MARKETING CONCEPTS AND STRATEGY CAN REDUCE RESISTANCE TO NUCLEAR POWER PLANT INSTALLATIONS

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CONTENTS

ACKNOWLEDGMENTS ii

Chapter

I. INTRODUCTION 1

Statement of the Problem 1
Purpose of the Study 2
Need for the Study 3
Scope and Limitations of the Study 5
Definitions 5
Statement of the Hypothesis 6
Sources of Data 6
Organization 6

II. HISTORY AND DEVELOPMENT OF NUCLEAR ENERGY 8

Early Reactor Development 8
Formation of the Atomic Energy Commission 8
Early Development of Nuclear Generating Plants 10
The Emergence of Opposition to Nuclear Power Plants . . . 12
Environmental Impact on Rivers and Lakes 13
Danger of Radioactive Emissions 15

III. AN EXAMINATION OF CURRENT ATOMIC ENERGY COMMISSION MARKETING TECHNIQUES 22

The Commission's Place in the Marketing System 22
Inadequacy of Present Marketing Strategy 23

IV. DEVELOPING A MARKETING STRATEGY FOR REDUCING PUBLIC RESISTANCE TO NUCLEAR POWER PLANTS 32

Marketing Concepts as Applied to Nuclear Power Plants . . 32
Marketing Strategy on the National Level 34
Marketing Responsibilities of Electric Power Companies on the Local Level 53
Summary 57

V. THEMES TO BE STRESSED IN THE PROMOTIONAL CAMPAIGN 59

Elements of an Effective Promotional Program 59

VI. SUMMARY, CONCLUSION, AND RECOMMENDATIONS 67

Summary 67
Conclusion 76
Recommendations 77

LIST OF REFERENCES 79

APPENDIX 82

A. MAJOR NUCLEAR POWER PLANTS IN THE UNITED STATES 83

B. DEATH RISK TO U.S. POPULATION FROM SELECTED HAZARDS 86

C. RECOVERABLE FORMS OF ENERGY IN THE U.S.
COMPARED TO CURRENT USAGE RATES 87

CHAPTER I

INTRODUCTION

Statement of the Problem

A great amount of confusion, controversy, and apprehension exists regarding the safety and desirability of nuclear-powered generating facilities. Public resistance to the construction of nuclear power plants has grown to the point where the development of a viable nuclear energy program is threatened (24:12).

The reason this situation prevails becomes clear when one sees, on the one hand, ecologists, medical doctors, and eminent scientists lined up in opposition to nuclear power stations and, on the other hand, electric utility officials, government spokesmen, and eminent scientists in favor of the extensive development of atomic power plants (24:12).

Many aspects of this problem can be traced to inadequate marketing practices on the part of the Atomic Energy Commission. If, as Levy suggests, buyers (in this case the citizens in the area where the nuclear plant is to be built) express their reaction to promotional activities by responding either positively or negatively (7:15), then, clearly, the seller of nuclear power plants (the Atomic Energy

Commission) must develop a marketing plan that will reduce resistance to the construction and operation of these facilities.

The setup and operation of a nuclear power plant proceeds along the following lines: an electric power company will contract with an authorized builder to have the plant constructed; the Atomic Energy Commission acts as a monitor during the various stages of construction to ensure that design requirements and other established criteria are being met; the local power company will own and operate the plant once it is completed. However, the responsibility for assuring that safety standards for a nuclear facility are observed and maintained falls upon the Atomic Energy Commission.

Unfortunately, on certain occasions the Commission has fallen short of its goal of providing a community with nuclear-generated electricity from a facility that meets strict safety standards. Often, additional measures could have been taken to make the facility safer and less offensive to the environment. However, the Commission made these improvements only after being prodded through court suits and public pressure. Much time, unfavorable publicity, and expense could have been avoided if these features had been included in the design of the original plant.

Purpose of the Study

The main purpose of this study is to demonstrate how marketing principles can be utilized by the Atomic Energy Commission and

electric power companies to inform the broad majority of Americans that a nuclear generating facility is a safe, reliable utility.

A well-designed and properly implemented promotional effort would serve two basic purposes: (1) to educate more people in regard to the fundamental technical aspects of nuclear power plants and (2) to present enough evidence concerning the safety record of nuclear plants and the stringent safety measures that are in operation in each plant to convince the public that nuclear power plants are indeed safe.

Hopefully, a greater dissemination of knowledge concerning nuclear plants will enable citizens to evaluate the risks versus benefits aspects of such facilities more accurately and thus reduce public resistance to nuclear plants.

Need for the Study

American society has placed ever-increasing demands on energy resources, particularly electrical energy. Due to the rising costs of the fossil fuels needed to run conventional power stations and the consequent pollution caused by using such fuels, nuclear energy presents itself as one of the more promising and technically feasible solutions to the power shortage.

Developing slowly over the past twenty-eight years, nuclear energy currently (in 1975) supplies only 6 percent of the United States' electrical needs (24:12). However, present plans call for the

construction of many new nuclear plants so that the United States can attain its goal of energy self-sufficiency. By 1980 one hundred additional plants are scheduled to be operating, providing 25 percent of the United States' electrical needs (20:22). Present projections call for one thousand plants to be in operation by the year 2000 (21:24). These facilities could provide up to 60 percent of all generated electricity in the United States (24:12). It is this program for large-scale nuclear power that has encountered strong opposition from critics who contend that the safety risks exceed the expected benefits.

A major impetus behind this ambitious program is the ominous fact that the U.S. is depleting its fossil fuel reserves faster than new supplies are being discovered. Many experts believe that a shift to a nuclear energy base is necessary if this country is to avoid severe dislocations in its economy and its standard of living in the next decade or so (22:4-5).

Viewed in this light, the necessity for the unimpeded development of nuclear power plants throughout the country assumes a high degree of urgency. In this context, then, a successful marketing strategy can play a significant role in any program to facilitate the large-scale development of nuclear power facilities. Thus, by exploring the various marketing problems involved in the current situation and by suggesting a marketing strategy to resolve these problems,

this study deals with a topic that promises to assume increasing importance for the United States and, perhaps, many other nations in the world.

Scope and Limitations of the Study

This study will not deal with peripheral issues such as the problem of disposing of radioactive waste. This issue is a spin-off from the atomic weapons program; the waste produced by nuclear power plants is negligible by comparison (21:24). Also, highly technical aspects of nuclear energy will be avoided. Most of the literature itself, including scientific journals, is presented in a very readable, easy-to-understand fashion.

This study will attempt to demonstrate how the application of marketing principles can help alleviate the present controversy over nuclear power plants. Strategies appropriate for both the general public and individual communities will be discussed, along with marketing goals, an advertising program, media selection, and resource constraints.

Definitions

The terms that will be used most frequently throughout this study are:

1. Nuclear power, nuclear energy - the employment of fissionable material to generate electrical energy

2. Nuclear power plant, nuclear generating station, nuclear facility - the building or group of buildings and other man-made structures necessary to the function of generating electricity from the use of nuclear material

Statement of the Hypothesis

Techniques currently employed by the Atomic Energy Commission differ substantially from those marketing techniques that can reduce resistance to the large-scale development of nuclear power plants.

In developing this hypothesis, the current marketing effort of the Atomic Energy Commission will be examined and criticized; marketing suggestions will then be proposed that, in the opinion of the writer, will help make nuclear power plants saleable and acceptable utilities.

Sources of Data

Due to the nature of this study, the data will consist of material gathered from a comprehensive examination of news and general interest periodicals, the appropriate scientific journals, information published by various government agencies, and an interview with electric power company officials.

Organization

This study will be organized into six chapters, the first chapter being introductory in nature. Its purpose is to acquaint the

reader with the overall plan of the study. The statement of the problem, the purpose of and the need for the study, and its scope and limitations will be discussed. In addition, the hypothesis of the study and the sources from which the pertinent data will be obtained will be presented.

Chapter II will introduce the reader to a brief history of the development of nuclear energy, the plans for future development, and the emergence of opposition to nuclear power plants.

Chapter III will present an evaluation of the Atomic Energy Commission's current marketing policies and objectives. The Commission's role in the marketing system and its relationship with consumers will also be discussed.

Chapter IV will be concerned with the development of specific marketing and promotional techniques that are applicable to the current situation. Various aspects of the advertising campaign and the media selection will also be discussed. In addition, the responsibilities of local power companies in the marketing effort will be examined.

Chapter V will deal with the various themes that should be stressed in promotional campaigns and their applicability to either the local or national level.

Chapter VI will offer a summary of the study, conclusions, and recommendations.

CHAPTER II

HISTORY AND DEVELOPMENT OF NUCLEAR ENERGY

Early Reactor Development

The first nuclear reactor in the world was constructed under United States government contract at the University of Chicago in 1942. The main purpose of the reactor, extremely primitive by today's standards, was to validate the fundamentally important premise that a nuclear chain reaction is possible (1:37).

During the ensuing years of World War II, many other reactors were constructed for research purposes and for the purpose of producing material to be used in the first atomic bombs. These early reactors, however, were merely crude forerunners of the reactors of today that are used to generate electricity (1:37).

Formation of the Atomic Energy Commission

Soon after the war, Congress decided to establish a permanent instrument through which the overall atomic energy program of the United States could be accomplished (1:50). Since many applications of atomic energy would be for peaceful purposes, it was felt that a non-military organization would be more appropriate for overseeing the

reports to the Commission. The Commission headquarters are located in Germantown, Maryland, with thirteen other field offices established throughout the country (32:647).

Although the Atomic Energy Commission employs approximately seven thousand people, most of the actual construction of nuclear power plants is done under contract (32:647). The principal contractors are Westinghouse and General Electric, together accounting for 70 percent of the nuclear power business. Other companies in this field, in order of descending market share, are Combustion Engineering, Babcock and Wilcox, and General Atomic (20:22).

Early Development of Nuclear Generating Plants

In the early years the weapons development program monopolized the attention and budgetary considerations of the Atomic Energy Commission. It wasn't long, however, before increasing emphasis was placed on non-military aspects of nuclear power (32:647). Accordingly, the Commission, in 1952, developed plans for the construction of the first nuclear power plant in the United States that would produce electricity (1:61).

The first plant was constructed at the Argonne National Laboratory outside of Chicago in 1956 at a cost of $4.4 million. It produces five thousand kilowatts of electricity that is used at the laboratory itself (1:64).

Another, somewhat larger, reactor was constructed in 1957 by North American Aviation at Santa Susana, California, near Los Angeles, and its six thousand kilowatts of electricity is fed directly into the grid of the Southern California Eddison Company (1:64).

Construction on the first full-scale nuclear power plant was begun in 1954 by Westinghouse under Atomic Energy Commission contract at Shippingport, Pennsylvania, near Pittsburgh. Completed in 1957, the plant produces ninety thousand kilowatts of electricity for the Pittsburgh area. The Commission owns and controls the reactor section of this particular plant while the electrical generating portion is owned and operated by the Duquesne Light Company of Pittsburgh (1:64-65).

Although several other plants were soon under construction, nuclear energy did not develop as smoothly as anticipated. Technical and production difficulties resulted in delays and higher costs. In addition, the thorough safety reviews necessary for obtaining a license to construct and operate a nuclear plant added to the delays (15:18).

The progress of construction, while slow, proceeded steadily, and by 1965 there were eleven nuclear plants in operation and many more were either planned or already under construction (12:27). As of June 30, 1974, there were forty-seven nuclear power plants in the United States of varying size and generating capacity (28:1).

It should be noted here that during the formative stages of the 1950s and 1960s the main emphasis in nuclear energy development was on

production and technical breakthroughs. A marketing program was non-existent; the need for one had not become apparent yet. The industry was in its infancy, so to speak, and it operated in relative obscurity. The public paid scant attention to the few nuclear plants that dotted the United States and the little publicity that did emerge was of a favorable nature. There was no "energy crisis" to spur large-scale development of nuclear generating facilities; construction proceeded at a leisurely pace, and the concept of having to market nuclear power plants like any other product was, apparently, not one which the Commission felt it would ever have to contend with.

The Emergence of Opposition to Nuclear Power Plants

In the late 1960s, with most of the technological problems overcome or close to resolution, a much larger role for nuclear energy was envisioned. The pace of construction was accelerated, and by the time fuel shortages began to appear in the early 1970s, nuclear energy offered itself as a viable long-term solution to America's energy needs. At the same time, however, serious questions concerning the safety and desirability of nuclear power plants began to emerge. Opposition to the development of nuclear energy began to grow. Environmentalists, scientists, journalists, and suburbanites made up the core of this opposition, and their opinions, widely circulated in the press, began to generate considerable public concern. A political issue was

created; Senator Mike Gravel (D-Alaska) has called for a nationwide moratorium on the construction of new nuclear plants (11:217).

Under provisions of the 1954 Atomic Energy Act, citizens have the right to appear before and be heard by atomic safety and licensing boards at the construction and operating permit stages of the licensing process. Not only can citizens, individually and collectively, contest these permits, but they can also appeal licensing board rulings to the federal courts (14:53).

As a result of this litigation, progress on new plants has been held up in New York, Maryland, Michigan, Ohio, and California. A newly constructed plant near South Haven, Michigan, was kept idle for almost a year because of action by a conservation group (19:67). The expense and uncertainty associated with legal entanglements and the consequent delays in construction have led some utility companies to drop plans to build nuclear plants, while at least two others--Florida Power and Pacific Gas and Electric--have cancelled orders for nuclear plants and plan to build fossil-fueled facilities instead. The Atomic Energy Commission itself has recently scaled down its own forecasts of the amount of nuclear generated electricity available by 1980 to 130,000 megawatts, off 13 percent from earlier predictions (11:217).

Environmental Impact on Rivers and Lakes

One aspect of nuclear power plants that was a frequent source of controversy was the effect of waste heat on any nearby rivers or

lakes into which the water used to cool the reactor was discharged. Nuclear generating plants produce a great deal of unusable heat (40 percent more than a conventional power plant) and, to remove it, most plants use water, either from a river or a lake. The water is drained out of the river cool and poured back in warm (18:76). In this process, the water can be raised in temperature from ten to thirty degrees Fahrenheit above normal. Since even a small rise in temperature can destroy fish and other organisms in the water, environmentalists were concerned that the ecosystems of our nation's rivers, estuaries, and lakes might be seriously damaged (18:76).

There is no doubt that this issue was a valid criticism and the possibility of aquatic life being injured due to thermal discharges from nuclear power plants posed a potentially serious problem. However, two factors have served to defuse this controversy. First, many nuclear plants have built either cooling towers or cooling ponds to dissipate excess heat. A cooling tower is a huge chimney-like structure through which the water trickles down and cools itself by evaporation (18:78). To facilitate dissipation of heat, a flow of air is circulated through the tower, either by mechanical means or a natural draft. In an artificially created cooling lake or pond, the water is recirculated from pond to plant, with only makeup added to replenish the losses due to evaporation (30:11-4). In areas with humid weather, cooling ponds work less well than towers (18:77). Second, gas-cooled

reactors (using helium or carbon dioxide) are now feasible (27:10), and this type of cooling will eliminate the use of water and will permit much greater flexibility in the siting of nuclear plants (16:147).

Thus, continually improving technology has enabled the nuclear power industry to overcome the particular problems associated with the disposal of waste heat.

Danger of Radioactive Emissions

The primary controversy now centers around the possibility of unsafe levels of radioactive material being released into the environment. This particular risk encompasses two facets: (1) low level release of radioactivity into the air and ground waters caused by the normal operation of nuclear plants and (2) the accidental release of large amounts of radioactivity (17:35).

The Atomic Energy Commission readily admits that small amounts of radioactive material can be released into the environment during the operation of a nuclear plant. During reactor operations, small amounts of radioactive particles escape from the fuel rods into the water that cools the fuel, and some impurities in the cooling water are made radioactive by interaction with neutrons from the fuel. Most of this radioactivity, however, is removed from the water by the coolant purification system which consists of demineralization filters (29:4).

Also, during the generation process, radioactive gases are formed, and this by-product is eventually discharged through a ventilation stack. Most of the radioactive elements in the gas have half-lives of less than thirty seconds, so that they decay to non-radioactive elements within the confines of the shielded plant. In addition, a minimum hold-up time of thirty minutes to sixty days, depending on the type of nuclear plant, is provided prior to release through an elevated stack. The radioactivity of the gas is monitored near the beginning of the hold-up period and during the discharge operation to ensure that emission rates are within specified limits (30:4-11 - 4-13).

Critics contend, however, that even miniscule amounts of radiation can pose harm, now and in the future, to human life. The Atomic Energy Commission counters by pointing out that we are all constantly exposed to radiation from cosmic rays and from radioactive elements that occur naturally in the soil. There are several places on earth (notably near Rio de Janeiro, Brazil, and in southwest India) where the natural background radiation is up to thirteen times higher than the average dose received by each person per year. Studies of the population living in these areas show no statistically meaningful effects from this high background radioactivity (with the exception of a slightly higher birthrate for male babies). Under Commission regulations and practices, the average amount of radiation that the population of the United States would receive as the result of one

thousand nuclear power plants operating within the U.S. would be less than 1 percent of that which we receive from natural background radiation (23:3).

In regard to an accident that might release large amounts of radioactive material, the list of scenarios is endless: a Boeing 747 could crash into a nuclear plant, a saboteur could plant a bomb near the reactor portion of a plant, an earthquake could shear a reactor shield in half, releasing a large amount of radioactivity in a populous area, and so forth.

Of course, the probability of any of these incidents occurring is small. In fact, the possibility of an act of nature or some other external force causing enough damage to a nuclear facility to pose a threat to the human population in the area is slight. In addition, safeguards do exist for such emergencies (30:5-19).

For one thing, a nuclear plant is designed and constructed to be able to withstand all types of natural calamities. One large power plant construction firm estimated that at least twenty-five to thirty additional people are needed at the work site (compared to a conventional power plant project) to satisfy the stringent quality standards in construction that are required by Atomic Energy Commission regulations (30:2-7). The concept of "quality assurance" pervades all aspects of nuclear plant construction, from the materials used to build the plant to the design and construction of the most complex and

sophisticated features (30:2-8). A nuclear plant located in San Onofre, California, for example, has reactor containment walls composed of high strength steel six to eight inches thick (13:16).

Second, in the event of any type of accident, or human or mechanical error, monitoring instruments would activate controls that would automatically shut down the reactors (5:104). Moreover, these safety systems are routinely inspected, tested, and maintained so that

> . . . exposure to credible external events or forces (loss of power, earthquakes, tornadoes, floods, hurricanes, impaction by moving vehicles, etc.) will not impair the ability to shut down the plant safely and maintain safe shutdown conditions (30:5-19).

The one type of potential accident that has created the greatest amount of controversy is one that involves internal factors: a meltdown. In such a situation, a major rupture in one of the pipes carrying the coolant would cause a loss of the coolant material and the reactor would begin to immediately overheat. Next, the independent emergency cooling system would have to fail. While the reactor would automatically shut down, it would be without coolant and would begin to melt. The molten reactor mass would then probably drop to the concrete floor beneath, burn its way through the floor, and sink into the soil below. It is estimated that the reactor would stay molten for days or even weeks and that the smoldering mass would release a significant amount of radioactive contaminants into the environment (11:218).

While the Atomic Energy Commission recognizes the fact that such an incident could occur, it also maintains that the abrupt failure of high quality stainless steel piping, inspected and tested before and after installation, is highly unlikely. That the emergency cooling system would also fail is an even more remote possibility (30:5-7). Thus, while the prospect of a loss-of-coolant accident, the failure of the backup cooling system, and a subsequent meltdown is indeed possible, the probability of such a sequence of events occurring is very small. One estimate places the odds of such an accident occuring as once in a million years--approximately the same odds as that of a meteor striking an American city (25:10).

It should be noted, also, that a nuclear power plant cannot explode like an atomic bomb. This fear has been a source of apprehension ever since commercial nuclear power has been on the scene (30:8-1). An atomic bomb requires almost pure uranium (235), whereas a nuclear plant uses only enriched uranium--i.e., 3 percent uranium (235). In addition, the characteristics of the fuel pellets prevent the "critical mass" from occurring that is required for a nuclear explosion (10:78).

Turning briefly to potential acts of sabotage, an Atomic Energy Commission sponsored study concluded that built-in safety features could negate singular acts of sabotage, and in order to damage a plant so as to pose an off-site hazard, a carefully developed plan

along with a considerable level of technical knowledge and ability would be required on the part of the saboteur(s). In addition, all nuclear power plants employ some form of security for visitor control, protection of personnel, and protection of the capital investment. While believing that the probability of a successful act of sabotage occurring to be small, nevertheless, the Commission issued guidelines to all nuclear plants in October 1971 that set forth protective measures designed to prevent an act of sabotage. Detailed security measures for the physical protection of a nuclear facility are withheld from public disclosure in accordance with Commission regulations (30:8-29 - 8-30).

Perhaps the best answer to critics of nuclear power safety is the exemplary record of the nuclear power industry. The facts are a matter of public record and are incontrovertible. In over twenty years of continuous operation, no accident has occurred in a commercial nuclear power facility that endangered the public health (30:8-21). During this same period, seven deaths (all plant personnel) resulted from accidental exposure to fatal radioactivity levels (10:79). Few other industries can match this enviable safety record.

It is clear that very meticulous procedures are followed to ensure safety in the operation of a nuclear power plant. Every kind of contingency is provided for in designing the safety systems that monitor the operation of a nuclear plant. There is, of course, some

risk involved in the operation of a nuclear generating facility. However, as the Atomic Energy Commission contends, "the assumption of successive failures [of safety systems] can be carried to the point at which safety systems can no longer be shown by conservative calculations to cope with the postulated accident." Thus, critics will always be able to pose some hypothetical situation in which a nuclear power plant can be shown to pose some risk to a nearby population. However, "the probability of occurrence of the required number of successive failures" of the built-in safety factors is so small that the overall risk to the population and the environment is extremely low (30:5-19).

CHAPTER III

AN EXAMINATION OF CURRENT ATOMIC ENERGY COMMISSION MARKETING TECHNIQUES

The Commission's Place in the Marketing System

In examining the current marketing strategy of the Atomic Energy Commission, it would be well to note the Commission's place in the overall marketing system and its relationship with the public. The Atomic Energy Commission is, of course, an independent government agency funded with tax dollars. It is far removed from the average citizen. Except for booklets and other distributed information pertaining to the work of the Commission, the average person has very little contact with that organization. It can be assumed, also, that except for a vague idea that the Commission is somehow connected with nuclear energy, the typical citizen knows little about the regulatory functions and other operational aspects of the Atomic Energy Commission.

One of the responsibilities of the Commission is promoting the peaceful uses of atomic energy. In this role, the Commission finds itself in a rather unique (and sometimes uncomfortable) position. The Atomic Energy Commission is a non-profit organization. Citizens do not solicit the services of the Commission, nor do they petition to have

nuclear power plants constructed in their area. Any decisions regarding the siting and construction of a nuclear plant are determined solely by the Commission. However, through public hearings, citizens are permitted to participate in the decision-making process relative to specific licensing actions (30:4). In fact, by exercising this right, citizens' groups in various parts of the country have successfully impeded or halted the construction of nuclear power plants.

Like other non-profit organizations, the Commission should place its emphasis on generating customer satisfaction rather than on "selling" its products (nuclear generated electricity and nuclear power plants). In this situation, customer satisfaction is equivalent to the assurance that nuclear power plants will not, through accident or through daily operation, pose a threat to human life or to the environment.

Inadequacy of Present Marketing Strategy

There is no evidence to suggest that a formal, long-range marketing strategy was ever developed to help facilitate public acceptance of nuclear power plants. To be sure, a massive and well-implemented public relations campaign has been carried on by the Atomic Energy Commission for many years but public relations techniques (news coverage, speakers, pamphlets, etc.) can be used just as effectively by the opposition. In addition, the public relations strategy

was essentially an isolated effort; effective coordination with other facets of the nuclear energy program was lacking.

Thus, it is not surprising that the Commission's promotional efforts down through the years have not achieved the desired results. Mr. Harold Brown, Atomic Energy Commission Assistant General Manager, has stated:

> We've had a public information program for twenty years and a lot of effort has gone into it. For example, we've put out something like ten thousand press releases. We have a film library of some eleven thousand prints. We've put out some fifty annual and semi-annual reports. We've made hundreds of speeches over the years and have circumnavigated the globe many times over spreading the gospel of the peaceful atom. Despite this, the message wasn't getting through (4:185).

In attempting to sell a specific community on the construction of a nuclear power plant, the promotional plan once again is largely a public relations effort.

The site of a nuclear plant will usually be near a small community, one with a population of less than twenty thousand and one that is located twenty to forty miles from a major metropolitan area. Such a location ensures that the population density in the area of the nuclear plant will be low. At the same time, transmission costs and power losses in delivering the electricity to the site of utilization (the metropolitan area) will be minimized (4:181).

The Atomic Energy Commission then initiates a campaign designed to convince city officials and the Chamber of Commerce that a nuclear

power plant will offer many advantages to the community. The prospect of additional jobs for the town and a reduction in taxes (a large portion of this burden to be assumed by the utility company) is presented to the city officials and eventually the citizens of the community. In addition, Commission sponsored publications such as pamphlets, booklets, and monthly newspapers may be widely distributed. The Commission will also provide speakers to relate the benefits of nuclear energy to the residents of the community (4:184).

This strategy has proven relatively successful in the past, but local resistance has continued to grow in many communities. In addition, this procedure has been severely criticized as an attempt to take advantage of people who lack a sophisticated knowledge of the potential hazards of nuclear power plants (4:181). Also, critics charge that, in dealing with a small community, the Commission engages in a massive propaganda campaign that presents only one-sided information (4:186). Whatever success that was achieved in dealing with smaller communities, however, was offset by the serious mistakes described below that the Commission has made in other areas.

Certainly one factor, perhaps the underlying factor, that led to the overall failure of the Commission's promotional efforts, as reflected by the continuing opposition to nuclear plants, was the Commission's own lack of information concerning citizens' attitudes toward nuclear power. Amazingly, by the Commission's own admission,

little "nationwide" sampling of public opinion has been done on the subject of nuclear power. Private polls commissioned by utility companies have generally shown that people living in their service areas do not oppose nuclear plants. However, an incongruity emerges from the fact that the number of contested licensing hearings is increasing and, in fact, opposition to nuclear power plants is significant and widespread (30:111-1).

Complicating the situation was the Commission's own policy of refusing to debate the critics of nuclear plants. The reasoning behind this approach was that the Commission did not want to undermine the integrity of its regulatory process by engaging in discussions that might be interpreted as an endorsement of a particular plant (30:111-7). Viewed in retrospect, it is fairly obvious that this policy was a mistake. The critics of nuclear plants were able to take--and maintain--the initiative and gain the momentum that has resulted in the present controversy today. In addition, the Commission's apparent unwillingness to face its accusers gave that much more credence to the arguments against nuclear power plants set forth by the opponents.

The Commission finally reversed its position in early 1969, but not before some damage had been done. Atomic Energy Commission spokesmen confronted critics in school auditoriums and other public

meeting places in New Jersey, New Hampshire, Vermont, New York, Michigan, Oregon, and elsewhere (30:111-4).

This new policy of facing opponents, while a step in the right direction, opened the door to another tactical blunder. The Commission participants' presentations often tended to be overly technical and scholarly and, consequently, left the impression that, in the Commission's own words, "the AEC was beating around the bush." The approach was altered and Commission spokesmen subsequently strove to present their answers in a "more straightforward and understandable manner" (30:111-5).

In 1963 the Commission established a research group to study the effects of radiation emissions resulting from the routine operations of nuclear generating facilities. The chief outcome of this study was a recommendation that the Commission's radiation standards should have been much stricter than they were at that time. The Commission strenuously fought this proposal for years, but in 1971 it finally relented and the allowable radiation emission levels were reduced to their present amounts. In taking this action, however, the Commission provided no explanation for its earlier opposition to more rigorous standards (12:27). One can surmise that the additional costs involved and the necessary slowdown in the planned construction of nuclear facilities that would result from implementing the recommended modifications were the reasons behind the Commission's opposition.

Nevertheless, the Commission's reluctance in this matter only provided more ammunition for the opponents of nuclear plants, and it gave the impression that the Atomic Energy Commission was not really interested in providing the safest possible standards for the operation of nuclear power plants. It was a serious public relations error.

Compounding the above mistake was the Commission's failure (or perceived failure) to provide the quality of technical safety that was demanded by the public. A case that might serve as an illustrative example involved the Palisades Nuclear Power Plant, located near South Haven, Michigan, on the eastern shore of Lake Michigan.

In this particular contest, extreme pressure from citizen's groups, conservation organizations, and the national Sierra Club (240,000 members strong) kept the newly constructed plant inoperative for almost a year at a cost of one million dollars per month. The protesting citizens were concerned with two factors: thermal and radiological pollution of Lake Michigan. The people were concerned whether or not the safeguards established by Commission regulations would save Lake Michigan from serious ecological damage that could result from the daily operation of the nuclear plant (14:53).

The original standards called for the lake water used to cool the reactor to be returned near the shoreline at temperatures up to twenty-eight degrees Fahrenheit warmer than the ambient lake temperature. The intervenors contended that the warmer water would destroy

some of the fish and plant life in the lake and would also increase the toxicity of the chemical pollutants already present (14:54). Consumers Power Company, operator of the plant, finally agreed to modify the cooling system by constructing cooling towers at a cost of ten million dollars to recirculate the water. While a small amount of water would be discharged back into the lake, it would at no time be more than five degrees higher than the ambient temperature of the lake (14:56).

The second point of contention involved the radiation discharge into the lake. Consumers Power Company stated that any radioactivity released from the plant "would be in very small, carefully monitored and controlled amounts." At all times, the utility insisted, the radioactivity levels would be within limits established by Commission regulations and would normally be at very small fractions of those limits. Again, however, the citizens were not satisfied with the prevailing Commission standards and demanded that additional steps be taken to protect Lake Michigan, and the residents dependent upon the lake for drinking water and recreation, from possible radiological contamination (14:55). The utility company agreed to upgrade the waste handling system of the plant so that discharge of radioactive material into the lake would be "essentially zero" (14:56).

Here, then, was a situation where the existing Atomic Energy Commission safeguards and regulations were regarded as inadequate by

the citizens in the area where the nuclear plant was to begin operation. It could be argued, no doubt, that the existing standards were sufficient to provide the area with an adequate level of safety. That issue is beside the point, however. The important fact is that, after seven months of public hearings (14:53), those standards were rejected by the citizens of Michigan because they were perceived as not being stringent enough. Another important fact in this case is that the Palisades Nuclear Plant could have originally been constructed to meet the higher standards of operation that were later built into the plant through costly modifications. Had this been done, much time, money, and unfavorable publicity could have been avoided. Still a third factor, and perhaps the most important, is that the protestors were finally satisfied that the nuclear plant, after the modifications were installed, was made as safe as possible using available technology. The intervening citizens agreed on March 12, 1971, to let the plant begin initial stages of operation (14:56).

There can be little doubt that the nuclear energy program received substantial setbacks because of the aforementioned incidents. Instead of using a long-range, flexible marketing policy to guide them, the Atomic Energy Commission relied on "ad hoc" responses to the various situations that arose. The Commission's marketing program, as it was implemented, consisted basically of an extensive public information program supplemented by speakers on various occasions.

The whole effort was essentially passive. It seemed that little was done to "reach out" and carry the message to broad segments of the American public. This policy led to additional problems, negative publicity, and, in general, the net result was the creation of an atmosphere of doubt and suspicion around the entire nuclear energy program itself.

The next chapter of this paper will deal with developing and implementing a marketing strategy that will help ameliorate the present situation and present workable guidelines with which to direct future efforts.

CHAPTER IV

DEVELOPING A MARKETING STRATEGY FOR REDUCING PUBLIC RESISTANCE TO NUCLEAR POWER PLANTS

Marketing Concepts as Applied to Nuclear Power Plants

In developing a viable marketing strategy for the purpose of reducing resistance to nuclear power plants, perhaps the terms "marketing" and "strategy" should be defined and examined, particularly in regard to the specific policies and objectives of the Atomic Energy Commission and the electric power companies.

Kotler defines marketing as "the set of human objectives directed at facilitating and consummating exchanges" (6:12). In its broadest application, this particular definition is appropriate to explain the basic marketing activities found in the field of nuclear energy. An exchange occurs since consumers pay for a particular service--i.e., the generation of electricity. This perspective, however, permits only a small view of the total picture.

The "marketing concept" is much more applicable to the situation faced by those organizations interested in promoting atomic energy. The marketing concept, which represents a shift from the

concept of a marketing strategy, therefore, is in contrast to "ad hoc" responses to new developments that arise in the marketplace (6:46).

In discussing marketing strategy, it should be mentioned that in order to ensure an effective integration of the various activities, a "core strategy" should be developed. A core strategy is a central concept that applies to the organization's programs and operations over a given period of time; it becomes the pivotal force for all other decisions, actions, and policies (8:32). In this case, of course, the core strategy is: reducing resistance to nuclear power plants through an effective marketing program.

Marketing Strategy on the National Level

This particular marketing effort necessarily falls under the responsibility of the Atomic Energy Commission. The Commission has the resources required to properly diffuse the necessary information throughout the nation.

The Atomic Energy Commission is cognizant of the fact that the average citizen knows very little about the technical factors concerning nuclear power plants and if the acceptance of such plants is to be accomplished, then a "solid information base must be presented to the public" (30:111-9). This program will require a more active and aggressive approach than the current effort, the latter being based on the assumption that the individual will take the time and energy (by

traditional sales-oriented approach, is defined as "a customer orientation backed by integrated marketing aimed at generating customer satisfaction as the key to satisfying organizational goals" (6:17). This concept is particularly relevant in the case of nuclear energy because much of the current controversy over nuclear power plants is the result, for one reason or another, of customer dissatisfaction.

Strategy, on the other hand, can be described as a grand design for what a company will do in the product-market area (9:714). More specifically, a strategy, in a business context, consists of "the schemes (or key concepts) whereby a firm's resources and advantages are managed in order to surprise and surpass competitors or to exploit opportunities" (8:2). Electric power companies face competition in the form of alternate power sources, both traditional and newly developed. Therefore, promoting nuclear power plants has certain competitive aspects in that such plants will help electricity remain a viable energy source for the future. The Atomic Energy Commission, of course, is not concerned with competitors but, rather, with the problem of reducing public hostility to nuclear power plants.

Combining the terms marketing and strategy, Kotler defines marketing strategy as a "set of objectives, policies, and rules that guides over time the firm's marketing effort . . . partly independent and partly in response to changing environmental conditions." This

requesting booklets and other materials) to learn about the pertinent facts concerning nuclear power facilities.

If, in fact, a well-developed marketing strategy is the key to alleviating present difficulties, then a framework must be established within which to develop this strategy. In a paper entitled "Using Marketing Concepts in the Not-For-Profit Organizations," Robert W. Eckles summarized the marketing process as follows:

1.	Market Research	-	Identification of a need Determination of the group with the greatest need
2.	Product Research and Development and Product Identification	-	Final design of or recognition of a need satisfying product or service
3.	Production	-	Production of the need satisfying product or service
4.	Distribution and Promotion	-	Distribution and promotion of the product or service to the target market in the most efficient manner
5.	Follow Up and Appraisal	-	Determine the effectiveness of the product to satisfy specific needs Redesign the product or service if it is not suitable to meet needs

(33:15)

A model is presented in figure IV-1 which outlines the suggested marketing strategy for the Atomic Energy Commission.

The remainder of this section will deal with expanding the various elements in the proposed marketing strategy.

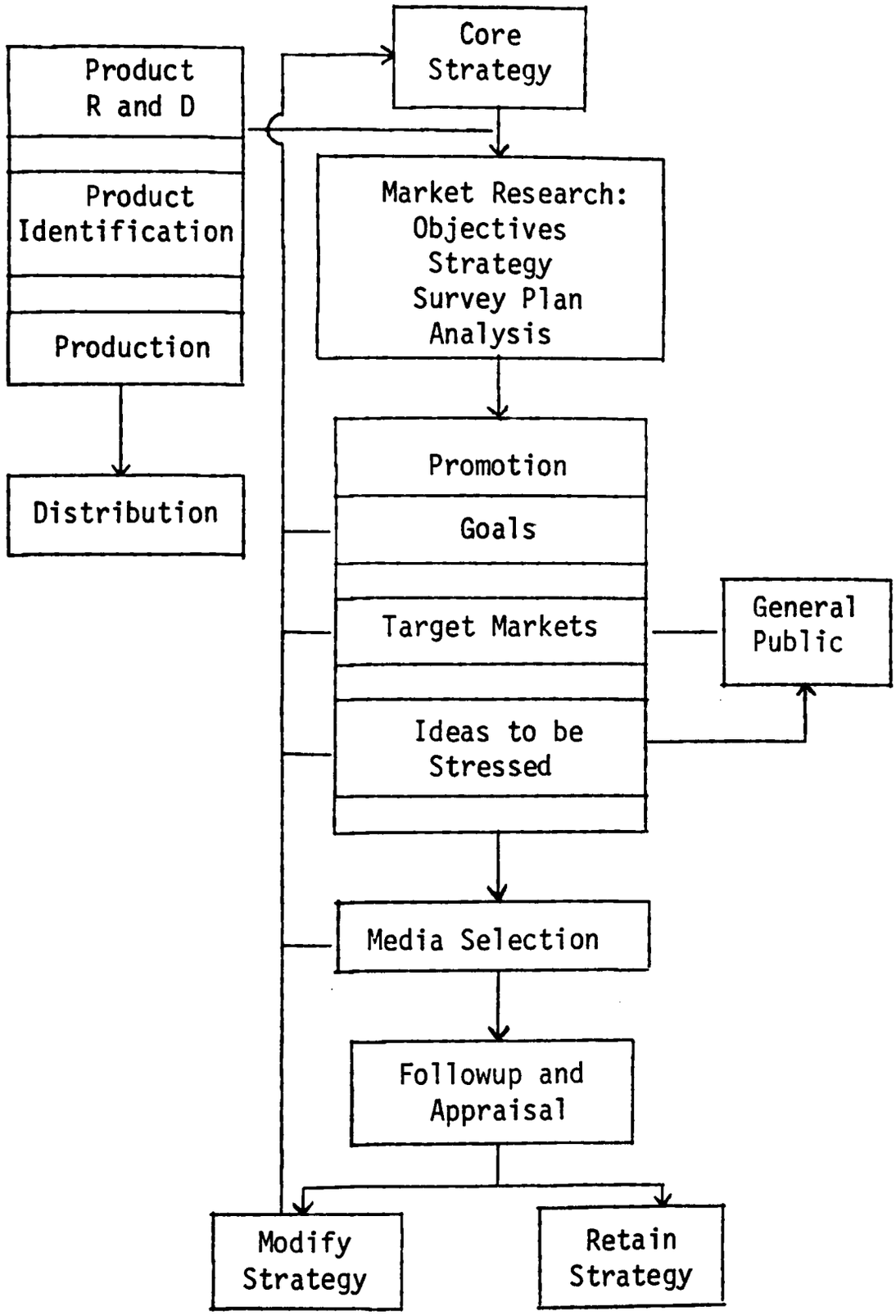

Fig. IV-1. Model of proposed Marketing Strategy for the Atomic Energy Commission

Market Research

Market research is not necessary to confirm the fact that electrical energy in ever-increasing amounts will be needed in the United States. One study, for example, projects a 60 percent increase in electrical energy usage in the decade between 1970 and 1980 (30:1-4). However, as mentioned in chapter III, more research is needed concerning citizens' attitudes toward specific aspects of nuclear power plants.

In establishing a market research program, the major steps, or elements, in the effort are: establishing research objectives, developing the research strategy, gathering the data, and analyzing the data after they have been obtained (6:321).

Research Objectives

Before the research project is initiated, objectives should be clearly defined. This helps eliminate the gathering of superfluous data (6:321).

In the case of the Atomic Energy Commission, three major objectives suggest themselves. One is to determine the basis for the negative or hostile attitudes some individuals have toward nuclear power plants. Research in this direction could provide helpful insight in developing a marketing program to combat antagonism toward nuclear plants. Second, market research could aid in determining whether or

not regional differences exist in attitudes toward nuclear power plants. Certain sections of the country may be more receptive to nuclear plants than others. Such information could be very useful in designing marketing strategies for different parts of the country. In addition, the data could be made available to local power companies to aid them in their efforts to promote nuclear power plants. Third, market research could reveal areas of conflict that might arise in the future. This would give the Atomic Energy Commission time to prepare alternate strategies to deal with such problems.

Research Strategy

Numerous methods exist by which information can be collected. The most common method of acquiring market information is through surveys. Since surveys are effective for gathering information on socioeconomic characteristics, attitudes, opinions, and motives, this method would seem to be the best approach for gathering the type of information needed by the Atomic Energy Commission (6:320).

In devising a research strategy, three elements must be considered. These are the survey method to be used, the research instrument to be employed, and the sampling plan that will best achieve research objectives.

Survey method

Of the three survey methods--telephone interviews, mail questionnaires, and personal interviews (6:322)--the latter method would seem to be the best approach for the Atomic Energy Commission, especially when the importance of the issues involved is considered. While the personal interview method is the most expensive (6:322), the advantages of versatility and the personal interaction between the interviewer and the respondent would be important factors in making the market research program a success.

Research instrument

Obviously, a questionnaire will be necessary in this situation. The issues to be probed suggest the use of a detailed questionnaire that contains enough open-ended questions to provide an in-depth view of respondents' attitudes toward nuclear plants. Open-ended questions, it should be noted, are those to which the respondent is free to answer in his own words (6:323).

Sampling plan

The nuclear power plant controversy long ago assumed national significance. Therefore, a sample of subjects representing all sections of the country and chosen by random sampling methods would do much to ensure the success of the research program.

To facilitate the sampling process, the country could be divided into various regions such as the West, Southwest, Middle West, Southeast, Middle Atlantic, and Northeast. Samples could be obtained from each section and the results compared.

Random sampling techniques are suggested here because these procedures offer greater accuracy and allow degrees of confidence to be placed on the preciseness of the universe inferences (6:324).

A standard method for determining the sample size is to estimate the proportion of prospective respondents who will answer either yes or no to a key question in the survey. If no accurate estimate can be made, then 50 percent is usually adopted as the proportion (2:102).

The formula for computing the sample size is:

$$n = \frac{pq}{\left(\frac{E}{z}\right)^2}$$

where

n = size of sample

p = proportion to be estimated

$q = 1 - p$

E = allowable error (½ the estimated confidence interval)

z = confidence level in terms of the standard deviation

(2:102-03)

For example, in this case the key question might be: "Would you be apprehensive if you learned that a nuclear power plant was going to be constructed in the area where you now live?" Since very little previous market research has been done on the subject of nuclear energy, 50 percent can be used as the estimated proportion responding either yes or no to the question. If a 95 percent confidence level is used, the standard deviation is 1.96. One-half of the confidence interval (5 percent) is equal to an allowable error of .025 (2:103). Thus, applying the formula as follows:

$$n = \frac{pq}{(\frac{E}{z})^2} = \frac{.50 \times .50}{(\frac{.025}{1.96})^2} = \frac{.25}{.012755^2} = \frac{.25}{.00016269} = 1{,}537$$

Therefore, for a national market research program on nuclear energy, 1,537 people would be surveyed on their attitudes toward that particular topic. It should be noted, however, that costs and other limiting factors may necessitate a reduction in the actual numbers of consumers that can be surveyed.

Analyzing the data

Once the data have been gathered, the essential facts must be distilled and organized into a meaningful study. This requires tabulating, classifying, and cross-classifying the responses. Graphs and tables, with accompanying explanations, are useful tools in emphasizing the important aspects of the market research findings (6:326). The final report can be very useful in providing a framework within which

various marketing decisions can be made. Fortunately, today many computer programs and applications exist which greatly facilitate the analysis of market research data.

Product Research and Development, Product Identification, and Production

Soon after World War II, the possibilities of utilizing nuclear energy in civilian applications were recognized. Employing nuclear energy resources for the generation of electricity is an option that has been available to the United States ever since the Atomic Energy Act of 1954 was enacted. This legislation authorized government support for the extensive research and development programs necessary for the development of large-scale nuclear power (30:1).

Production of such facilities began in 1957 and has continued at a moderate pace, with various improvements and refinements occurring as a result of continually advancing technology. For example, the newer nuclear plants and those planned for construction have a much larger generating capacity than earlier plants (28:1). In addition, the development of breeder reactors, which produce more fuel than they consume, promises to reduce substantially the costs of generating electricity by nuclear energy (30:1-17). Finally, in the near future, nuclear power plants may be designed so that, in addition to producing electricity, the heat from the reactor can be used for the desalinzation of water (27:51).

Numerous additional nuclear plants are scheduled for construction by the end of the century, although in the light of present circumstances, any projection on the state of nuclear power by the year 2000 must be regarded as tentative.

Distribution

The selection of a nuclear power plant site is not the responsibility of the Atomic Energy Commission. The Commission either approves or rejects a site that has been chosen by the power company that proposes to build the nuclear plant (30:3-11).

The present distribution of nuclear power plants does reflect the relative demand for electrical energy in the different sections of the nation. Nuclear plants are located in twenty-two states, with most of the plants sited in industrial areas of the Middle West and the populous Northeast. In addition, many plants are under construction or are scheduled to be built in the Southern states (28:1).

It would appear that nuclear power plants are located in those areas that have the greatest need for additional sources of electric power. However, these may not have been the areas where they were most desired by the consumers. Therefore, this aspect of the nuclear energy program may not have proceeded logically from a marketing point of view. It will remain for a market research program to determine if this was the case or not.

Promotion

The Atomic Energy Commission has admittedly failed in its goal of spreading the gospel of the peaceful atom. The Commission has relied heavily on public relations techniques to sell the American public on the benefits and the necessity of large-scale development of nuclear energy. This program, while boasting a large array of speakers, films, press releases, and other informational materials, has not proven effective in achieving the aforementioned goal of the Atomic Energy Commission (4:185).

To enhance the prospect of success in achieving the desired ends, any future promotional effort of the Atomic Energy Commission should contain the following elements: (1) specific goals based on time constraints, (2) designating the market to be reached through the promotional campaign, (3) a formulation of various approaches or ideas to be stressed in the promotional effort (this will be covered in chapter V), (4) an evaluation of the various media to be used, and, finally, (5) a recognition and acceptance of the existing resource constraints.

Establishing Goals

The goal here is relatively well defined: to achieve public acceptance of nuclear power plants. Establishing a timetable within which this goal--and secondary goals--should be attained must, by

necessity, be related to probable developments in the energy crisis. Specifically, a prime factor of concern should be the rate of depletion of our non-renewable resources. Experts' opinions vary on how long our fossil fuel resources will last at present usage rates, with some typical estimates being fifteen years (10:9) to thirty-one years (22:4) for petroleum and ten years (10:28) to thirty-four years (22:4) for natural gas. An examination of the literature reveals that virtually all observers agree that the United States is depleting its nonrenewable energy resources faster than such new resources are being discovered and that the next two decades will be the critical period in which the energy crisis will have to be resolved.

Based on the above information, the following promotional strategy goals, along with their respective time constraints, are presented:

1.	Education of the public in regard to the basic technical aspects of nuclear power plants	- eighteen months to two years
2.	Convincing the broad majority of American people that nuclear power plants are safe	- three years
3.	Effectively reducing public resistance to nuclear power plants	- four to five years
4.	Continuing education to maintain a positive awareness of nuclear energy and related developments	- an indefinite period of time

The various promotional messages that will help achieve these goals are discussed in chapter V.

The Target Market

Since the market in this case is the general public, undifferentiated marketing would seem to be the best approach because this type of marketing deals with the market as an aggregate. Mass advertising media and universal themes are relied upon and, thus, the costs associated with segmental marketing are avoided. The type of marketing research needed is less costly and media discounts through large usage are possible (6:183).

Media Selection

The Atomic Energy Commission's choice of media will be largely dependent on three factors: the target market's media habits, the media's effectiveness for presenting the message, and the relative costs of the various types of media (6:685).

The target audience's media habits is perhaps the first factor that should be considered. Different groups of consumers can be reached more effectively through certain kinds of media than they can by other types (6:685). In this situation, the Atomic Energy Commission would be attempting to reach adults of both sexes.

The promotional message itself is an important factor in choosing among media. The various types of media offer varying degrees of effectiveness for demonstration, visualization, explanation, believability, and color (6:585).

The cost of the different media is also a significant factor. Generally, television is an expensive medium, whereas newspapers are regarded as among the least costly forms of media (6:685).

The media traditionally used to advertise electric power have been newspapers, accounting for 75 percent of the advertising exposure. However, in recent years the breakdown in media usage has assumed the following proportions: newspapers - 40 percent; television - 35 percent; all other - 25 percent (34).

In an interview with the writer, an electric power company executive commented that the appropriate media mix for advertising nuclear-generated electricity would place "newspapers and television on an equal footing" (34). The reasoning behind this is that the unique characteristics of each medium (newspapers and television) make it possible to reach effectively different groups of people. For example, newspapers impart greater detail and those who are intensely interested in nuclear plants can receive a more thorough exposure to the facts through newspaper advertising (3:170). Television, on the other hand, covers the highlights and thus effectively reaches those who are either unable or unwilling to take the time to explore the nuclear energy situation more thoroughly (3:173).

Based on the above information, media usage for a national marketing program is suggested as follows:

Newspapers - 40 percent

Television - 40 percent

Other - 20 percent

Under the category of "other," mass circulation magazines could prove to be effective vehicles for reaching large numbers of people throughout the country economically. Specialized newspapers such as the Wall Street Journal can serve to reach important segments of the populace. While lacking a visual dimension, radio could be used in a limited manner to increase audience exposure.

Resource Constraints

A total of $8,960,000 has been budgeted for the "Information Services" division of the Atomic Energy Commission for the fiscal year 1975. While this figure represents a 31 percent increase over the sum allotted for 1974 (32:3461), it is only .3 percent of the total funds appropriated for the Commission (26:303). Compared to the advertising outlays for other industries (based on percentage of sales), the sum available to the Commission for public relations and advertising is relatively small (6:677), especially considering the task to be accomplished. In addition, there is always the risk that, in future years, a budget-minded Congress will choose to cut funds for this particular area.

In any event, the Commission will have to operate within the realities of the existing situation, now and in the future. This means

that each advertising dollar will have to be used in the most effective way possible. Certain priorities will have to be established. For example, the nearly nine million dollars budgeted for fiscal year 1975 includes the sum of $600,000 to be spent on an Atomic Energy Commission display for a Bicentennial project in Idaho (31:3462). While this project may impress those who will see it, the $600,000 may have been better spent on trying to reach greater numbers of people through advertising activities.

Certainly, in the future, careful consideration must be given to the manner in which the funds allocated to the Information Services division of the Atomic Energy Commission are utilized. This is especially important if the Commission hopes to gain additional funds for promotion in the future.

Follow Up and Appraisal

This aspect of the marketing strategy involves several factors. First of all, evaluating the effectiveness of the product (nuclear power plants) can simply mean determining if the particular plant operates properly in regard to the generation of electricity. This particular aspect falls into the realm of technical factors and applications which need not be explored here.

However, a second factor that is particularly applicable to an effective marketing strategy is the question of whether the consumer's need to feel safe (in regard to nuclear power plants) is being met.

As examined earlier in this paper, certain instances have occurred in which citizens registered their lack of confidence in the existing standards and safeguards that govern the operation of nuclear plants. Safety is the overriding issue in the current controversy over nuclear plants. If this issue could be settled, then the entire problem would be well on the way to being resolved.

Applying one of the marketing concepts stated earlier in the chapter, the next step is the redesigning of the product or service if it does not meet specific needs. If consumers are to be made to perceive nuclear power plants as safe and dependable sources of electricity, then this desired perception will have to be based on sound technical realities.

The technical area is one in which the Atomic Energy Commission has the expertise and the authority to take decisive action, particularly in dealing with the factors of safety and environmental protection.

As discussed in chapter III, the issue of ecological damage to lakes and streams can be negated by the use of cooling towers and cooling ponds. The newer plants are being built with these facilities, while some of the older plants have had these cooling systems added later (12:27). In addition, gas-cooled reactors are now feasible (27:10). If all future nuclear plants employ one of these features,

then this particular environmental factor will be eliminated, once and for all, as a source of criticism.

A second factor that has caused some alarm is the release of small amounts of radioactive material into the environment during normal plant operation. As pointed out in the Palisades controversy in Michigan, plant waste handling systems can be modified to reduce the levels of radioactive emissions far below the amounts specified in Atomic Energy Commission regulations. Such strict standards should be applied to all nuclear plants planned for future construction even if, as the Commission contends, such standards are higher than necessary for maintaining safe emission levels. While such action would add considerably to the expense of nuclear plants, the costs of lawsuits, construction delays, and the attendant unfavorable publicity must also be considered.

One technical innovation that could have far-reaching implications is the concept of building nuclear power plants underground. Several underground facilities exist in Europe (30:8-34), and the well-known physicist, Dr. Edward Teller, has suggested that nuclear power plants should be sited underground in this country (4:163).

The most attractive feature of underground nuclear plants is the probability that underground siting would permit absolute containment of radioactive products from any conceivable type of accident (30:8-34). In other words, the risk factor of radioactive contamination

to the outside environment resulting from an accident or sabotage would be reduced to zero. While this is an exciting possibility, the Commission is cool to the idea of underground nuclear plants, citing such factors as increased costs, the lack of engineering designs for underground siting in the U.S., and the limitations imposed by the geology of the proposed site. General studies are underway, however, which will assess the problems and advantages of underground siting (30:8-34 - 8-35). While such an innovation would pose considerable engineering problems and would increase the cost of nuclear plants, the one overriding advantage would be the immunity of such facilities concerning issues of safety. In fact, underground siting, more than anything else, would help resolve the entire issue of safety.

Another factor that should be included in any appraisal is the degree to which the marketing strategy is achieving the desired results. Fortunately, a method exists by which the amount of success in attaining the marketing goals can be measured. This measurement tool has been used by the Commission in the past, and it consists of monitoring the number of contested hearings for nuclear plants (30:111-1). This measuring device can provide some indication of the degree of success of the marketing program. The amount and the type of news media coverage given to the nuclear plant controversy will also provide some indication of the state of public attitudes.

The Marketing Responsibilities of Electric Power Companies on the Local Level

The Atomic Energy Commission is, by law, responsible for promoting the peaceful uses of atomic energy (30:1). However, there are several reasons why local power companies (that is, those that have contracted to have a nuclear plant constructed) should develop their own marketing programs to complement the efforts of the Atomic Energy Commission.

For one thing, the local power company is more familiar with the situation in its area than would be the Atomic Energy Commission. Secondly, the local power company has a direct financial interest in the nuclear plant and, consequently, the degree of acceptance or rejection of the plant by the community assumes great importance. Thirdly, there is the possibility that the power company will achieve a greater degree of success in promoting nuclear energy on the local level than has the Atomic Energy Commission.

Initial Strategy

During the preliminary stages of nuclear power plant development--i.e., when the local utility is exploring the possibilities of constructing such a plant with a contractor--it would be advantageous to introduce the concept of nuclear power to the consumers in the area. This can be done through press releases which relate the local utility's interest in establishing a nuclear plant in the area. The

advantages and benefits that a nuclear plant would offer to the area can also be discussed in these articles (34).

In addition, the public can be kept informed as to the various developments in the project. The results of any studies undertaken by the power company or the contractor, the factors involved in choosing a site for the nuclear plant, and other newsworthy items can be presented to the community through the local media. By keeping the local consumers well informed, the power company can, to an extent, pre-empt any outside group of obstructionists who might wish to turn the situation into a controversy.

It should also be mentioned that since the nuclear power plant controversy has often taken on political overtones, the appropriate federal and state legislators should also be kept well informed on each development in any nuclear power plant project.

Long-Range Strategy

Once the utility and the contractor have committed themselves to the project, it will be necessary to expand the promotional efforts, although the overall program can still remain relatively low-key. It should be noted that from its inception to its completion a nuclear power plant requires nine or ten years to become operational. Therefore, any marketing or promotional strategy will necessarily be drawn out over that period of time (34). In other words, even after acceptance

of a nuclear plant is achieved, it will be necessary to perpetuate this condition in forthcoming years.

A four- or five-man speakers' bureau established by the utility company would be a great asset in reaching various segments of the public. In addition, materials for film and slide presentations can be obtained from the Atomic Energy Commission, various electric industry organizations, the company contracted to build the nuclear plant, or the material can be produced by the utility itself (34).

A situation may arise in which speakers well-versed on the technical aspects of nuclear power plants are needed by the local utility. Such speakers can be provided by the Atomic Energy Commission. However, as one utility company executive stated, it is more advantageous to obtain scientific personnel from the company contracted to construct the nuclear plant. For one thing, after having worked with the local power company on the project for a length of time, the contractor will have a more knowledgeable grasp of the particular situation than would an outside party such as the Atomic Energy Commission. Also, it is in the contractor's interest to successfully complete the project. It can be assumed, therefore, that the contractor will provide the best possible assistance to the local utility (34).

Informing the Community Through Specialized Programs

There are certain situations that are especially suited to the type of personal, face-to-face presentation that speakers can provide.

Younger members of the community can be exposed to the facts about nuclear power plants through school programs. Most schools are responsive to programs of this type. Various programs can be developed for schools starting with the upper level elementary grades on through high school (34).

Civic clubs represent another medium by which to diffuse knowledge of nuclear power plants. Many of the influential leaders of a community belong to such organizations. In addition, civic clubs are constantly looking for good programs, and if the power company has developed a reputation for providing good programs, it will have little difficulty in reaching these audiences (34).

Media Selection

The kinds of media and media mixes that would most effectively promote nuclear energy and nuclear power plants were discussed in the preceeding section in this chapter.

Specific promotional messages will be discussed in chapter V.

Market Research

Much of the marketing effort of the local power company will be of an informal, almost personal, nature, particularly in the early stages of the project. However, during the nine- or ten-year period in which the nuclear plant is being constructed, various situations may

arise which indicate a need for market research. This topic was covered in detail in an earlier part of this chapter.

Summary

The Atomic Energy Commission is a governmental agency attempting to sell the concept of large-scale nuclear power plant development to the American public. There is reason to believe that it can achieve a greater measure of success in attaining this goal by adopting and utilizing traditional marketing practices and concepts. These concepts can be designated as: market research, product research and development and product identification, production, distribution and promotion, and follow up and appraisal.

In formulating their marketing strategy, the Atomic Energy Commission should place emphasis primarily on market research, promotion, and follow up and appraisal.

Market research can provide a base of information on which to construct a viable marketing strategy.

Through promotion, the Atomic Energy Commission can present various themes to the public that can contribute to the ultimate acceptance of nuclear power plants.

The Commission should evaluate the extent to which consumers' needs are being met by nuclear power--particularly the need to perceive nuclear plants as safe, dependable sources of electrical energy. If

deficiencies exist in this area, then the appropriate technical corrections and innovations should be considered.

While the Atomic Energy Commission has the resources to promote nuclear power plants on the national level, there are many things that an electric power company can do on the local level.

First of all, the local utility can keep the community informed of the various stages in the nuclear plant project through press releases.

In addition, a speakers' bureau can be established to reach various segments of the community, such as civic clubs and schools. Speakers with a technical orientation can be obtained from the company contracted to build the nuclear plant.

By necessity, the marketing program will extend over the nine- or ten-year period that is required for the construction of a nuclear plant. If necessary, market research can be used to increase the effectiveness of the marketing efforts of the power company.

CHAPTER V

THEMES TO BE STRESSED IN THE PROMOTIONAL CAMPAIGN

Elements of an Effective Promotional Program

A successful promotional campaign should be comprised of the following themes, or ideas, each of which is intended to accomplish the promotional goals listed in chapter IV. These messages are: (1) Nuclear power plants are much like conventional power stations in terms of operation; (2) Nuclear power plants offer unique advantages to a community; (3) Nuclear power plants can prevent power shortages; (4) The record has shown that nuclear plants are safe; and (5) The question of nuclear energy is important enough to warrant the examination of both sides of the issue.

Some of these ideas will be better suited to either the general public (the domain of the Atomic Energy Commission) or small communities (where local electric power companies can play an important role), although most of them will be applicable to both.

Although in chapter IV it was noted that certain media would be more advantageous than others, these particular themes are applicable to all types of media. They could be utilized by individual speakers or by the traditional vehicles of mass media advertising.

Also, these themes address themselves only to areas of known resistance. Hopefully, market research will reveal potentially troublesome issues that might emerge in the future.

Nuclear Power Plants Are Much Like Conventional Power Stations in Terms of Operation

This particular element of the promotional strategy is applicable to both communities and the general public.

It is necessary to dispel the aura of mystery surrounding the term "nuclear energy." Actually, aside from the heat source, nuclear plants and regular fossil-fueled plants are quite similar. A nuclear electric plant has been described as "mankind's most complicated device yet for boiling water" (20:22). This message should be emphasized; the fear of nuclear power plants will be lessened to the extent that reliable information about such facilities is diffused throughout all levels of society.

This task can be facilitated by the use of simple illustrations that present clearly the major components of a nuclear plant and the function of each. Very skillful use is made of such drawings in various Atomic Energy Commission publications. The principal advantage in this approach is that it enables one to realize that the only basic difference between a nuclear plant and a conventional generating facility is the type of fuel used to produce the heat that is necessary to create steam.

Erroneous ideas concerning nuclear plants could also be corrected. For example, the worry persists that a nuclear plant can explode into a mushroom cloud, like an atomic bomb. This is, in fact, physically impossible (10:78), and educating consumers to this fact could do much to eliminate this unnecessary element of concern among the general populace.

Nuclear Power Plants Offer Unique Advantages to a Community

One obvious advantage that can be presented in a promotional campaign is the cleanliness in the operation of nuclear plants. These facilities do not emit particulates, sulfur oxide, or any other type of combustion product (16:147). As one writer commented, nuclear generating plants can be as "neat and clean as a hospital" (5:101). This aspect can be contrasted, of course, to fossil-fueled plants whose huge stacks often emit considerable amounts of effluents into the atmosphere. If air pollution is to be controlled and if future energy needs are to be met, then nuclear power plants can be promoted as a logical and feasible alternative to conventional generating stations.

A region served by a nuclear power plant will have a cheaper source of electricity than could be provided by a conventional plant. While a nuclear plant is more expensive to construct than a conventional power station ($500 per kilowatt of capacity as compared to $400, respectively), it is considerably less expensive to operate. As the

price of fossil fuels continues to rise, nuclear fuel--i.e., enriched uranium--can prove to be an attractive alternative because it is relatively plentiful and inexpensive to use. For example, at current prices for uranium it requires $5.75 worth of nuclear fuel to provide the seven thousand kilowatt hours of electricity that an average household consumes in a year. This compares to $15 for coal generated electricity and up to $33 for oil (20:22). In addition, nuclear fuels are compact sources of energy, resulting in less mining and transportation costs than for coal, for example. The water pollution, land defacement, and human injuries associated with mining are correspondingly reduced (16:147).

Lastly, a nuclear power plant presents a somewhat more aesthetic appearance than a regular power station. With its large white concrete and steel sphere, cooling tower, and connecting buildings, a nuclear generating station can often be the most impressive man-made sight in the area (19:67). It presents a pleasant departure from the often unsightly appearance of a fossil-fuel plant.

Enumerating the advantages of nuclear power plants is a promotional message that can be used on both a local and a national level. If presented convincingly enough, perhaps eventually a demand could be created for nuclear plants.

Nuclear Power Plants Can Prevent Power Shortages

This particular appeal would probably have the greatest impact on individual communities.

No community, large or small, wants to experience the dangers and inconveniences of brownouts and blackouts and the attendant economic hardships that result from a shortage of needed electrical power.

Nuclear plants, aside from providing a dependable source of electricity, use enriched uranium as their fuel, the supply of which is not affected by the decisions of foreign governments.

In addition, the local citizenry can be informed that delaying or halting the construction of a nuclear power plant poses certain drawbacks. First of all, delaying the completion of a nuclear plant under construction can result in costs ranging from $1 to $5 million per month. This expense is due to interest on construction loans, loss of revenue, and extended labor costs. More importantly, many of these costs will ultimately be borne by the people in the service area of the nuclear plant when it is finally completed (30:5-6).

The Record Has Shown That Nuclear Power Plants Are Safe

Promoting the outstanding safety record of nuclear power plants over the past nineteen years can help convey the fact to the public that nuclear plants are not inherently dangerous.

No accident serious enough to pose a threat to the public has ever occurred during the operation of a nuclear power plant. In addition, the naval propulsion program utilizes 123 nuclear reactors (similar to those used in nuclear electric plants) to power submarines and surface ships. At no time since the first nuclear submarine was launched has the navy experienced a reactor accident. Thus, counting both nuclear power plants and naval reactors, nuclear reactors have accumulated over 1,150 reactor years of experience without a serious accident (30:2). In addition, the overall accident rate for personnel in the nuclear power industry compares favorably with the low rates of the natural gas industry and is considerably lower than that in other energy related industries, particularly coal mining and oil well drilling (30:6-19). This factor of safety-consciousness can also help improve the image of the Atomic Energy Commission, the electric power companies, and the nuclear energy industry in general.

It can also be pointed out that, given the realities of the existing technology, a nuclear power plant cannot be guaranteed to be 100 percent safe any more than an airline company can guarantee an airplane trip to be absolutely safe. As the Atomic Energy Commission has said, some people "who willingly accept everyday risks such as highway traffic, walking across streets, using electricity and fire, often use another yardstick with respect to nuclear power, insisting on absolutes which will never be attainable" (30:111-12).

Promotion of the nuclear power industry's safe record should be equally effective on both the local and national levels.

The Question of Nuclear Energy is Important Enough to Warrant the Examination of Both Sides of the Issue

This approach would be particularly effective in dealing with individual communities.

One critic has asserted that the reason opposition to nuclear plants is growing is because "the public is indeed interested to hear about atomic power, but what they want is hard information, not the 'gospel of the peaceful atom'" (4:186). There may be a great deal of truth in that statement. Accordingly, electric utility companies should consider utilizing the concept of the two-sided message. That is, when presenting the advantages and benefits of nuclear power plants, the disadvantages (e.g., higher construction costs) and the potential hazards (however remote) should also be discussed. In addition, the arguments and issues that opponents are likely to raise should be discussed, clarified, and, when necessary, refuted. The two-sided message approach is particularly applicable in this situation because two-sided messages tend to be effective with audiences who are likely to be exposed to counter-arguments. Also, when dealing with a group that is initially opposed to nuclear power plants (which, under present circumstances, would probably be the majority of audiences), power company spokesmen would probably be more effective if they started with the

opponents' argument and concluded with strong arguments for nuclear power plants (6:542). A forthright approach such as this may also help enhance the credibility of the speaker and the organization which he represents.

To summarize the previous discussion, a matrix is presented in figure IV-1 which indicates whether a particular promotional theme would be more effective on a local level, or a national level, or both.

	Local	National	
Nuclear plants are much like conventional plants	X	X	
Nuclear power plants offer unique advantages	X	X	
Nuclear plants prevent power shortages	X		
Nuclear plants have a good safety record	X	X	
Both sides of the issue should be examined	X		

Fig. V-1. Applicability of suggested promotional themes

CHAPTER VI

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

The Problem

During the last several years the issue of the safety and the desirability of nuclear power plants has grown into a national controversy. Public resistance to the large-scale development of nuclear plants had reached such a dimension that the development of a viable nuclear energy program was threatened.

Ecologists, scientists, and government officials have all entered into the dispute, each setting forth its own argument for or against nuclear power plants. The net results of this furor have been a confused and apprehensive public and a somewhat dismal prospect for solving the problems of an energy-hungry nation.

Viewed in the light of a marketing problem, one must conclude that the principal "seller" of nuclear energy, the Atomic Energy Commission, must develop a marketing program that will effectively reduce resistance to the construction and operation of nuclear plants.

Historical Development of Nuclear Energy

Nuclear reactors were established in this country during World War II for the purpose of producing the first atomic bombs. While atomic power was credited with bringing a swift and decisive end to the war, it was also apparent that such energy had significant peacetime applications.

In 1946 Congress established a new civilian agency to oversee both military and peaceful development of atomic energy. The Atomic Energy Commission was charged with establishing and enforcing safety standards for the construction and operation of nuclear power plants and granting the necessary licenses in respect to nuclear facilities.

Initially, weapons development was the major concern of the Atomic Energy Commission. Soon, however, plans were prepared for the construction of the first nuclear facilities that would generate electricity. The first nuclear generating plants were small, laboratory-type projects that produced relatively small amounts of electricity. The first full-scale nuclear power plant was constructed near Pittsburgh, Pennsylvania, and began operating in 1957. Since that time, forty-six additional nuclear plants have been constructed and are now operating in this country.

Resistance to Nuclear Power Plants

In the late 1960s, with most of the technical problems resolved, the pace of construction began to increase. By 1980

one hundred nuclear plants were scheduled to be operating, supplying 25 percent of the electrical needs of the United States. By the turn of the century, one thousand nuclear power plants would be providing 60 percent of all generating electricity in this country.

Unfortunately, the rapid growth of nuclear energy coincided with public awakening to the environmental issues that confront our society. Serious questions were posed concerning the safety and desirability of nuclear power plants.

In many cases, lawsuits by citizens' groups were initiated. Construction progress on new plants was halted in many parts of the country. One newly constructed plant in Michigan was kept idle for a year at a cost of one million dollars a month.

The critics' complaints centered on two issues: (1) the environmental impact of nuclear power plants on rivers and lakes, and (2) the danger of radioactive emissions during the routine operation of the plant.

Water from a river or lake was used to cool the reactors of nuclear plants, and in this process the possibility of injuring the aquatic life was real. However, most nuclear plants have since built specialized cooling towers or ponds to dispose of excess heat. In addition, gas-cooled reactors are now feasible. This type of cooling completely eliminates the need for large quantities of water.

The controversy then shifted to the possibility of unsafe amounts of radioactive material being released into the environment. The Atomic Energy Commission contends that any radioactive material released into the air is of such a miniscule amount that it poses no threat to human life. Moreover, under Commission regulations, the amount of radioactive exposure received from one thousand nuclear plants would be less than 1 percent of that from natural background radiation. Thus, this particular aspect of the controversy has, to a large extent, been defused.

Accordingly, the focus of the criticism has moved away from environmental factors to the possibility of an accident releasing lethal amounts of radioactivity. The Atomic Energy Commission maintains that monitoring instruments automatically shut down the reactor in the event of an accident or some type of malfunction. In addition, a nuclear plant is designed and constructed to withstand all types of "external events" such as earthquakes, floods, tornadoes, and other natural disasters.

Current Atomic Energy Commission Marketing Techniques

No evidence exists to suggest that a long-range marketing strategy to help facilitate public acceptance of nuclear plants was ever developed. The need for one was not yet apparent during the 1950s and the early 1960s. Apparently, the problem of countering

resistance to nuclear power plants was not one which the Commission felt it would ever have to contend with.

The Commission does, however, maintain an extensive public relations program. It consists of press releases, a film library, speakers, and numerous publications. The program is essentially passive and, admittedly, has proven to be a failure.

The situation was not helped by certain mistakes that the Commission made in other areas. For example, the Commission waited until 1969 before it began to publicly debate the critics of nuclear plants. By that time, the opponents had gained the initiative in the controversy. In addition, perceptive critics were able to point to instances where Commission standards concerning environmental safeguards seemed inadequate. Some foresight and long-range planning could have enabled the Commission to avoid much of the additional expense and the harmful publicity that occurred during various stages of the controversy.

Developing a Marketing Strategy for Nuclear Power Plants

The marketing process can be summarized as follows: (1) market research; (2) product research and development, product identification, and production; (3) distribution and promotion; and (4) follow up and appraisal. The following paragraphs will deal with each of these topics.

The Atomic Energy Commission has stated that little research has been done on citizens' attitudes toward nuclear energy. Market research in this area could reveal the basis for hostile attitudes toward nuclear plants; it could aid in determining if regional differences exist in attitudes toward nuclear plants; and, hopefully, such research might reveal potential areas of conflict that have not yet emerged.

The feasibility of employing fissionable elements for the generation of electricity was recognized shortly after World War II. Research and development toward this end has continued since that time. The first full-scale nuclear power plant began operating in 1957 and, as of June 30, 1974, forty-seven such plants were producing electricity in the United States. Numerous additional plants are scheduled to be operating by the end of the century.

In regard to distribution, nuclear plants are located in those areas that have the greatest need for electrical energy--i.e., industrialized areas of the Middle West and the Northeast. However, it will remain for market research to determine if these are the areas where nuclear plants are most desired.

In the area of promotion, the Atomic Energy Commission has not been successful in its goal of spreading the gospel of the peaceful atom.

An effective promotional strategy should be based on specific goals along with relevant time constraints. These goals are:

(1) educating the public in regard to the basic technical aspects of nuclear power plants (eighteen months to two years), (2) convincing the broad majority of American people that nuclear power plants are safe (three years), (3) effectively reducing public resistance to nuclear plants (four to five years), and (4) continuing education to maintain a positive awareness of nuclear energy and related developments (an indefinite period of time). The time constraints are based on expert opinion concerning the rate of depletion of our non-renewable resources.

In order to achieve the above promotional goals, certain themes, or appeals, should be stressed in the campaign.

The following themes are applicable to both the local and national levels:

Nuclear power plants are much like conventional power plants in terms of operation.

Nuclear power plants offer unique advantages to a community.

The record has shown that nuclear power plants are safe.

These appeals would probably have the greatest impact on the local level:

Nuclear power plants can prevent power shortages.

The question of nuclear energy is important enough to warrant the examination of both sides of the issue.

In this case the target market is the general public. Undifferentiated marketing, which utilizes mass advertising media, would seem to be the best approach.

In recent years the breakdown in media usage for advertising electric power has been almost evenly divided between newspapers and television, with the latter having a slightly larger share. Because of the unique advantages by both television (it effectively covers the highlights) and newspapers (they impart greater detail), an equal mix between the two seems advisable. For example, newspapers and television might share 80 percent of the exposure between them and the remaining 20 percent could be used for other types of media such as radio, magazines, and outdoor advertising.

The follow up and appraisal aspect of the marketing process can have two applications. One factor, certainly, is determining whether the customer's need to feel safe (vis-a-vis nuclear plants) is being met. Safety requirements fall under the responsibility of the Atomic Energy Commission; it has the authority to change or improve existing standards. The perception of nuclear plants as safe, reliable sources of electricity must be based on sound technical facts.

Of course, another important factor to be included in any appraisal is measuring the effectiveness of the marketing program. By monitoring the number of contested hearings over nuclear plants, the Commission can determine if hostility toward nuclear plants has diminished to any significant degree.

The effective promotion of nuclear power plants will necessitate a very careful allocation of advertising funds. A very important factor is the fact that the overall scope of the promotional program will be determined by the amount of funds appropriated for this purpose by Congress. Therefore, Commission officials must at all times be able to justify the spending of funds on any given promotional effort.

While the Atomic Energy Commission has the responsibility of promoting nuclear energy on the national level, local electric power companies can do many things to help facilitate the acceptance of nuclear plants.

First, press releases can keep the public informed during the initial stages of a nuclear power plant project. The appropriate federal and state legislatures should also be kept informed on the various developments.

Once the project is well under way, a speakers' bureau could be established by the utility company. This can serve as an important vehicle for reaching schools, civic clubs, and other segments of the community.

By combining the appropriate promotional themes with the proper media mix (as discussed earlier in this section), the local power company can do much to promote the acceptance of nuclear power plants.

Conclusion

The hypothesis of this study was: techniques currently employed by the Atomic Energy Commission differ substantially from those marketing techniques that can reduce resistance to the large-scale development of nuclear power plants.

Relative to this hypothesis, the evidence presented indicates that the current marketing efforts of the Atomic Energy Commission have failed to produce broad public acceptance of nuclear power plants. Therefore, this part of the hypothesis was proven to be true.

The marketing program suggested in this paper to alleviate the current problems remains to be tested. It was developed by the writer after an analysis of the many factors involved in the present controversy. The proposed strategy is based on accepted marketing concepts and principles and incorporates many elements not present in the Atomic Energy Commission's current program. However, this part of the hypothesis cannot be proven or disproven unless the recommendations were actually carried out.

Overcoming public hostility to nuclear power plants is no small task, nor is it an insurmountable problem. The goal cannot be accomplished overnight; yet it must be achieved as quickly as prevailing circumstances permit. Obviously, a great deal of planning and diligent effort will be necessary to inform the American public on the importance of developing a large-scale nuclear energy program.

The current problems associated with energy--all forms of energy--suggest that the situation may become critical in the not-too-distant future. Ironically, it may be the next serious energy crisis, more than anything else, that helps the cause of nuclear energy. If, for one reason or another, electrical shortages should develop in various parts of the country, it is conceivable that critics of nuclear plants would find less and less support for their views.

Another factor that clouds the future of nuclear plants, unrelated to public resistance, is the impact of price inflation. Costs of proposed nuclear plants have risen dramatically while the project was still in the planning stage. Certainly, costs will play an important role in determining the scope of nuclear plant development in the United States.

Only the future can answer the question of whether or not nuclear energy will achieve its full potential in this country. The development and implementation of a sound marketing program will do much to overcome the present obstacles to nuclear energy development.

Recommendations

Comprehensive research concerning citizens' attitudes toward nuclear power plants is a necessity in developing a marketing program for such facilities. The accumulation and analysis of market research data would help pinpoint areas of particular concern to the average person. Erroneous ideas or misconceptions concerning nuclear plants

could be discovered and, through promotion, corrected. The Atomic Energy Commission has the monetary resources to carry out extensive marketing research surveys in selected sections of the country.

Since the size of the Commission's budget for promotion is determined by Congress, the need for such funds should be brought to the attention of the appropriate Senators and Representatives. While wholesale involvement in politics by the Commission is not recommended, the current situation concerning nuclear energy is quasi-political, and without the support of Congress the prospects for overcoming the present impasse over nuclear power plants will be greatly diminished. Therefore, when appearing before the various Congressional committees, Atomic Energy Commission spokesmen should have detailed information relating to the need for an expanded marketing program and how such a program will ultimately serve the best interests of the nation.

Close cooperation between local power companies and the Atomic Energy Commission is important. Ideas, expertise, and data can be shared. Local utilities are familiar with the particular situation and circumstances in their service areas. Therefore, they are in a position to make significant contributions to the overall program of marketing nuclear power plants.

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APPENDIX

A. Major Nuclear Power Plants in the United States

B. Death Risk to U.S. Population from Selected Hazards

C. Recoverable Forms of Energy in the U.S. Compared to Current Usage Rates

APPENDIX A: MAJOR NUCLEAR POWER PLANTS IN THE UNITED STATES

State and Name of Plant	Capacity in Kilowatts
Alabama	
Browns Ferry Nuclear Power Plant	2,130,000
Arkansas	
Arkansas Nuclear One	850,000
California	
Humboldt Bay Power Plant	65,000
San Onofre Nuclear Station	430,000
Diablo Canyon Nuclear Plant	1,084,000
Rancho Seco Nuclear Station	804,000
Colorado	
Fort St. Vrain Generating Station	330,000
Connecticut	
Haddam Neck Plant	575,000
Millstone Nuclear Power Station	1,480,100
Florida	
Turkey Point Station	1,386,000
Crystal River Plant	825,000
Illinois	
Dresden Nuclear Power Station	1,818,000
Zion Nuclear Plant	2,100,000
Quad-Cities Station	1,600,000
Iowa	
Duane Arnold Energy Center	569,000
Maine	
Maine Yankee Atomic Power Plant	790,000
Maryland	
Calvert Cliffs Nuclear Power Plant	845,000

State and Name of Plant	Capacity in Kilowatts
Massachusetts	
Yankee Nuclear Power Station	175,000
Pilgrim Station	664,000
Michigan	
Big Rock Point Nuclear Plant	75,000
Enrico Fermi Atomic Power Plant	1,093,000
Palisades Nuclear Power Station	700,000
Donald C. Cook Plant	1,060,000
Minnesota	
Monticello Nuclear Plant	545,000
Prairie Island Nuclear Plant	1,060,000
Elk River Reactor	530,000
Nebraska	
Fort Calhoun Station	457,400
Cooper Nuclear Station	778,000
New Jersey	
Oyster Creek Nuclear Power Plant	640,000
Salem Nuclear Generating Station	1,090,000
New York	
Indian Point Station	2,103,000
Nine Mile Point Nuclear Station	625,000
R. E. Ginna Nuclear Power Plant	490,000
J. A. Fitzpatrick Nuclear Plant	821,000
Pennsylvania	
Peach Bottom Atomic Power Station	40,000
Peach Bottom Station: Units 2 and 3	2,130,000
Shippingport Atomic Power Station	90,000
Three Mile Island Nuclear Station	819,000
South Carolina	
H. B. Robinson S. E. Plant	700,000
Oconee Nuclear Station	2,658,000

State and Name of Plant	Capacity in Kilowatts
Vermont	
Vermont Yankee Generating Station	513,900
Virginia	
Surry Power Station	1,576,000
North Anna Power Station	898,000
Washington	
N-Reactor/WPPSS Steam	850,000
Wisconsin	
Genoa Nuclear Generating Station	50,000
Point Beach Nuclear Plant	994,000
Kewaunee Nuclear Power Plant	541,000

SOURCE: U. S. Atomic Energy Commission. Nuclear Power Reactors in the United States, June 1974, p. 2.

APPENDIX B: DEATH RISK TO U.S. POPULATION FROM SELECTED HAZARDS

Hazard	Annual Chance of Death Based on One Person Out Of:	Probability of Death Per Person Year
Cancer	625	1.6×10^{-3}
Auto accident	3,600	2.8×10^{-4}
Drowning	27,000	3.7×10^{-5}
Choking on food	100,000	1×10^{-5}
Cancer from medical X-rays	100,000	1×10^{-5}
Lightning	1,000,000	0.8×10^{-6}
Cancer from nuclear effluents	25,000,000	4×10^{-8}
Nuclear power plant accidents leading to releases of radioactivity	10,000,000,000	1×10^{-10}

SOURCE: U.S. Atomic Energy Commission. Safety of Nuclear Power Reactors (Light Water-Cooled) and Related Facilities. Final Draft, Pubn. 1250, 1973, pp. 6-44.

APPENDIX C: RECOVERABLE FORMS OF ENERGY IN THE U.S. COMPARED TO CURRENT USAGE RATES

Recoverable Fossil Fuels in the U.S.	10^{15} BTU's	Usage Rates as a Percentage of Total Energy Consumption
Coal	33,000	17 percent
Oil shale, tar sands	1,500	0
Petroleum	1,000	46 percent
Natural gas	800	32 percent

SOURCE: "Energy Crisis--the Challenge, the Solution." Westinghouse News, 11 January 1974, p. 4.