.6
15	ELEC. GEN - STEAM - COAL	12,233.37	3.729	64.85	4,729.2	68,487.2

TALLY SHEET
OF REDUCTIONS IN EMISSIONS, ETC.
(WATER)

		ACIDS	BASES	DIS. SOLIDS	SUS. SOLIDS	NON-DEG. ORG	BIO. O.D.	CHEM. O.D.
1	TOTAL	594.5	49.1	3,117.4	532.3	353.0	90.1	552.2
2	GASOLINE VEH.	-	-	-	-	-	-	-
3	DIESEL BUS	-	-	-	-	-	-	-
4	REFINERY, VEH. FUEL	-	-	9.4	17.9	56.6	17.9	109.5
5	S.H. COMMERCIAL GAS	-	-	-	-	1.9	-	-
6	S.H. COMMERCIAL D. OIL	-	-	15.2	28.9	91,2	28.9	177.1
7	S.H. COMMERCIAL R. OIL	-	-	22.2	43.3	137.4	43.3	265.6
8	S.H. COMMERCIAL, COAL	-	-	-	-	-	-	-
9	S.H. RESIDENTIAL, GAS	-	-	-	-	2.0	-	-
10	S.H. RESIDENTIAL, D. OIL	-	-	-	-	-	-	-
11	ELEC. GEN - GAS T. - GAS	-	-	-	-	-	-	-
12	ELEC. GEN - GAS T. - OIL	-	-	-	-	-	-	-
13	ELEC. GEN - STEAM - GAS	-	-	-	-	-	-	-
14	ELEC. GEN - STEAM - OIL	-	-	-	-	-	-	-
15	ELEC. GEN - STEAM - COAL	594.5	49.1	3,070.6	442.2	63.9	-	-