NUCLEAR POWER TRANS-FORMATION

Joseph P. Tomain

NUCLEAR POWER TRANSFORMATION

Joseph P. Tomain

Indiana University Press

BLOOMINGTON AND INDIANAPOLIS

Manufactured in the United States of America

Library of Congress Cataloging-in-Publication Data

Tomain, Joseph P., 1948–
Nuclear power transformation.

Includes index.
1. Nuclear industry—Law and legislation—United States. 2. Nuclear energy—Government policy—United States. 3. Nuclear industry—Government policy—United States. 4. Nuclear energy—Government policy—United States. I. Title.
KF2138.T66 1987 346.7304'6724 86-45397
ISBN 0-253-34110-8 347.306467924

1 2 3 4 5 91 90 89 88 87

NUCLEAR POWER TRANSFORMATION

To the Memory of Those Who Suffered Chernobyl

PREFACE

This book can be subtitled "From Three Mile Island to Chernobyl." During this period, the regulation of the commercial nuclear power industry in the United States experienced a radical transition caused by dramatic changes in nuclear markets and nuclear politics. Unfortunately, nuclear power, once the hope and envy of energy suppliers, has turned out to be a costly mistake. Now, and for the foreseeable future, there will be no more investment in new nuclear plants. Instead, nuclear regulation will be occupied with existing and nearly on-line plants. Furthermore, unanticipated costs of nuclear power such as costs attributable to evacuation, plant decommissioning, and waste disposal are now being identified and allocated during this transitional period. The consequence of the transition is clear: There will be no more nuclear power plants constructed in the United States until costs are lowered and industry safety claims receive wide public acceptance. These are assertions about the economics and politics of nuclear power and they are the twin conditions for a resurgence of nuclear power.

The nuclear regulatory transition is not discrete in the sense that a conscious change in government policy was announced and implemented. Instead, the change is largely unconscious and is taking place gradually. The transition can be dated from March 28, 1979, the date of the incident at Three Mile Island, to April 26, 1986, the date of Chernobyl. TMI and Chernobyl serve as more than convenient mileposts in the history of nuclear power. TMI made the United States aware of unforeseen costs, just as Chernobyl made the world aware of unforeseen risks. These accidents are stark reminders of the complexities, risks, and costs of government-sponsored and regulated enterprises. Further, and more important, the events which occurred between these dates have significantly changed the direction of the nuclear and electric industries. *Nuclear Power Transformation* is about the economic, political, and legal dimensions of the transition.

This book is the end result of a collaborative effort. It began as a project in my Energy Law and Policy seminar in 1984 at the University of Cincinnati College of Law. A group of students and I were interested in examining the problems of nuclear plant cancellations and decided that we would each examine an aspect of the problem and write a chapter ultimately to be published as a book. As the project expanded and the students graduated, I altered the focus and theme of the book. Still, this book would not have been written without the help of several persons who deserve special thanks and recognition. Thomas Gabelman and James Jorling greatly contributed to the case studies in chapter two and to the history of nuclear regulation in chapter one. Lois Zettler and Jo Jones Riser developed the background for the discussion of public participation in chapter three. Without the facts uncovered by the diligent research of these four contributors, there would be no story. Rebekah Bell Estes tracked down the several state public utility commission cases in chapter five, and Lynn Schumacher and Michael Norse helped provide the discussion of government liability in chapter six. Finally, special thanks is due Constance Dowd Burton for her many contributions to the final form of this book. As my research assistant, she helped edit the manuscript and find obscure references. More important, through our many conversations and rereadings, she helped shape the final product.

The University of Cincinnati College of Law assisted this project with two summer grants, and provided the expert word processing help of Charlene Carpenter. My sincere appreciation to all who helped bring this work through to completion.

Contents

PREFACE ix

INTRODUCTION 1

ONE *Institutional Setting* 6

TWO *Three Failed Decisions* 29

THREE *Public Participation* 55

FOUR *Nuclear Power Market* 79

FIVE *Accommodating Nuclear Power* 102

SIX *Responsibility and Liability* 135

SEVEN *Transition and Beyond* 161

NOTES 173

INDEX 207

Introduction

A few seconds after 4 o'clock on the morning of March 28, 1979, pumps supplying feedwater to steam generators in the containment building of General Public Utility's Unit No. 2 near Harrisburg, Pennsylvania, closed down.[1] Automatically, emergency feedwater pumps kicked on, but a closed valve in each line prevented water from reaching the generators. The closed valves were not noticed by plant operators. As a result, another critical valve, the PORV, thought by plant operators to have closed after thirteen seconds, stuck open, sending critically needed coolant to the containment building floor. As the steam generators boiled dry, the reactor coolant heated and expanded. Two large pumps automatically began pouring coolant into the reactor chamber while pressure dropped. As a result of even more operator errors, known anomalously as common-mode failures,[2] these pumping systems, designated to send cooling water into the reactor vessel to reduce pressure and heat, were manually shut down. For critical hours, as water boiled into steam, the reactor failed to cool and began to disintegrate. The fuel rods crumbled, and gases within the rods escaped into the coolant water. After two hours and twenty-two minutes, a blocked valve was closed, stopping the flow of over 32,000 gallons of contaminated coolant into the containment building. Then thousands of gallons of deadly radioactive water were negligently pumped into an adjoining building. These events and those that followed are commonly referred to as the accident at Three Mile Island. TMI, a milestone in the history of commercial nuclear power, marks the end of its developmental period and the beginning of its transformation.[3]

The transformation is decisive. The once-unified pronuclear energy policy existing from the conclusion of World War II to 1979 has been shattered.

Currently, new commercial nuclear development has ended, and no consensus exists on what shape future policy will take. Before any recognizable policy is formed and implemented, political and economic interests influencing policy developments must work their way through a complex of decision-making processes. This book, about the transitional period of nuclear regulation, describes how and why the pronuclear preference disintegrated, sketches the contours of future policy, and argues that the new policy must confront institutional biases established during the developmental years of nuclear power. Briefly, the conclusion is that more responsive, democratic, and participatory decision-making processes are necessary before future nuclear policy achieves legitimacy.

Prior to TMI, the popular conception of a nuclear catastrophe was a core meltdown. The meltdown, colloquially referred to as the China Syndrome, is a nightmarish phenomenon in which the molten reactor core melts through thousands of tons of concrete and steel encasing the fuel rods and burns its way into the ground, emitting massive amounts of radioactive gas on its way to contaminating underground water tables. The radioactivity released into the atmosphere and the water system is predicted to cause over three thousand prompt fatalities, tens of thousands of illnesses, latent cancer fatalities, and genetic defects, and economic losses of $14 billion.[4] According to economist Daniel Ford, former executive director of the Union of Concerned Scientists, TMI was within thirty to sixty minutes of a core meltdown.[5]

As frightening as the vision of a health and safety holocaust is, the irony of TMI is the change in focus away from the radioactive to the financial consequences of a nuclear incident. Even at the writing of this book, the TMI story has not ended. There are two electric generating plants on the island. Because of the accident, both Units No. 1 and No. 2 were shut down. Unit No. 1 was permitted to reopen in 1985, and Unit No. 2 remains closed and contaminated. The clean-up costs of the TMI accident run over $1 billion,[6] multiples of previous estimates for partial plant decommissioning.[7] Costs continue to mount for clean-up, plant decommissioning, purchase of replacement power, and a welter of associated litigation,[8] including claims against the utility from those who suffered psychological damages. TMI is symbolic of nuclear plant cancellations, conversions, and delays costing tens to hundreds of billions of dollars. Collectively, the events surrounding TMI and its aftermath signal the beginning of an important new era for the commercial nuclear power industry and for its regulation by government. This era is captured by the question, Who pays?

The nuclear power industry has been brought to a halt primarily by market forces that have policy and regulatory reverberations. Commercial nuclear power, once believed to be the bright and shining hope for our energy future, has been stalled. Projections concerning the expansion of nuclear power plants have been revised continuously downward. In 1960, the government estimated 1,500 plants by the year 2000. The projections dwindled by the mid-1970s, when only 400 plants were planned. In 1981, only 78 additional plants were forecast.[9] The current prognosis is that in addition to the 77 nuclear plants already on line and generating electricity, about 50 more will be added, even though some 163 plants had been planned.[10] That no new nuclear power plant has been ordered since 1978 demonstrates the lack of faith that utility managers and private-sector investors have in the industry. The remaining 113 plants under construction are being either canceled or converted to burning fossil fuels, especially coal. In addition, most of the plants are experiencing undreamed-of postponements. The cancellations, conversions, and delays signify the abandonment of faith in commercial nuclear power. Nuclear abandonment may be, and most likely is, only temporary.[11] Nevertheless, because of the magnitude of the abandonment costs, society's response, particularly that of the regulatory establishment, affects future nuclear policy. The response also has an impact upon the relationship of government and industry, energy policy and politics, and law and legal institutions.

The country's overall energy planning needs an abandonment costs-allocation policy for the costs attributable to mistaken nuclear decisions. The policy, to be administered by various legal institutions, must recognize market signals and needs and must be responsive to changing political demands. Briefly, the market requires that costs be spread as efficiently as possible, which is best accomplished through uniform centralized decision making. The political reality is that nuclear power decision making is being rapidly decentralized at federal and state levels, and nuclear policy is severely fragmented as a consequence. Unfortunately, remnants of the past promotional policy are contained in the legal system now handling an unanticipated set of problems. The legal system was influenced by a promotional policy based on political and market factors no longer operating. Nevertheless, past policy shapes current legal decisions. This divergence between past policies and current needs and the conflict between politics and markets exemplify a major transition in nuclear regulation.

To fully describe and evaluate the new emerging regulatory structure, chapter one places nuclear regulation in its historical and economic contexts. Major legislative and judicial pronouncements will be discussed. Then, the interested parties are identified through case studies in chapter two. Chapter three continues the case discussion, with special emphasis on public participation. After the dramatis personae are identified, the market and the financial situation of the electric industry and of nuclear utilities are presented in chapter four. The nuclear market is such that billions of dollars have been mistakenly invested in construction of plants that produce no electricity and threaten to bankrupt utilities. In order to protect the electric industry, state and federal regulators are making decisions that accommodate the financial needs of utilities. These accommodations are explained in chapter five. In chapter six, the current system of legal liability rules is analyzed in order to suggest a direction for regulatory reform. Chapter seven concludes with an analysis of the necessary framework for future regulatory policy and institutional redesign.

Commercial nuclear power and its regulation move much by their own momentum. Government and industry invested heavily in nuclear power because it promised so much. Their faith was such that a healthy energy future would be assured by choosing the nuclear option. In the rush to meet the future, both government and industry created a regulatory structure promoting nuclear power without either party assuming concomitant responsibilities for having made the choice. Safety, environmental, and financial risks were passed from government to consumers and taxpayers, while industry insulated itself from those liabilities by passing risks to shareholders. Such was the faith in nuclear power. Faith has led to disillusionment, and disillusionment has led to a reconsideration of the place of nuclear power in our energy plan.

The narrowest focus, or core, of the book's discussion deals with how to spread the costs associated with "bad decisions" regarding nuclear power plants. *Bad* is as descriptive as it is evaluative. Nuclear plant construction costs, for example, have been outrageously uneconomical. Costs of delay, conversion, and cancellation are all inefficient, because they are costs that could and should have been avoided or minimized with more stringent regulatory and managerial oversight. Normatively, not only are these "mistakes" bad because they are inefficient, they are also bad because the nuclear regulatory system has institutionalized a mismatch between liability and responsibility. Generally, the persons or entities responsible for the mistakes are not liable. Moving away from the center of the discussion, the significance of the abandonment-costs problem for nuclear power and energy policy is discussed more generally. Further away from the center, the narrow but significant topic of abandonment costs is used to examine the consequences of a joint government-industry policy choice on law and legal institutions.

Energy law and energy policy are both dynamic topics. Energy policy is seen as fragmented, splintered, internally inconsistent, and indeterminate. Energy law is seen as ever-changing, elephantine, chaotic, and ineffective.[12] An objective observer easily can become a policy-making nihilist given these characterizations and walk away from a discussion about energy law and policy because it is overly complex and deeply uncertain. Such disengagement does not leave a very satisfying aftertaste. Energy industries account for a minimum of 10 percent of the GNP. Energy companies are among the largest entities in the private sector. Twelve of the first twenty companies on the Fortune 500 list are energy concerns.[13] The size and number of government regulators are comparable. The DOE, with 20,000 employees, and the NRC deal exclusively with energy matters. Other agencies spending considerable time on energy include the Department of Interior, the Department of Transportation, the Interstate Commerce Commission, and the Environmental Protection Agency, to name some of the largest. In addition to these agencies, committees and subcommittees of the House and the Senate and the caseload of the courts are also heavily energy-involved. Energy is not a self-regulating field; it taxes the time and resources of each branch and level of government. Energy law and policy are international in scope, historically rooted in our culture, and geopolitically entrenched in our governmental system. Energy is a matter of major concern in both the private and public sectors and at state and national levels. Nuclear power and abandonment costs touch all of these issues.

1. Institutional Setting

REGULATORY HISTORY

The transformation of commercial nuclear power and its regulation is the product of its peculiar history. The market for nuclear power, the regulatory institutions designed to promote it, and the current abandonment-costs predicament are consequences of a government-industry joint venture that failed. That failure triggered the transition. The earlier pronuclear policy was aided and abetted by a complex legal apparatus, which can best be explained by briefly reviewing the statutory scheme and judicial cases that implemented it.

The federal government has been pivotal in the development, regulation, and promotion of nuclear technology since its inception. Although subatomic physics has been on the cutting edge of the hard sciences since the turn of the century, the translation from a theoretical and experimental science to an applied technology did not occur until the United States government galvanized a preeminent group of physicists behind the design and construction of the atomic bomb. Under General Leslie Groves, the Manhattan Project was the coordinated effort bringing theory into actuality and culminating in the successful bomb explosion at Los Alamos.

Nuclear fission, the splitting of the nucleus of an atom with a consequent release of energy, is used in all commercial nuclear power reactors today. The first nuclear reactor in the United States was operated in 1942 by a group of scientists led by Enrico Fermi and Leo Szilard. The fission reactor was created by the United States to counter the perceived threat of Germany's building and using an atomic bomb. Though German scientists had discovered nuclear fission in 1938,[1] there was no real chance that Germany would use the bomb during the war. Nuclear power's first public appearance resulted in the desolation of two Japanese cities, the end of World War II, and the dawn of the Nuclear Age. The destructive force of the atom became known before the public was aware that the power could be tamed for such peaceful purposes as the generation of electricity. The end of the war ended the military's near-exclusive control of nuclear technology.

The early shift from military to commercial use was made at the behest of physicists intrigued with the scientific and technological mysteries of nuclear power. For many scientists, work on the Manhattan Project was the highlight of their careers.[2] For others, the movement from war to peace was a way of atonement.[3]

Although military control was looked upon with suspicion, the federal government was not removed from the regulatory process. To the contrary, the federal government steered the course of this technology through its infancy. The Atomic Energy Act of 1946 formally shifted control over nuclear development from the military to the civilian government.[4] The 1946 act attempted to keep secret all information about the development of nuclear power so that other countries would not be able to build a nuclear bomb. The attempt at secrecy failed when both the Soviet Union and Great Britain detonated their own nuclear devices. In addition, the act strictly maintained the government monopoly over the control, use, and ownership of nuclear energy until the Atomic Energy Act of 1954.[5]

Two regulatory bodies were created by the 1946 act. The civilian five-member Atomic Energy Commission (AEC) was the primary administrative agency. The chief functions of the AEC were to encourage research and promote development of the technology for peaceful use. The act also created an eighteen-member Congressional Joint Committee on Atomic Energy (JCAE). This watchdog committee comprised members from each legislative chamber. After the removal of the military from the process, the only persons with nuclear sophistication were the scientists who worked on the bomb, and AEC policy reflected their interests together with those of the JCAE.[6]

Very little development of commercial nuclear power occurred during the period 1946-1954. The physicists, naturally, were more involved with scientific problem solving than with commercialization. In the late 1940s and early 1950s, the AEC together with the JCAE shifted nuclear policy to producing electricity for the public's use on a larger scale. A small "breeder" reactor first produced electricity in 1951, but the major breakthrough came when the Navy's submarine Therman Reactor I began producing electricity in 1953. Under Admiral Rickover's direction, the groundwork was laid for the prototype of the present-day reactor, designed as part of the U.S. Navy's submarine program.

While the AEC and JCAE looked to the eventual commercialization of nuclear power, the Atomic Energy Act of 1946 restricted ownership of reactors and fuels to the government. By 1953, the Eisenhower administration, under pressure from scientists, business leaders, and diplomats, revised the nation's atomic energy policy and encouraged private commercial development through passage of the Atomic Energy Act of 1954. The 1954 act ended the federal government's monopoly over nonmilitary uses of atomic energy. It allowed for private ownership of reactors under an AEC licensing procedure. The policy of the new law was stated in a House of Representatives report, which stressed:[7]

> The goal of atomic power at competitive prices will be reached more quickly if private enterprise, using public funds, is now encouraged to play a far larger role in the development of atomic power than is permitted under existing legislation. In particular, we do not believe that any developmental program carried out solely under governmental auspices, no matter how efficient it may be, can substitute for the cost-cutting and other incentives of free and competitive enterprise.

The 1954 act, the bulk of which governs today, set the tone and the goals for commercial nuclear energy. Private-sector public utilities were designated to take the lead and to run the reactors. At the time, utilities believed that nuclear-generated electricity would be "too cheap to meter," that costs would be so low that they would need not bother billing customers. The peaceful use of such destructive resources would help absolve the guilt of Hiroshima and Nagasaki while keeping the United States in the forefront of the development and control of nuclear technology. This approach consolidated public opinion behind nuclear power.

Lewis Strauss, chairman of the AEC, interpreted the policy behind the 1954 act as a mandate to rely principally on private industry to develop civilian reactor technology. The first step, the Power Reactor Demonstration Program of 1955, was an attempt to involve private industry in a competitive program whereby five separate reactor technologies would be tested. Government and private industry were to develop reactors jointly. Once the reactors were developed, government was to step out of the project, and privately owned utilities were to assume fiscal responsibility. Private industry was not receptive to bearing the financial burden and was unenthusiastic.

The results of the Power Reactor Demonstration Program in its initial years were not overwhelming. Private firms were unwilling to invest in nuclear plants without government's shouldering financial responsibility. There was great pressure on the government to finance the industry, and Strauss felt that financial-liability roadblocks should be removed by government. The critical impediment was the nuclear accident. Officials of General Electric, one of the major reactor builders, threatened withdrawal from nuclear development activity, stating that GE would not proceed "with a cloud of bankruptcy hanging over its head."[8] In reaction, Congress passed the Price-Anderson Act of 1957, limiting industry liability and assuring some compensation for the public.[9] The act removed the last obstacle to private participation. Westinghouse executive Charles Weaver recalls, "We knew at the time that all questions (about safety risks) weren't answered. That's why we fully supported the Price-Anderson liability legislation. When I testified before Congress I made it perfectly clear that we could not proceed as a private company without that kind of government backing."[10]

Congressional hearings on the Price-Anderson Act reveal that there would be no commercial nuclear power plants built by the private sector without a financial safety net provided by the government. The act limits a public utility's financial exposure in the event of a nuclear incident. The ceiling for liability was set at $560 million in the original act. This amount consists of all the private insurance the utilities could raise, which from 1957 to 1967 amounted to $60 million, with the government standing good for the remainder. Every ten years the act comes up for renewal. Now, the act requires the utilities to foot the insurance bill. Under the 1975 amendments of the act, industry is assessed $5 million per reactor. There are eighty reactors, which together with $160 million of available private insurance equals a $560 million contribution by industry, essentially eliminating government participation.[11]

The Price-Anderson Act's $560 million limitation on liability is a hard, maybe even a "tragic," policy choice.[12] As noted earlier, government estimates of damages caused by a core meltdown are $14 billion. Already, TMI's costs exceed $1 billion. A $560 million liability limitation means that once that amount is reached, additional costs incurred as a result of a nuclear incident will be absorbed by the victims. The people who live near the plant may suffer personal and property damage in excess of the ceiling amount absent either a voluntary contribution by industry or an additional commitment by government. The government subsidy enables utilities to build plants without the normal checks against putting a defective product on the market. Such insulation from liability seems unfair, and may well be, but is entirely legal.[13] The Price-Anderson Act typifies the nature of nuclear power regulation. Government and industry have encouraged each other to participate in a long-term joint venture without assuming normal market risks. Instead, most risks are imposed on the public.

The first nuclear reactor to be connected to an electric distribution system in the United States began operating in late 1957 at Shippingport, Pennsylvania. Its sixty-megawatt capacity was the largest at that time. Over the next three to four years, larger and larger plants were built as part of the nuclear power experiment. The public and the electric utilities were becoming comfortable with the nuclear idea.

Electric utilities did not start ordering reactors in any number until manufacturers guaranteed plant prices. Reactor vendors, the manufacturers,