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**THE STRATEGIC GOALS PROGRAM FOR METAL FINISHING IN
SOUTHWESTERN PENNSYLVANIA:**

An analysis of a sector-based voluntary environmental program

Ronald R. Vance Jr.
May 2, 2000

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ABSTRACT

The Strategic Goals Program for Metal Finishing is an innovative sector based, voluntary program designed to achieve environmental performance beyond regulatory compliance in conjunction with economic savings. This study evaluated the level of success of this experimental program by measuring its achievements against its intended goals through the use of database research and a series of interviews of electroplaters in Southwestern Pennsylvania. Based on the results of this study, Strategic Goals Program is succeeding in achieving environmental improvements and cost reductions simultaneously in electroplating facilities in Southwestern Pennsylvania, which could indicate future success of the program in the rest of the state and nation. If successful nation-wide the Strategic Goals Program could provide for a paradigm shift away from command-and-control toward a more flexible environmental regulatory system.

Introduction

For the past 30 years, a command-and-control system of environmental regulation was used to achieve improved environmental quality by mandating pollution reductions and control technologies. While this system was greatly successful in achieving environmental improvements, it was not cost-effective. The cost of compliance for the regulated industries greatly affected their ability to make a profit, and thus, slowed economic growth. Therefore, under such a regulatory structure, economic growth is sacrificed for environmental improvements.

To assist US firms in global market competitiveness, the US government is looking for ways to spur economic growth while protecting and improving environmental quality. Because there is an antagonistic relationship between environmental improvement and economic growth under current environmental regulations, the government is seeking alternatives to command-and-control systems, such as voluntary programs, and market-driven systems.

The Strategic Goals Program for Metal Finishing (SGP) is an innovative sector-based, voluntary program designed to achieve environmental performance beyond regulatory compliance in conjunction with economic savings. The SGP stresses pollution prevention and resource efficiency to achieve these goals. This study shall evaluate the level of success of this experimental program by measuring its achievements against its intended goals.

The study is based on a series of interviews with electroplaters in Southwestern Pennsylvania. This region has been very active in the SGP and has one of the largest number of participants in the country. Success in Southwestern Pennsylvania could represent achievements that could be achieved by metal finishers in the rest of the state and country. The success of the SGP approach would demonstrate that "cleaner, cheaper, and smarter" environmental performance can be achieved. This would help to legitimize the Common Sense Initiative (CSI), the "centerpiece" of EPA's "reinvention" efforts

(3,5,6,8,10,13), and thus, demonstrate that improvements in environmental performance can occur simultaneously with economic growth. If such an experiment was successful it could be applied to other industrial sectors. Therefore, success of the SGP could facilitate the paradigm shift needed in the US environmental regulatory structure to allow for simultaneous environmental improvement while accommodating economic growth.

Program Evolution

Command-and-Control

While command-and-control policies have been successful in achieving environmental improvements, they are both economically and environmentally inefficient, due to their prescriptive nature. Specifying what control technologies a company must use to meet an environmental standard in a one-size fits all manner, requires companies to adopt a control system that may not be the best fit for their operations. Mandating technologies removes the ability of companies to use their own innovation to find the most cost-effective way to meet an emission standard. Preventing innovation of control technologies also prevents companies from utilizing new control measures that could lower emission levels below the standards (4,8,13).

The command-and-control system also creates an adversarial relationship between firms and regulatory agencies, diverting resources away from environmental goals into the costs of monitoring, reporting, permitting, and litigation. Due to the lack of trust, this type of relationship also prevents the parties from working together to find the best method to improve environmental quality (4,8,13).

Alternatives to Command-and-Control

In 1990, the Environmental Protection Agency (EPA) began their Partners for the Environment Program. Through partnerships with industry and trade groups, activist groups, and federal, state, and local governments this program demonstrates "that voluntary goals and commitments achieve real [and measurable] results in a timely and cost effective way...often more quickly and with lower costs than would be the case with regulatory approaches." The program includes 28 different initiatives that are in various stages of development and implementation (3).

33/50 Program

Launched in 1991, the EPA's 33/50 Program represented the first major voluntary environmental policy in the US. This program encouraged companies to reduce emissions of 17 targeted toxic chemicals from 1988 levels by 33% as of 1992 and by 50% as of 1995 (1,2,3).

The program had 1,294 participating companies, approximately 13% of those eligible. These companies achieved the 50% reduction goal in 1994, one year ahead of schedule. By 1995, the participating companies reduced targeted chemical emissions over 507 million pounds or 60% from 1988 levels, non-participating companies achieved reductions of 227 million pounds or 40% (1), and in Pennsylvania, 398 of 1,142 companies participating in the program achieved reductions of 47.1 million pounds or 51% (2).

Common Sense Initiative

Launched on July 20, 1994, the Common Sense Initiative (CSI) is the "centerpiece" of EPA's "reinvention" process and represents a "fundamentally different approach" to environmental regulation. The goal of CSI is to find "cleaner, cheaper, and smarter" methods of reducing pollution. The program brings stakeholders, including industry and trade groups, activist groups, and federal, state, and local governments together, forming six sector committees: petroleum refining, iron and steel, computers and electronics, automobile manufacturing, printing, and metal finishing. These committees meet and discuss ways to change the currently complex and prescriptive environmental regulations into "cleaner, cheaper, and smarter" solutions. Every type of industry has a different set of circumstances, and by allowing the flexibility for each sector to develop a plan that is best fit to their situations, the problems of the one-size-fits-all environmental regulations are relieved. Flexibility also allows each sector to use its expertise and ingenuity to develop the best method of reducing pollution in their sector. This interaction

builds trust among the stakeholders in the joint effort to develop better environmental protection strategies (3,5,6,8,10,13)

Two studies have been performed to evaluate the progress of the CSI. Both reports found that the CSI had not shown the great success that was expected. Both studies recommended that the EPA strengthen their leadership in the program. Both reports also mentioned that the procedures and processes needed to be clearly defined. In some sector committees the stakeholders were having a hard time reaching any type of agreement. In both cases a stronger definition of operational procedures was recommended (5,6,8,10).

The methods used in the Scientific Consulting Group (SCG) study included the evaluation of process, products, effects, and impacts in order to determine the level of CSI's success and to identify improvements. The data was collected through reviewing literature, observing sector meetings, and interviews of stakeholders involved in the processes. Their sample consisted of 46 total individuals representing all stakeholders groups and sectors. Interviews were guided by a list of questions which the interview had been given prior to the meeting so that all relevant information would be ready. SCG did not perform a statistical analysis on the data due to the fact that the sample was small and not random (10).

The purpose of the United States General Accounting Office (GAO) study was to assess the CSI's progress toward its goals and EPA's measures of CSI's progress. The GAO followed the method described in the Government Performance and Results Act of 1993 which determines a program's progress from the comparison of its results to its goals. Data collection occurred through the review of literature on the program and projects, interviewing of stakeholders, observation of CSI's Council, committees, subcommittees, and the goals of 36 sector projects. The study group further investigated 15 of the 36 sector projects by determining if the projects were designed to meet CSI's cleaner, cheaper, and smarter environmental performance and if performance measures

towards these goals were in place. In 11 of the 15 projects studied there were no such measures in place (6,8).

EPA responded that the GAO's methodology did "not adequately recognize the breadth of the initiative's accomplishments," and that it was "unfair" to expect such results at this stage in the Initiative's development (6,8).

The GAO restated the purpose of the CSI was to provide the "centerpiece" of EPA's reinvention efforts and that its goal was to find cleaner, cheaper, and smarter environmental improvements, and thus, insisted that CSI's goals be redefined to include measures of progress and success (8).

Strategic Goals Program

The Metal Finishing Sector Subcommittee of the CSI was formed in January of 1995. In December of 1995 the Administrator of the EPA issued a challenge to the Subcommittee to develop "cleaner, cheaper, and smarter goals" for the industry. The subcommittee responded with the Strategic Goals Program for Metal Finishing (SGP), marking the first agreement reached by a sector-stakeholder group under the CSI. It was, thus, the first opportunity to legitimate EPA's "reinvention" philosophy (7,11).

The SGP, launched on October 27, 1997, consists of "cleaner, cheaper, and smarter" environmental goals to be obtained by 2002 from a 1992 baseline, including the following:

- "Smarter" Goals
 - 98% metals utilization
 - 50% reduction in water use
 - 25% reduction in energy use

- **"Cleaner" Goals**
 - 90% reduction in organic Toxic Resource Inventory chemicals
 - 50% reduction in metal emissions to air and water
 - 50% reduction in land disposal of hazardous sludge
 - Reduction in sludge generation
- **"Cheaper" Goals**
 - Long-term economic benefit from meeting smarter and cleaner goals
 - 50% reduction in costs of unnecessary environmental costs
- **Other Goals**
 - Increased compliance with environmental regulations
 - 80% facility participation (9,11,12).

Summary

The command-and-control environmental management system presents serious impediments to achieving environmental improvement and economic growth simultaneously. Therefore, the EPA has begun several partnership programs to try and find alternatives to command-and-control regulations. The 33/50 program was the first voluntary program and it was successful in achieving environmental improvement beyond that required by law. However, there was no measure for the costs of such actions included in the program.

The CSI included performance goals but the progress of the initiative has been slow. The studies performed on the CSI provide insight in how to construct an analysis of such a programs success.

The SGP was the most successful element of the CSI, and by establishing performance measures, progress toward the goals can be determined. Success of the SGP would be the first indicator that environmental improvement and economic growth can occur simultaneously.

Objectives

The objective of this study was to determine the success of the Strategic Goals Program as measured by facility:

- participation;
- environmental improvement; and
- cost savings.

Expected Findings

It was expected that SGP participants would show increased environmental performance and economic savings over those achieved by the non-participating electroplaters. Because the program was only approximately at the half-way mark, it was not expected that the SGP participants would have fully met the goals of the program. The findings of the study could be generalized to the national scale of electroplaters. However, this generalization would be limited due to the differences between the regional population of electroplaters in Southwestern Pennsylvania and other regions of the country.

Methodology

Variables

The variables for this experiment were SGP participation, environmental performance, and cost savings. SGP participation was considered the independent variable, and defined as a facility's written agreement to participate in the program. Environmental performance and cost were treated as the dependent variables. Environmental performance was defined as energy and water use, sludge production and disposal, and violations with environmental regulations. Costs was defined as the amount paid for energy, water, and sludge disposal and recycling.

Sample

The sample for this study consisted of electroplaters within Southwestern Pennsylvania. According to PA DEP data, at the time the study was performed, of approximately 50 metal finishing facilities in Southwestern Pennsylvania there were 29 electroplaters , and of these, 18 were participants in the SGP. A list of these electroplaters is included in Appendix A.

This sample was a convenience sample, and thus, is not random. Because the SGP was a new program, areas with greater number of participants provided for a greater measure of the program's success. Overall there were 27 participants in the SGP from Southwestern Pennsylvania, including electroplaters, galvanizers, powder coaters, and publicly owned treatment works (POTWs), that represent one of the largest number of SGP participants within a given region among the state and the nation. In order to control for extraneous variables among all SGP participants, electroplaters were chosen for this study because the program's goals were designed for electroplating operations, and they represent the majority of participants in Southwestern Pennsylvania.

Data Collection

Data for this study were obtained from questionnaires and databases, both of which were secondary data. The questionnaire, located in Appendix B, was given to electroplaters in Southwestern Pennsylvania, and used to obtain information about the facility, environmental performance, and costs. Interviews were performed using the questionnaire as a guide. The facility contact received the questionnaire prior to the interview so that he or she may be prepared to answer the questions.

Facility participation information was obtained from a PA DEP database. The information gathered was in two forms; the total number of electroplaters in Southwestern Pennsylvania, and the number of those electroplaters signed on to the SGP. The questionnaire was used to determine the reasoning behind a facilities participation or non-participation. The length of time a facility had participated could have been used to control for differences in facility progress toward the goals, but this information was not available for all of the participants

Compliance data, obtained from a PA DEP database and facility interviews, provided the number and type of violations that each electroplater received annually from 1997 to 1999. For this study a violation was defined as the receipt of a notice of violation from an environmental regulatory agency.

Environmental performance data were collected through the interviews. Energy and water use, and sludge production, disposal, and recycling data were collected as annual usage sums for 1992 and 1999. The annual average water content of the sludge for those years was also collected.

Cost data were also collected through the interviews. Cost of energy per kilowatt-hour, water per gallon, and waste disposal per pound, as well as the amount of money received per pound of recycled waste were collected for 1992 and 1999.

The interview data for this study were provided by the facilities without being verified. To a certain extent this brings the validity of the data into question, as well as that of the study's finding. In an effort to minimize false reporting, facility information will be used anonymously. This does not prevent the problem, but will minimize its effects.

Data Analysis

The data were analyzed using the following categories:

- **Participation**

Facility participation was calculated using the following formula:

$$\text{Percent participation} = (\text{participants}/\# \text{ electroplaters}) \times 100$$

- **Compliance**

Facility compliance will be calculated using the following formula:

$$\text{Number of violations} / \text{number of inspections}$$

- **Environmental Performance**

Sludge production was calculated using the following formula:

$$\text{Sludge production} = \text{pounds sludge produced} \times (1 - \text{percentage of water})$$

Percent change of energy and water use, and sludge production, disposal, and recycling from the baseline year to 1999 was calculated using the following formula:

$$\text{Percent Change} = 1 - \frac{\text{(1999 level / 1992 level)}}{\text{(1999 production / 1992 production)}}$$

- **Costs**

Energy and water costs was calculated using the following formula:

$$\text{Percent Change} = 1 - \frac{\text{(1999 level / 1992 level)}}{\text{(1999 production / 1992 production)}}$$

Sludge disposal cost was calculated using the following formula:

$$\text{Percent Change} = 1 - \frac{\text{(99 cost of disposal + recycle / 92 cost of disposal + recycle)}}{\text{(1999 production / 1992 production)}}$$

Reductions were compared to the goals of the SGP, and comparisons will be performed between SGP participants and non-participants. Statistical evaluations were not performed due to the small sample size and non-random sampling.

Results

Participation

Of the 29 electroplaters in Southwestern Pennsylvania, 18 were participants, and 11 were non-participants in the SGP resulting in a 62% participation rate. Of the 15 electroplaters interviewed for the study, 13 were participants, and 2 were non-participants, giving a 86.67% participation rate. See Figures 1 and 2.

During the interview the participants were asked to prioritize the reasons they signed on to the SGP, and they responded with the following:

1. Receive technical assistance
2. Cost savings associated with the program
3. Improve DEP-facility relationship
3. Receive regulatory assistance
3. Company has a proactive philosophy
6. Networking opportunities with other metal finishers
7. Public recognition
7. Receive reporting assistance
9. Pollution prevention and energy efficiency site assessments
9. Improve POTW-facility relationship.

Refer to Appendix C for participant reasoning data.

During the interview the non-participants were asked why they did not sign on to the SGP, and they ranked their reasons in the following manner:

1. Lack of resources: manpower, financial, time, etc.
1. Cannot see benefit of the program
3. Costs associated with the program outweigh the benefits
3. Other: Company does very little electroplating

Refer to Appendix D for non-participant reasoning data.

Compliance

Compliance data were found for 20 electroplaters, 14 participants and 6 non-participants. Participants were found to have had an average of 5.00 inspections and 1.07 violations per facility over the three year period from 1997-1999. Therefore their violation to inspection ratio was 0.214.

Non-participants were found to have an average of 4.50 inspections and 0.66 violations per facility. Therefore, their violation to inspection ration was 0.147.

A large majority of the violations, 15 of 19 total violations received by all of the facilities, were in the category of hazardous waste. Other violation areas included residual waste which accounted for 1 violation, employee training which accounted for 1 violation, and NPDES which accounted for 2 violations. See Figure 3.

Refer to Appendix E for facility compliance data.

Environmental Performance

Water consumption decreased among participants by an average of 29.87%, whereas it increased among non-participants by an average of 0.05%. See Figure 4.

Electricity consumption decreased among participants by an average of 20.33%, whereas it increased among non-participants by an average of 6.75%. See Figure 5.

Sludge production decreased among participants by an average of 51.14%, whereas it decreased among non-participants by an average of 3.85%. See Figure 6.

Sludge disposal decreased among participants by an average of 59.28%, whereas it decreased among non-participants by an average of 3.85%. See Figure 7.

Sludge recycling increased among participants by an average of 62.53%, whereas it did not change among non-participants. See Figure 8.

Refer to Appendix F for environmental performance data.

Costs

Water costs decreased among participants by an average of 27.50%, whereas it increased among non-participants by 4.10%. See Figure 9.

Electricity costs decreased among participants by an average of 24.96%, whereas it increased among non-participants by an average of 30.30%. See Figure 10.

Sludge Costs decreased among participants by an average of 74.14%, whereas it decreased among non-participants by an average of 10.45%. See Figure 11.

Refer to Appendix F for cost data.

Discussion

Participation

The participation rate in Southwestern Pennsylvania was 62%, 18% short of the goal of 80%. Facilities exposure to the SGP will increase as time goes on through increased facility participation and increased research into the success of the program by studied such as these. Participation can be expected to increase with increased exposure to the program. Recruiters for the program may wish to emphasize the areas of the program that the participants assigned a high priority.

Participants indicated that their primary reason for joining the SGP was for technical assistance. Although not recorded in the participants' ranking, networking was a common emphasis during the interviews. Also, the pollution prevention and energy efficiency site assessment is a source of technical assistance, but it too scored low. This may be contributed to the lack of knowledge or understanding of such a program.

Cost savings was ranked second among reasons for signing on to the SGP. The bottom line is what runs business decision making and thus it is reflected as a high priority among participants. This is also reflected in the non-participants high ranking of the lack of resources, not seeing the benefit, and cost associated with the program as leading reasons for not signing on to the SGP.

Compliance

Non-participants were found to have a better compliance record than did participants. However, inspections are not performed uniformly across the sector in frequency and quality. Some facilities interviewed never had an inspection, while others had 8 in the past several months. The facilities are not inspected by the same individuals, and different inspectors interpret and apply the regulations differently. Therefore, compliance is an inconsistent measuring criteria.

Environmental Performance

Participants achieved greater environmental improvements than did the non-participants. The participants were able to meet the following goals:

- Reduction in sludge reduction
- 50% reduction in sludge disposal.

Participants did make progress towards the following goals:

- 50 % reduction in water consumption - participants achieved a 29.87% reduction
- 25% reduction in energy consumption - participants achieved a 20.33% reduction.

While the participants fell short of reaching the goals, they are well on their way towards meeting those goals in 2002. Some of the companies were unable to use 1992 as their baseline and are thus forced to use a more recent year as their baseline. This may effect the ability of the companies to fully achieve the performance goals. Companies, included in this study, had also signed on to the SGP just a few weeks before the study. These companies could just be beginning to improve their performance which would not be accounted for in these evaluations.

Costs

Along with the environmental improvements the participants cut costs in all areas measured while not participants experienced increased costs in everything but sludge costs. By achieving cost reductions the participants were able to achieve the SGP goal of long-term economic benefit from meeting the "smarter and cleaner" goals.

Conclusion

While the goals of the Strategic Goals Program have not yet been fully met, electroplaters in Southwestern Pennsylvania have made great progress. The participation rate in the region is among the highest in the nation. Facilities are achieving environmental improvements along with cost reductions which validates the fact that both can occur simultaneously under an environmental program.

Based on the results of this study, the Strategic Goals Program is succeeding in Southwestern Pennsylvania, which could indicate future success of the program in the rest of the state and nation. If successful nation-wide the Strategic Goals Program could provide for a paradigm shift away from command-and-control toward a more flexible environmental regulatory system.

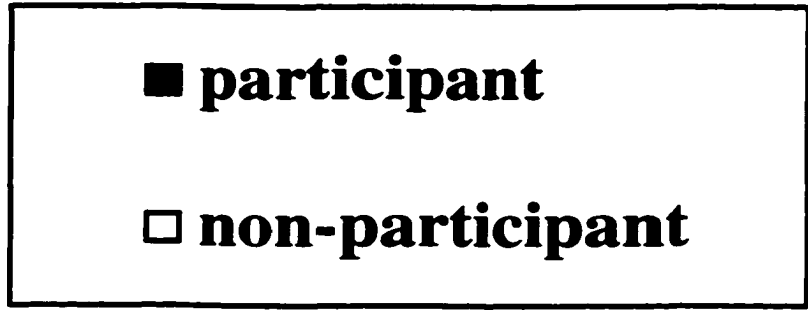
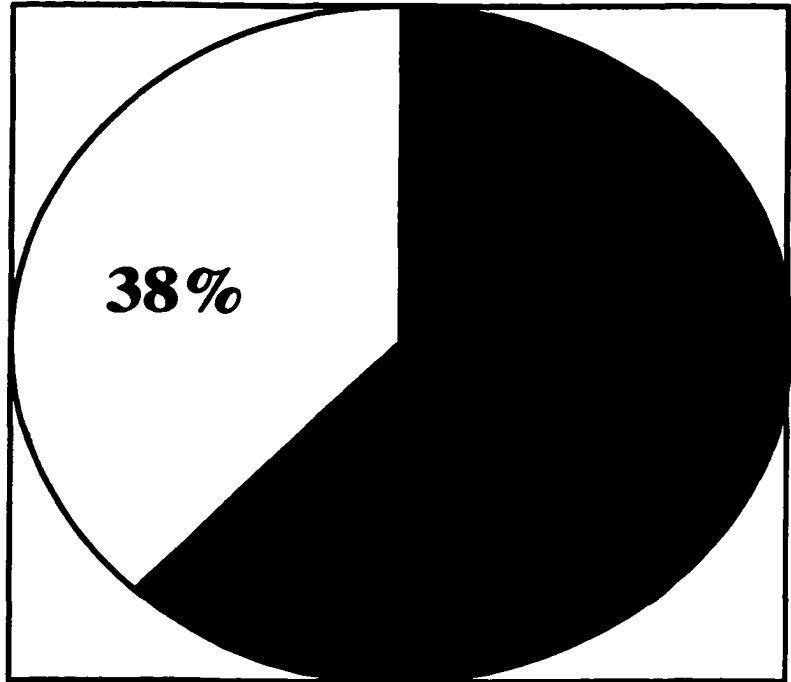


Figure 1: Participation Results in Southwestern Pennsylvania

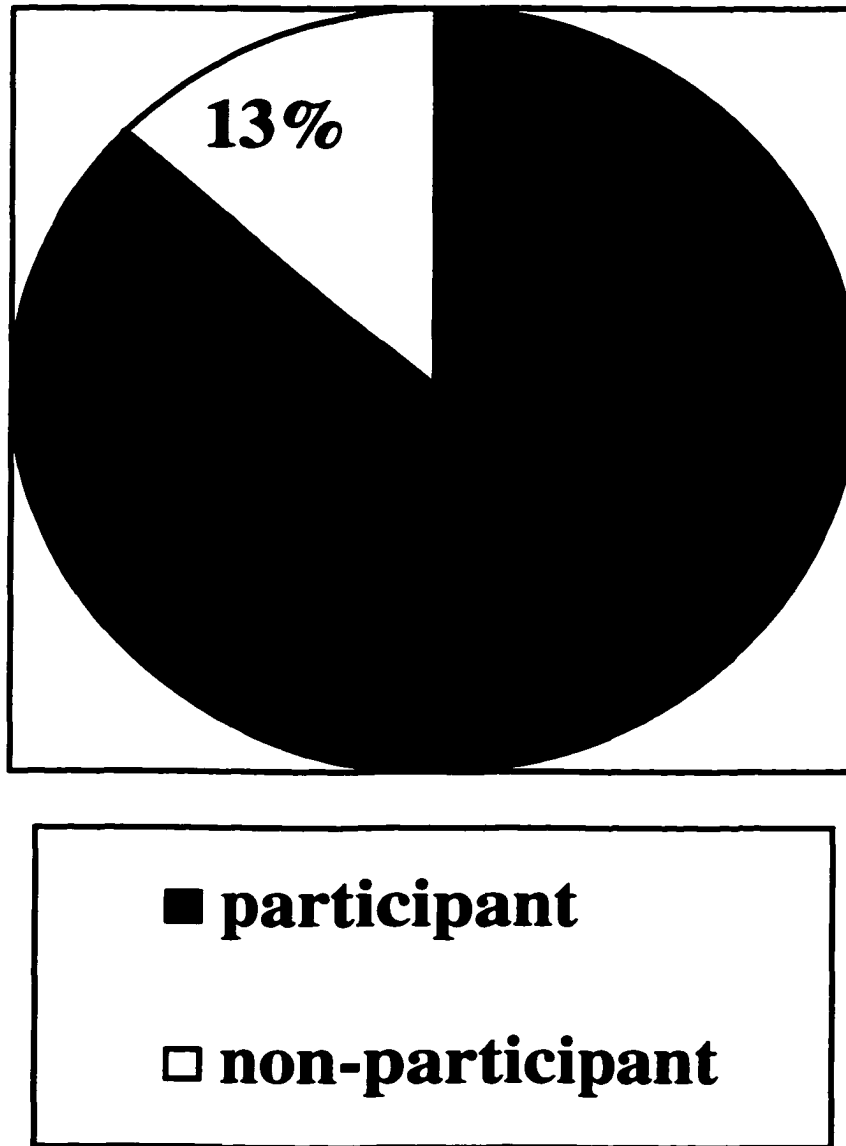
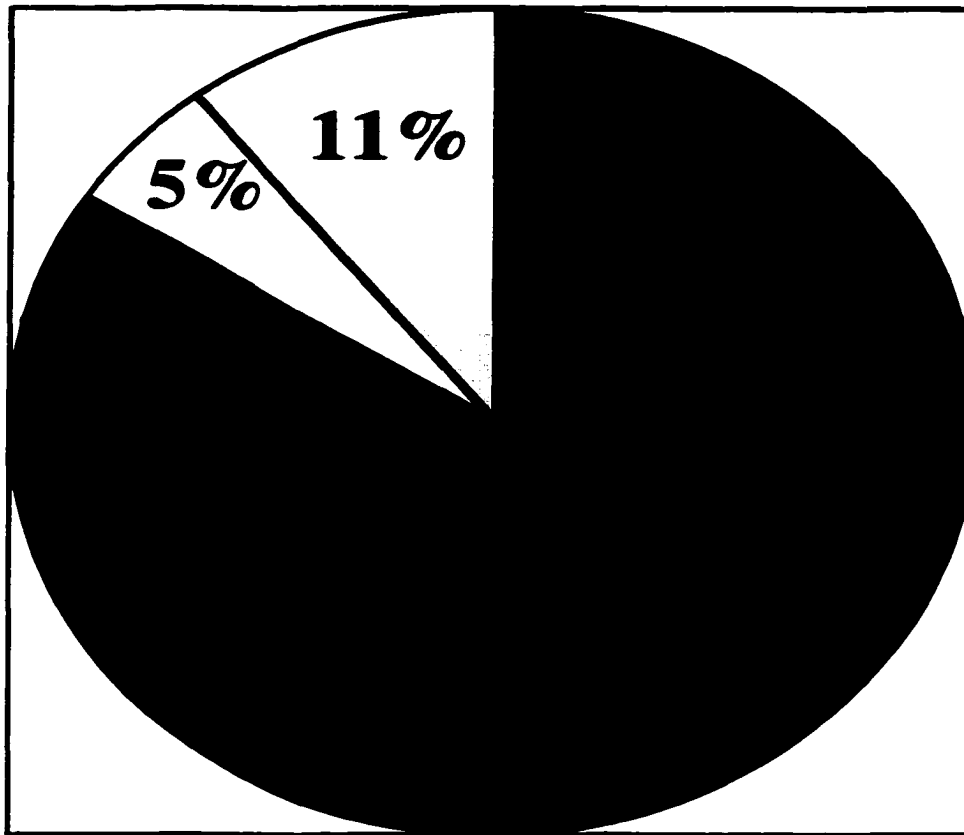


Figure 2: Participation Results in the Study



- hazardous waste
- residual waste
- employee training
- NPDES

Figure 3: Violations by Category

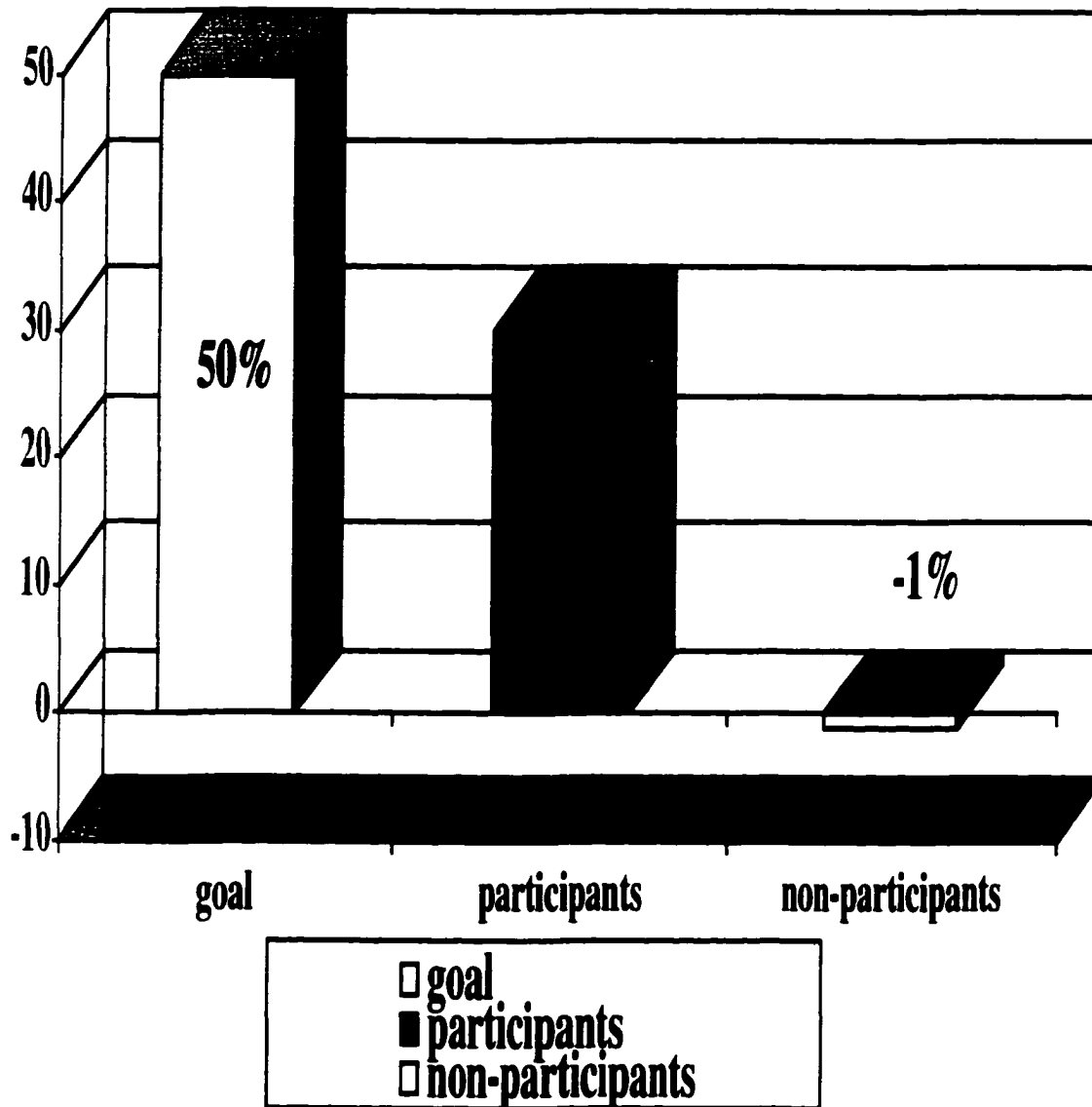


Figure 4: Reduction in Water Consumption

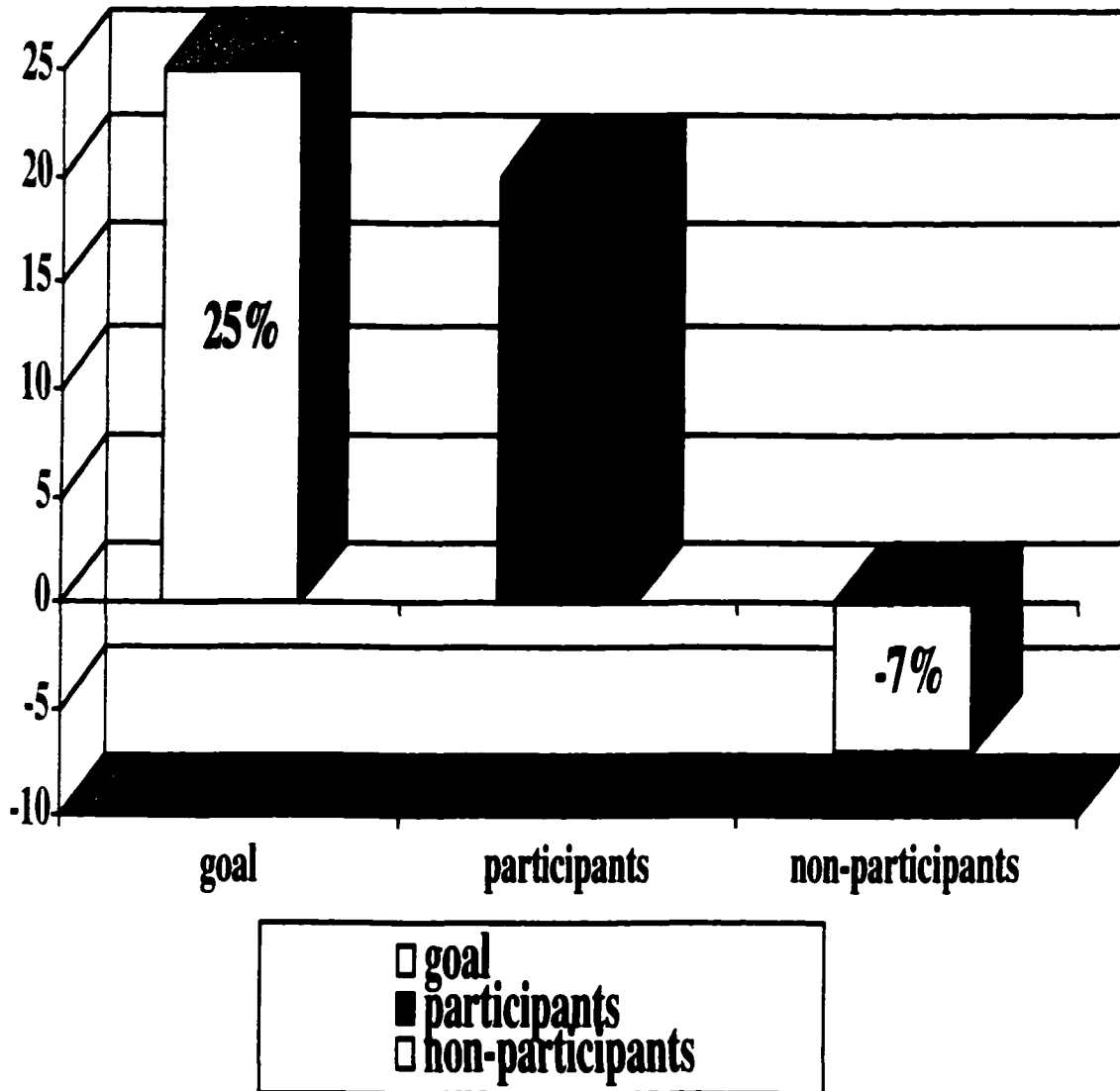


Figure 5: Reduction in Energy Consumption

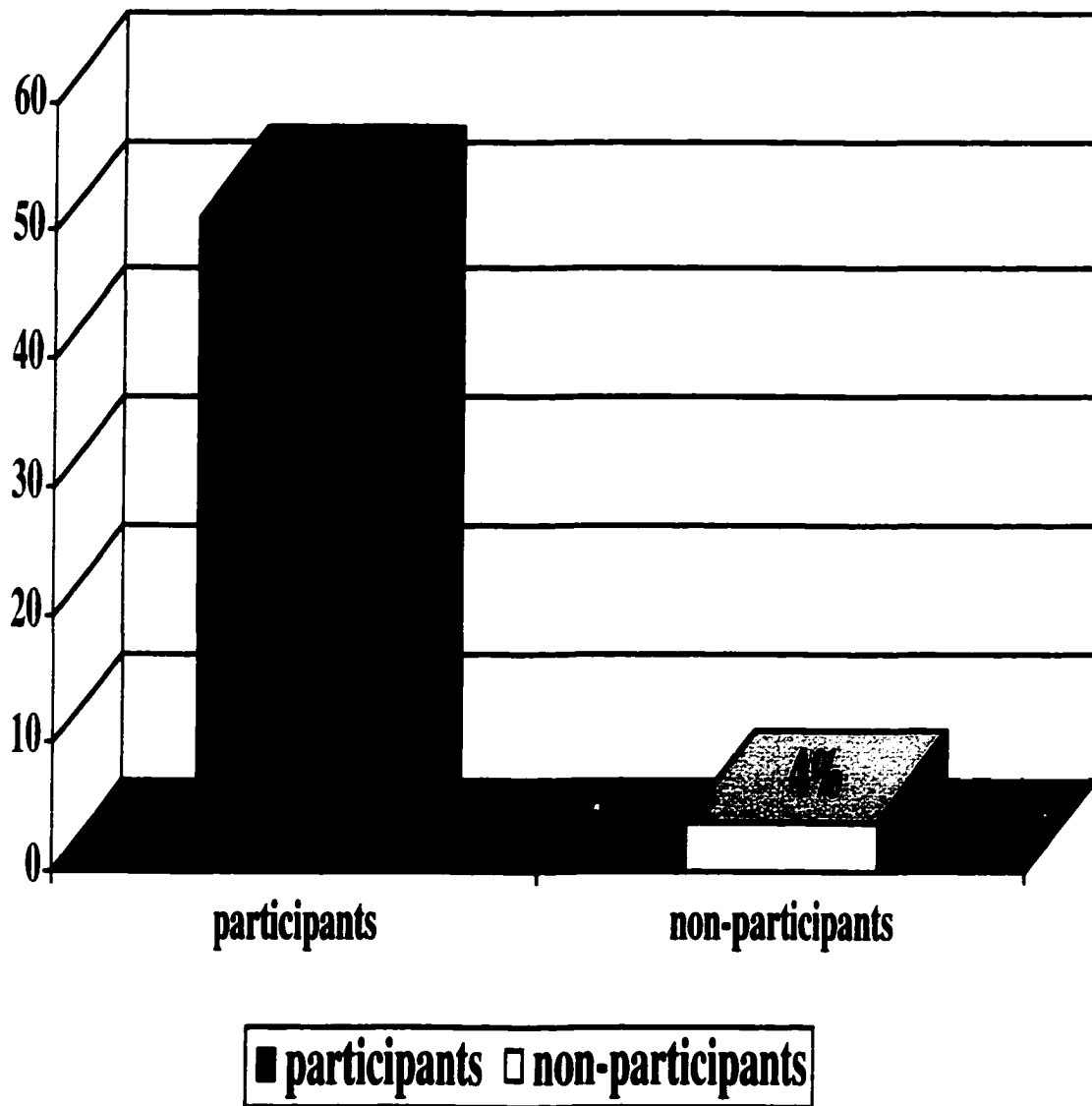


Figure 6: Reduction in Sludge Production

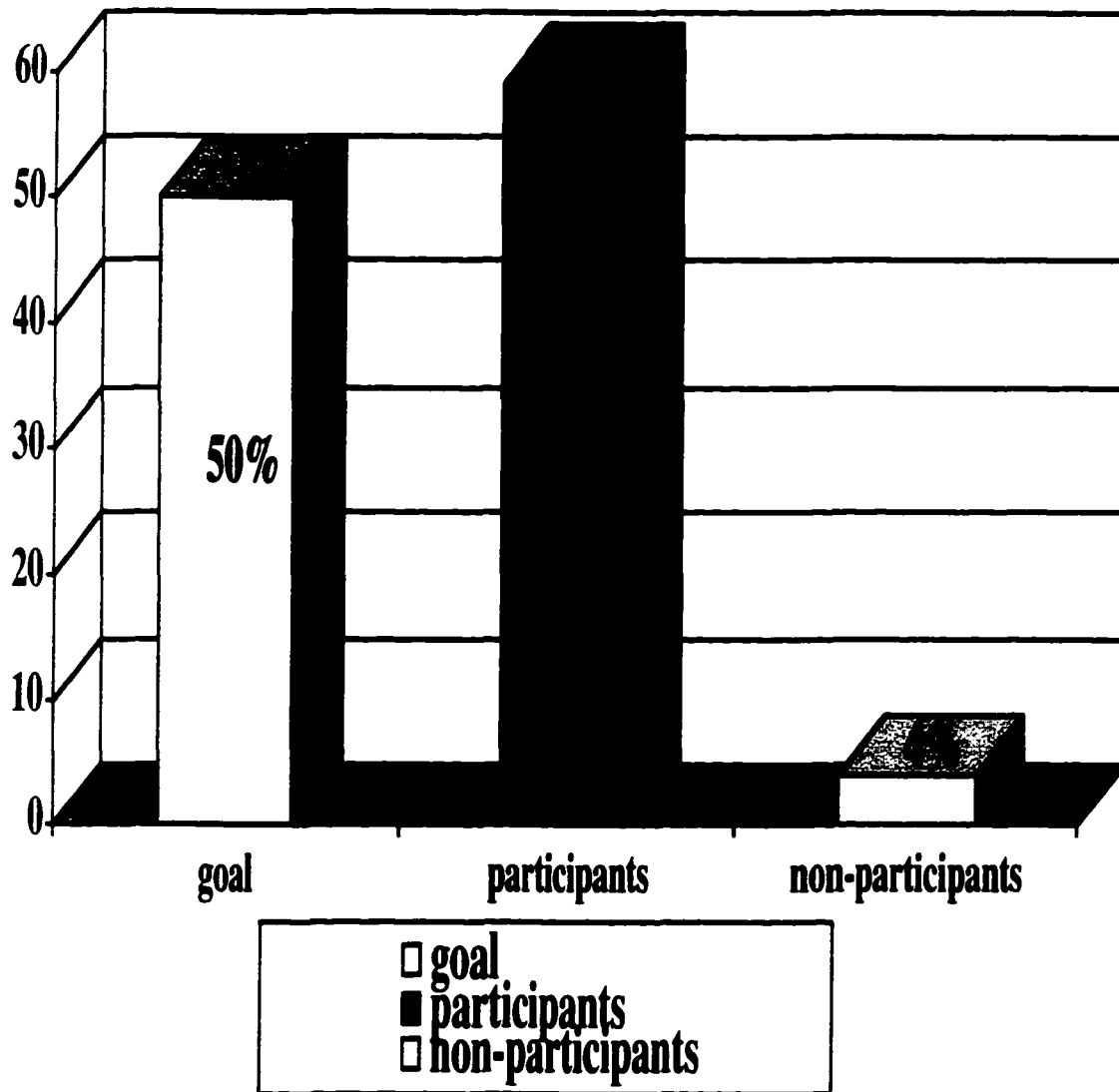


Figure 7: Reduction in Sludge Disposal

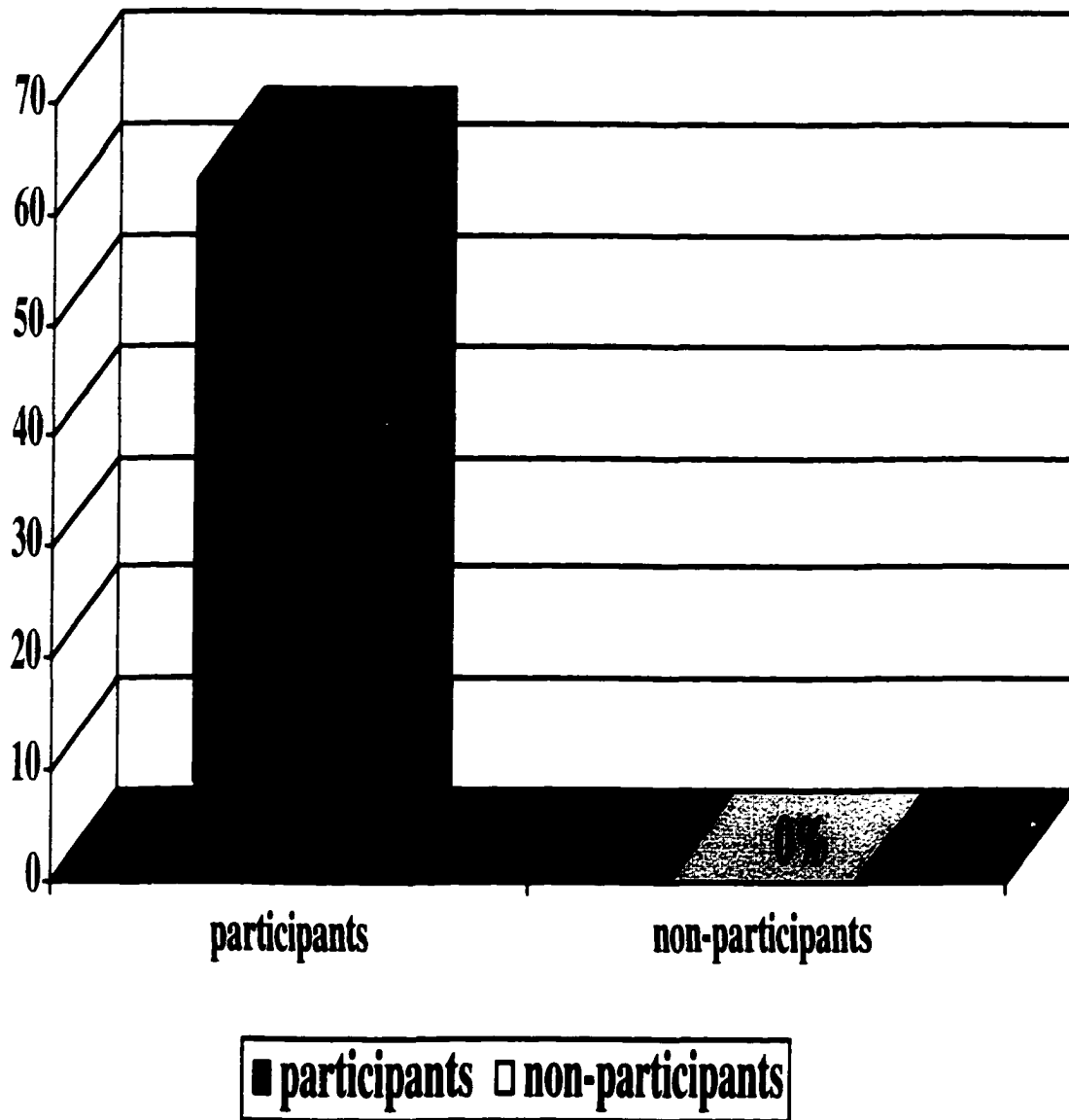


Figure 8: Increase in Sludge Recycling Activities

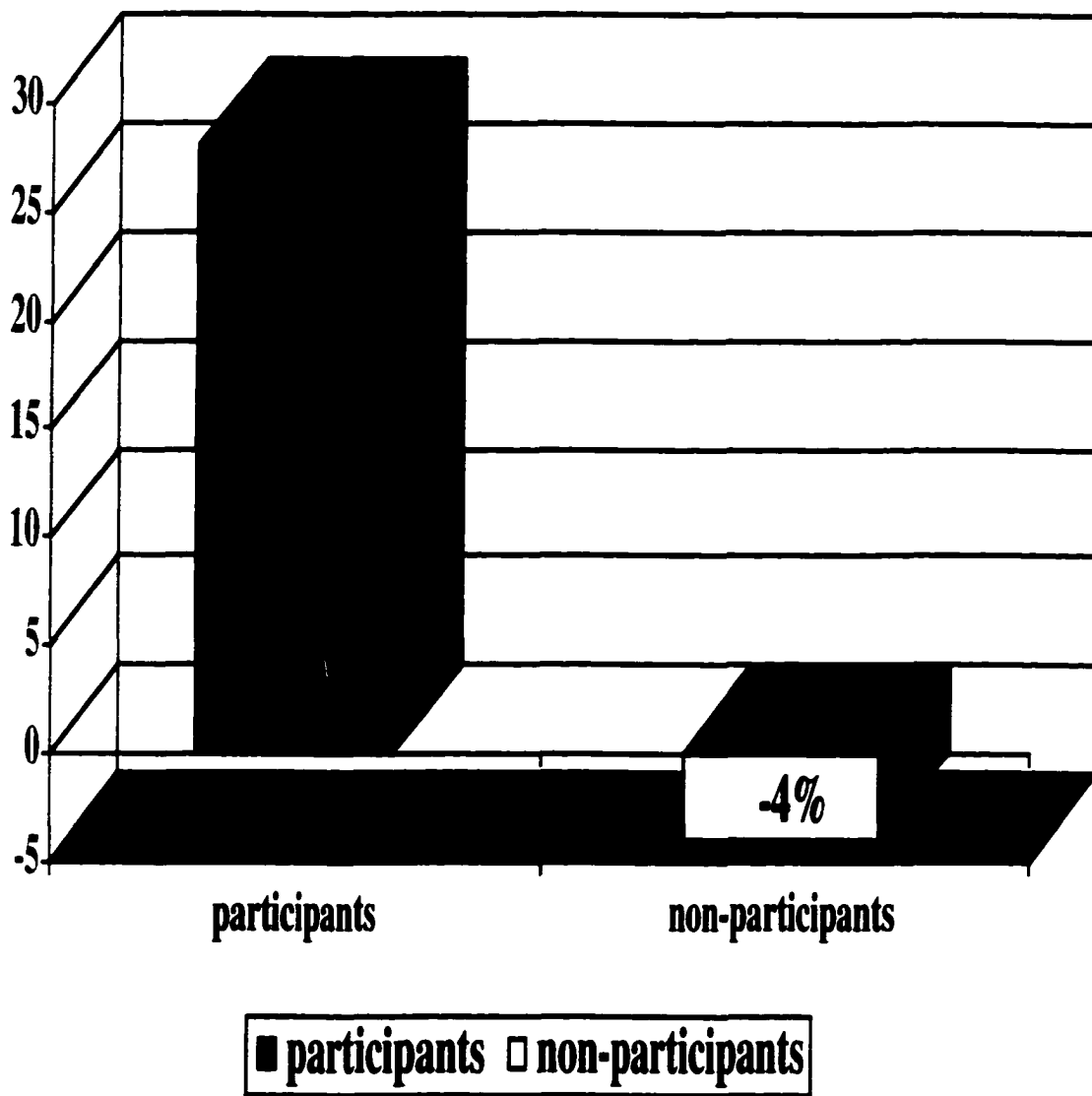


Figure 9: Reduction in Water Cost

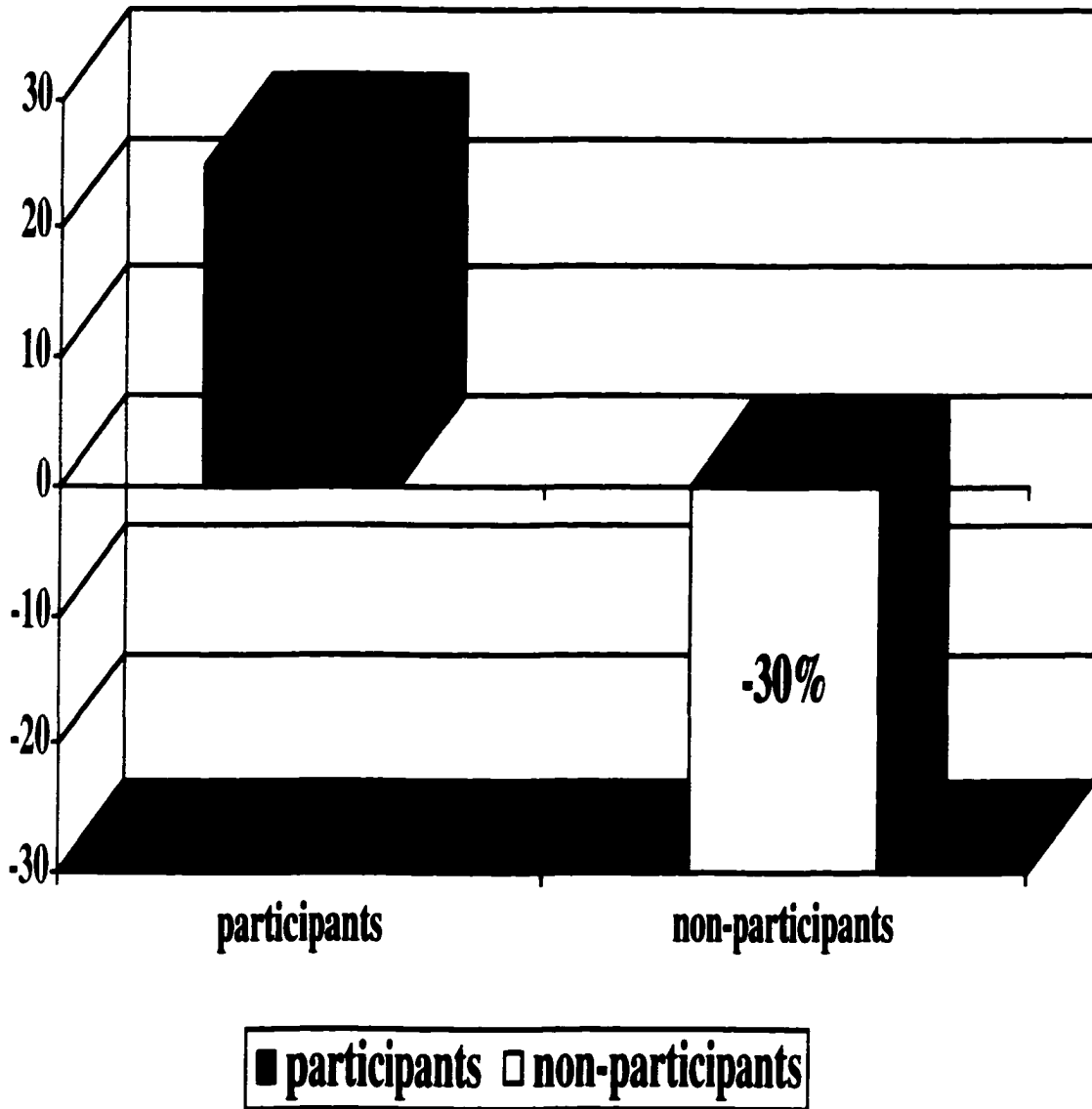


Figure 10: Reduction of Energy Cost

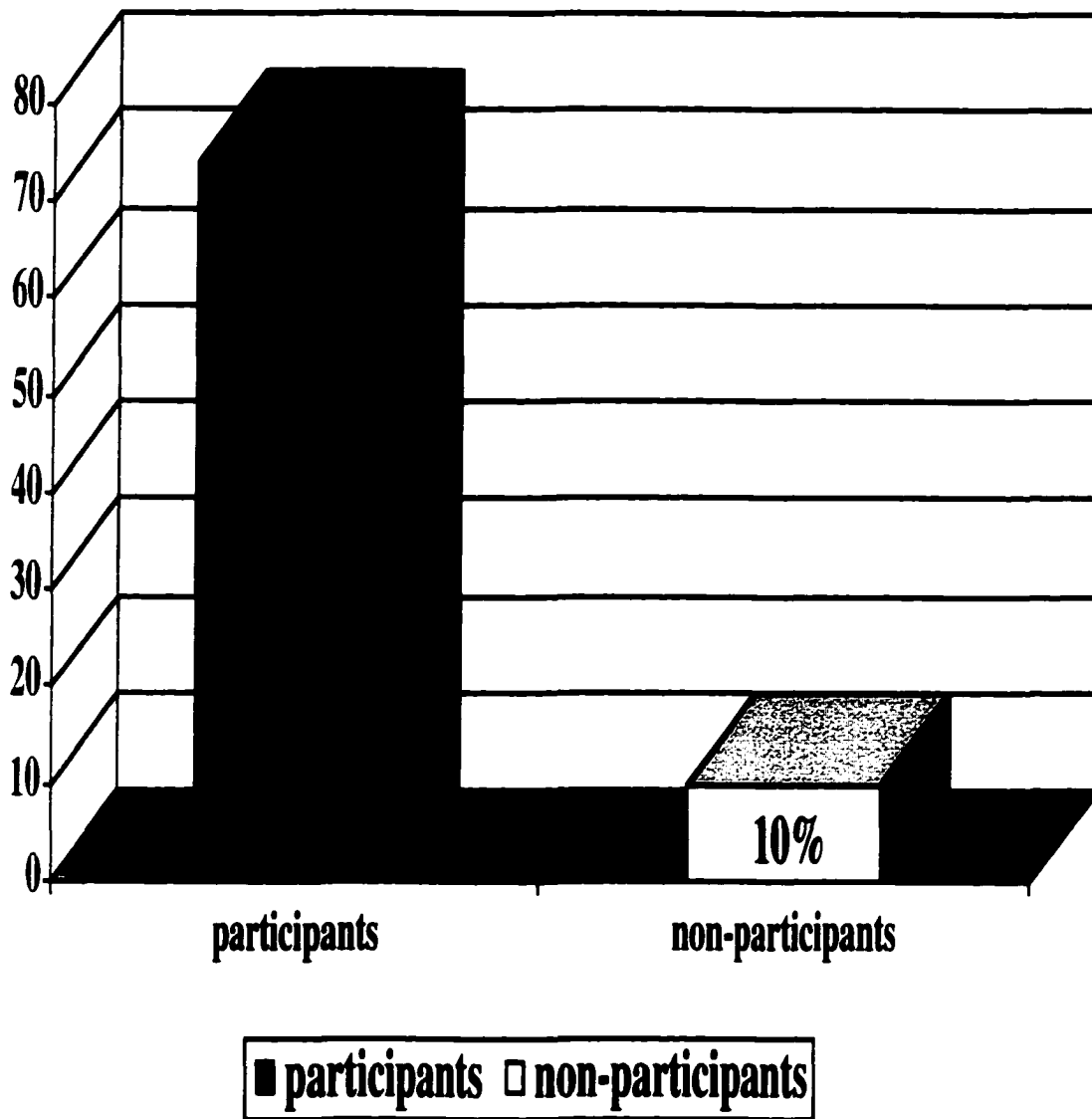


Figure 11: Reduction in Sludge Disposal Cost

Appendix A

List of Electroplaters in Southwestern Pennsylvania

(* denotes SGP Participant)

Advanced Metallurgy Inc.*
American Video Glass*
Armoloy of Western PA, Inc.
Bill's Chrome
CKE, Inc.*
Cleaveland/Price Inc.*
Concurrent Technologies Corp.*
Cowan Metal Finishing Co.*
CSM Industries*
Cutler-Hammer*
East Liberty Electroplating Co.*
Electro-Mec
Elizabeth Carbide Die Co., Inc.*
Frank Mance Plating Service
Industrial Machine Works*
Jersey Chrome Plating
Keystone Rustproofing*
Latronics Corp.*
Leading Technologies, Inc.*
M&P Refinishing
Mance Plating Co.
Paul's Chrome*
Pittsburgh Industrial Plating Co.
Pittsburgh Lamp and Plating Service Co.*
Powerex, Inc.
Rockwood Manufacturing Co.
S&S Chrome Plating*
Seebacher's Plating Mill
Warek Manufacturing*

Appendix B

Electroplater Survey

Is the company a participant in the Strategic Goals Program: ___ Yes ___ No

If you are a participant in the Strategic Goals Program, please indicate the top three reasons that you signed on. Number your selections from 1-3 with one being the most important.

- ___ Improve DEP-facility relationship
- ___ Cost savings associated with the program
- ___ Receive regulatory assistance
- ___ Public recognition
- ___ Pollution Prevention and Energy Efficiency Site Assessments
- ___ Receive technical assistance
- ___ Receive reporting assistance
- ___ Company has a proactive philosophy
- ___ Improve POTW-facility relationship
- ___ Obtain regulatory incentives
- ___ Networking opportunities with other Metal Finishers
- ___ Workshops
- ___ Other: _____

If you are not a participant in the Strategic Goals Program, please indicate the top three reasons that you did not sign on. Number your selections from 1-3 with one being the most important.

- ___ Avoid dealing with DEP when not required
- ___ Cost associated with the program outweigh the benefits
- ___ Lack of resources: manpower, financial, time, etc.
- ___ Compliance concerns
- ___ Public recognition
- ___ Management of company will not approve the program
- ___ Company does not see the benefit of the program
- ___ Other: _____

Appendix B

Compliance History:	1997	1998	1999
• # of Inspections	_____	_____	_____
• # of Violations	_____	_____	_____
• Type of Violations	_____	_____	_____

Production Levels (Choose one):	1992 (baseline)	1999
• Material Handled (ssf):	_____	_____
• Sales (\$):	_____	_____
• Labor Hours (hr)	_____	_____
• Units produced (#):	_____	_____
• Other: _____	_____	_____
Water Consumed per Year (gal):	_____	_____
Cost of Water (\$/gal):	_____	_____
Electricity Consumed per Year (kWh): _____	_____	_____
Cost of Electricity (\$/kWh):	_____	_____
Sludge Produced per Year (lb):	_____	_____
Average Water Content of Sludge (%): _____	_____	_____
Sludge Land Disposed per Year (lb): _____	_____	_____
Cost of Sludge Disposal (\$/lb):	_____	_____
Sludge Recycled per Year (lb):	_____	_____
Price received for Recycled Sludge (\$/lb): _____	_____	_____

APPENDIX C: Reasons Participants Signed On

Participant	DEP	Relat	Cost Sav	Reg. Asst.	Public Rec.	Tech. Asst.	Report Asst.	Proactive	P2/E2	POTW	Rel. Reg.	Incen.	Networking	Workshops	Other
Yes			X					X							
Yes			X			X									X
Yes				X											
Yes	X					X									X
Yes				X				X							X
Yes			X			X									
Yes	X		X			X									
Yes	X					X									
Yes	X					X									
Yes	X		X			X									
Yes	X		X			X									
Yes	X		X			X									
Yes	X							X							
Yes	X					X		X							
Yes	X					X		X							
Yes	X					X									
Total	5	6	5	5	2	8	2	5	1	1	1	1	4		
Rank	3	2	3	3	7	1	7	3	9	9	9	9	6		

APPENDIX D: Reasons Non-Participants Did Not Sign On

Participant	Bad DEP Relationship	Costs	Lack Resources	Compliance	Recognition	Management	No Benefit	Other
No		x	x				x	
No			x				x	little plating
Total		1	2	2			2	1
Rank		3	1				1	3

APPENDIX E: Facility Compliance Data

Participant	97 Inspect	97 Viol	97 Viol Area	98 Inspect	98 Viol	1998 Viol Area	99 Inspect	99 Viol	1999 Viol Area
Yes	3	0		2	0		2	0	
Yes	2	0		3	0		2	0	
Yes	4	0		1	0		1	0	
Yes	0	0		0	0		0	0	
Yes	2	0		2	0		2	0	
Yes	0	0		0	0		2	3	Haz. Waste
Yes	2	4	Haz. Waste	1	0				
Yes				3	3	Haz. & Res. Waste	4	0	
Yes	0	0		0	0		1	0	
Yes	0	0		0	0		1	2	Haz. Waste & Employee Training
Yes	2	0		2	0		3	0	
Yes	5	0		8	0		8	0	
Yes	0	0		0	0		1	0	
Yes	1	3	Haz. Waste	0	0		0	0	
No							2	1	Haz. Waste
No	2	0		2	0		3	0	
No				1	0		5	0	
No							2	1	Haz. Waste
No				4	1	NPDES	4	1	NPDES
No				1	0		1	0	
Total									
Mean									
Part. Total									
Part. Mean									
NonPart. Ttl									
NonPart. Mean									

APPENDIX E: Facility Compliance Data

Participant	Ttl Inspect	Ttl Viol	Violation Areas	Violations/Inspections
Yes	7	0		
Yes	7	0		
Yes	6	0		
Yes	0	0		
Yes	6	0		
Yes	2	3	Haz. Waste	
Yes	3	4	Haz. Waste	
Yes	7	3	Haz. & Res. Waste	
Yes	1	0		
Yes	1	2	Haz. Waste & Employee Training	
Yes	7	0		
Yes	21	0		
Yes	1	0		
Yes	1	3	Haz. Waste	
No	2	1	Haz. Waste	
No	7	0		
No	6	0		
No	2	1	Haz. Waste	
No	8	2	NPDES	
No	2	0		
Total	97	19		
Mean	4.85	0.95		0.196
Part. Total	70	15		
Part. Mean	5	1.07		0.214
NonPart. Ttl	27	4		
NonPart. Mean	4.5	0.60		0.147

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APPENDIX F: Environmental Performance and Cost Data

Participant	Water Use	Water Cost	Electricity Use	Electricity Cost	Sludge Production	Sludge Disposal	Sludge Recycling	Sludge Cost
Yes	-62.20%	-68.90%			-41.10%	-100.00%	168.40%	-118.80%
Yes	10.20%	20.20%	22.90%	-4.90%	-88.80%	0.00%	0.00%	0.00%
Yes	-80.20%	7.40%	-10.10%	-10.90%	36.10%	0.00%	36.10%	-64.50%
Yes			-71.40%	-71.40%	-88.90%	-88.90%	0.00%	-98.40%
Yes	-40.00%	-40.40%						
Yes	-60.10%	-39.90%			-23.80%	-23.80%	0.00%	-23.80%
Yes	31.40%	-87.30%	-60.80%	-60.60%	-51.90%	-90.20%	216.00%	-93.70%
Yes	-15.40%	4.70%	-18.80%	-20.90%	-71.30%	-71.30%	0.00%	-81.10%
Yes	-52.50%	-43.50%	-4.10%	-6.00%	-79.40%	-100.00%	79.70%	-112.80%
Yes								
Yes	0.00%	0%	0%	0%				
Yes								
No	-2.80%	5.30%	2.60%	18.40%	23.10%	23.10%	0.00%	9.90%
No	2.90%	2.90%	10.90%	42.20%	-30.80%	-30.80%	0.00%	-30.80%
Total	-288.70%	-239.50%	-128.80%	-114.10%	-416.80%	-481.80%	500.20%	-614.00%
Mean	-24.43%	-21.77%	-14.31%	-12.68%	-14.68%	-48.19%	50.02%	-61.40%
Part. Total	-288.80%	-247.70%	-142.30%	-174.70%	-409.10%	-474.20%	500.20%	-593.10%
Part. Mean	-29.87%	-27.50%	-20.33%	-24.96%	-51.14%	-59.26%	62.53%	-74.14%
NonPart. Totl	0.10%	6.20%	13.50%	60.60%	-7.70%	-7.70%	0.00%	-20.90%
NonPart. Mean	0.05%	4.10%	6.75%	30.30%	-3.85%	-3.85%	0.00%	-10.45%

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