

Images of nuclear energy: Why people feel the way they do

Emotions and ideas are more deeply rooted than realized

by
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Controversy over nuclear energy, both bombs and reactors, has been exceptionally durable and violent, exciting more emotion and public protest than any other technology. A main reason is that during the 20th century, nuclear energy gradually became a condensed symbol for many features of industrial and bureaucratic authority (especially the horrors of modern war). Propagandists found nuclear energy a useful symbol because it had become associated with potent images: not only weapons, but also uncanny scientists with mysterious rays and mutant monsters; technological utopia or universal doom; and even spiritual degradation or rebirth. These images had archaic connections stretching back to alchemical visions of transmutation. Decades before fission was discovered, the images had already become associated with radioactivity and nuclear energy; thus they relate less to technical facts than to deep-rooted concerns about authority and personal and social transformations.

Nuclear energy is the most extreme case where public fear of technology goes beyond what seems reasonable in the light of actual experience. Recent surveys of both Americans and Japanese show that for evoking feelings of dread, reactor accidents outweigh every other modern risk, including problems that each year visibly harm millions of people. The only risk that is feared as much is nuclear war. There is nothing anywhere near this for a topic that looks on the surface to be a matter of plain technology, yet that when looked at more deeply turns out to involve such a great deal more.

It is easy to see that on nuclear issues, whether weapons or reactors, the rallies and demonstrations of protestors are filled with

anxiety and anger. Even among pro-nuclear people, beneath the controlled language, there is a lot of anxiety, a lot of anger. And why not? After all, everyone has heard that nuclear weapons can blow up the world — or maybe deter those who would blow it up. With nuclear reactors, too, everyone agrees they are immensely important. They will save us from the global disasters of the Greenhouse Effect — or perhaps they will poison all our posterity.

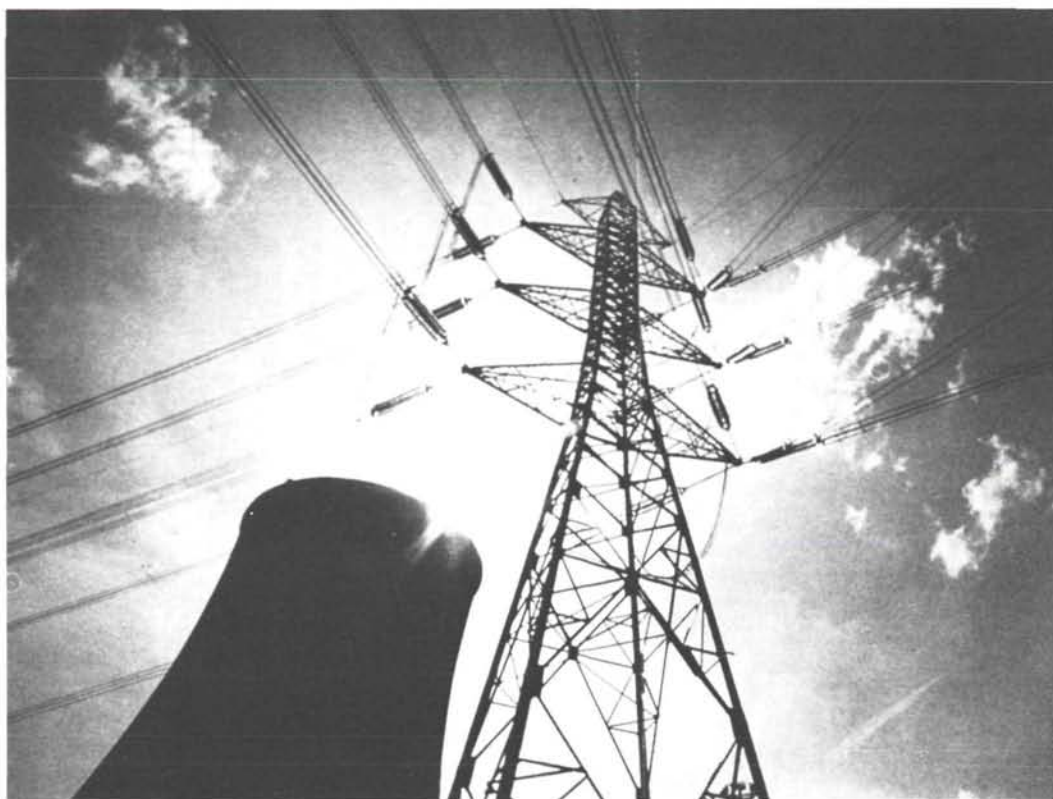
Most of us take for granted these intensely emotional ideas; we suppose the ideas flow from the nature of the bombs and reactors themselves. But I have come to feel uneasy about this over the years doing historical research on nuclear energy. The fact is, emotions came first, and the powerful devices themselves came later.

"The New Alchemists"

When I studied the nuclear debates of the mid-century, I was bothered that the most powerful images people used — for example, the cartoon picture of a planet like a round bomb on a fuse — are far from literal truth. What most disturbed me was that I had run across all this before. Studying the history of science at the turn of the century, long before uranium fission was discovered, I had seen this same imagery of exploding planets and so forth. So the images could not have come from any realistic appraisal of nuclear energy; they came from somewhere else.

It was all there already at the very beginning of the history of nuclear energy, back in 1901. What happened then was that two scientists, Ernest Rutherford and Frederick Soddy, discovered that radioactivity signals a change of atoms from one element to another. "I was overwhelmed," Soddy recalled, "with something greater than joy. . . a kind of exaltation." He blurted out, "Rutherford, this is transmutation!"

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Nuclear energy: "a great symbolic power".
(Credit: Sodel, Phototèque EdF)

"For Mike's sake, Soddy," his colleague shot back, "don't call it transmutation. They'll have our heads off as alchemists." Already at the moment the new science was born, it was flooded with emotion, both exaltation and anxiety.

Why this emotion? What did the word "transmutation" mean? It meant, of course, the thing the alchemists had been looking for. That's truly important, because for the first generation of nuclear research, reminders of alchemy were everywhere. The press called nuclear scientists "The New Alchemists" — eventually even Rutherford used these words. An old tradition was at work.

Scholars have studied the alchemical tradition, and they have uncovered some surprising things about what these images have traditionally signified. Transmutation of base metal into gold was only an aid, a symbol, for deeper mysteries. Alchemy was a quest for ultimate knowledge. Transmutation concealed a great and perilous secret: the divine secret of life itself. The alchemists believed that in their crucibles, substances literally died and were reborn; things descended into corruption and putrefaction before they could be transformed into pure gold. And this process could be an aid, a symbol for the agonizing descent into spiritual darkness that is necessary, some believe, for any great psychological transformation. So transmutation

traditionally called to mind the great theme of spiritual rebirth.

It doesn't stop there. In many cultures around the world, the descent into corruption symbolizes not only personal, but social trouble — a coming time of chaos, when humanity will be victimized by plagues and wars, and in the extreme the entire universe will be destroyed. The secret of transmutation was the secret of Armageddon. Beyond this could come the millennium, all of society purified by fire, transmuted into perfection, into what was called — by no coincidence — the Golden Age. In short, the moment the idea of transmutation was brought up — and this was central in the early years of nuclear physics — personal and social transformation, hopes for the greatest conceivable things, and shattering dangers ranging right up to the end of the world were brought up, too.

All this may sound unfamiliar. And certainly irrational. Is it far-fetched to suppose that these ancient traditions had anything to do with early feelings about nuclear energy? No. In fact within a year of the discovery of transmutation, Soddy announced that the energy locked within atoms was so great that the earth must be seen as a storehouse full of explosives; a man who could unleash this energy, he said, "could destroy the earth if he chose." Soon everyone had heard the idea that, as Rutherford put it, "some fool in a

laboratory might blow up the universe un-awares.”

There was nothing new about the idea of the end of the world, of course. What was relatively new was the idea that the end of the world could be brought on not by some act of God, nor by a cosmic catastrophe beyond any human control, but by one group, even a single person: the sorcerer's apprentice would no longer endanger only himself, but everybody. Journalists and science fiction authors warned that a careless nuclear experimenter could destroy the world, even the entire universe.

It wasn't new for people to exclaim that science was going too far. We've always had worries about men who poke unwisely into the secrets of nature: alchemists, sorcerers, Faust, Frankenstein. But in modern times the old stereotype was transformed into a new and more specific figure: the mad scientist. He is a brilliant man, at first almost a fatherly authority figure; but then something goes wrong. One example was a 1936 American movie, "The Invisible Ray", in which Boris Karloff played a scientist — tampering, as his mother tells him, "with Secrets We Are Not Meant to Probe!" He built a radium ray projector, capable of blasting people or curing their illnesses — a sort of magic wand. Karloff meant to use it only for good, but then he gets a dose of his own weird radiation, and begins to glow in the dark. He goes murderously insane, and creeps about killing people with a touch of his hand.

So it's not just accidents we have to fear, but deliberate use of the secret dangerous powers. There's some deep psychology here — but I won't get into that. It's enough to say that it's "natural" for people, when they hear about mighty secrets and new forces, to think of weapons. Even before World War I, physicists were speculating about nuclear weapons. The phrase "atomic bomb" was first used by H.G. Wells in a 1913 novel. He described a cataclysmic world war in which the bombs and their radioactivity rendered cities uninhabitable for generations. But people realized that now there had to be a world government, run in fact by scientists and science-minded people. Soon atom-powered cars were flitting about, atom-powered cities rose in deserts and arctic wastes, there was universal peace and even free love.

The old alchemists would not have been surprised. The descent into corruption leads to salvation, Armageddon leads to the millenium. The secret of transmutation conceals terrors, yes, but also the path to the Golden Age. That's the standard way the old myths went. And the early nuclear physicists said exactly the same.

Soddy said that nuclear energy would fulfill the old alchemists' dreams of a Golden Age. He meant this literally; he had read up on the history of alchemy and deliberately called the old myths into modern times. In a book that was widely read everywhere from the United States to the USSR, he wrote: "A race which could transmute matter would have little need to earn its bread by the sweat of its brow. . . such a race could transform a desert continent, thaw the frozen poles, and make the whole world one smiling Garden of Eden."

If this sounds like Wells, it's because Wells had read Soddy. This kind of millennial talk became familiar to everyone. The hopes for nuclear energy were just as grandiose as the fears.

Atomic rays and nuclear forces

But the main public interest in nuclear energy, however, had little to do with either bombs or industrial energy. Soddy put it in a nutshell. "The philosopher's stone," he said, "was accredited the power not only of transmuting the metals, but of acting as the ELIXIR OF LIFE." The elixir of life, bringing the transmutation of the body, perfect health, perhaps even bodily immortality. That shouldn't be surprising, since the secret of transmutation, as I said, was the secret of life-force, rebirth.

Radium was in fact useful in treating certain types of cancer. But the press solemnly reported that radium might entirely conquer all cancer. It might cure tuberculosis, make the blind see. It might create life, said the newspapers, and raise the dead. By 1930 there were about 100 patent medicines on the market whose active ingredient was radium — pastes, tonics, powders, pills, and suppositories, that promised to cure everything from warts to baldness; indeed they could restore your youth, and revive flagging sexual powers. Mineral springs were proud of the radioactive content of their waters — something most of them don't advertise nowadays.

The public was aware that nuclear energy had a harmful side. Newspapers correctly reported that rays could cause sterility, genetic mutations, and cancer. Yet so could many other things, such as common chemicals. In the hands of competent doctors, people said, radiation would save far more lives than it would take—which was in fact the case. We should not let people forget that radiation has been and still is responsible for saving many millions of lives, many times what it has cost us even through nuclear bombs.

It's only when you look behind the optimism, away from journalism and into the deeper levels

of culture revealed by science fiction stories and B-movies, that you find a special anxiety about radioactivity. For radioactivity — as the name says — is about rays, and rays are another of those symbols with ancient meanings. In mythology, rays carry magic power — even the mystic life-force itself.

And death, of course: these symbols are all two-sided. There were thunderbolts, the evil eye, and many other forms of baleful rays. Even before nuclear energy was discovered, scientists studying X-rays got letters from people who thought it wrong to probe the secrets of “death rays.” Such talk redoubled after the discovery of radioactivity. By the 1930s there were literally dozens of death-ray movies like Boris Karloff with his ray projector: radiation had become a secret power in the hands of the authorities, for good or evil.

Still, through the 1930s the anxieties remained a matter off to the side, restricted to the adolescent world of science fiction. The present reality of atomic energy was medical blessings, and the future possibilities were still more enticing.

After atomic bombs were actually built, it's not surprising that the frightening side of the picture began to grow stronger. People could only understand the news in terms of what they already had in their heads. As soon as people heard the words “atomic bomb,” if you look at what was said on radio and so forth even before there was any accurate report about what had actually happened at Hiroshima, everywhere you find talk of doomsday and hellfire, cosmic secrets, and Frankenstein.

By that time physicists were coming to understand the fact that nuclear forces are neither more nor less cosmic than more familiar electrical forces — that a release of nuclear energy is magical only in the same sense that the burning of a match is. But most people took it as a fact that there was something supremely mysterious, almost divine, in any manifestation of atomic energy.

Fears of nuclear energy

Scientists didn't point out that nuclear energy is nothing mystical; rather they took advantage of their association with the magical power. Hundreds of these atomic scientists gave speeches and wrote articles. And they got a respectful hearing — after all, they were the new magicians. Far from denying that, scientists deliberately made the story even more frightening.

The scientists made sure everybody grew familiar with images of Hiroshima. For example,

the lobbying group at Los Alamos sent lumps of fused sand from the first test site to the mayors of 42 cities, just to remind them what could happen to their cities. The scientists wanted to scare people into taking action to prevent another war. Of course, other cities had been treated the same during World War II — the fire bombing of Tokyo had wiped out 17 square miles and caused a million casualties, far more than at Hiroshima and Nagasaki combined. But that wasn't the point; the point was that science and technology could now do almost anything. Thus atomic bombs came to stand for something more than just themselves; they became a condensed representation for all the horrors of modern technological warfare.

The people who spread the fear of atomic bombs believed that fear could be a goad to healthy action—war could be avoided; they would set people on the path to the Golden Age. Scientists and journalists, perhaps even political leaders, remembered the science-fiction utopias of their childhood, and said that nuclear power plants could make them come true. The world's deserts would become “blooming gardens,” jungles would become “lands flowing with milk and honey,” the earth would become “a Promised Land”. If only scientists were given enough money to work with, they would make an Atomic Golden Age. It was the old double-faced image of danger and redemption.

The most common image was a “crossroads”. One road led to atomic destruction, the other to an Atomic Golden Age. The possible futures were extreme. Nobody realized we would in fact take neither road, but strike out cross country between them.

To be blunt: the public views of nuclear energy after Hiroshima were just about the same as the views they held before Hiroshima — and right back to the turn of the century. The image seemed dominated by optimism, but it had a powerful undercurrent of anxiety.

By the 1950s if not much earlier, for most of the world, nuclear energy had come to stand for more important things. Nuclear energy wasn't just reactors that could produce electricity, and isotopes that could fight cancer; it stood for magical devices that could bring a utopian new civilization. And nuclear energy wasn't just weapons that could destroy cities; it stood for murderously crazy inventiveness and universal death itself.

The possible destruction of civilization around the world was something new in human history. It was hard for people to consider it objectively, and there is much evidence that most people preferred to just ignore the awful

thoughts. But in the late 1950s there was one way the hidden anxiety did lead to public action. Radioactivity was an aspect of nuclear weapons that people felt they just had to do something about — for it was already drifting into their own living rooms. I'm talking about fallout.

From fallout to protests

Fallout from bomb tests became a big-time issue in the mid-1950s, after radioactive dust from a hydrogen bomb test killed a Japanese fisherman. Public debate began, starting in Japan; within the next few years protests became worldwide and vehement. The biggest protests outside Japan were in Britain, but the same ideas spread everywhere, even in the Soviet bloc. It got to the point where some mothers worried about giving children fresh milk, since it could be contaminated by strontium-90.

Something new was happening in the imagery now. Radiation no longer seemed benign (even though it continued to help millions of cancer victims). It wasn't even seen as a mixture of good and bad magic. Now it began to seem only evil, a sort of ultimate pollution. Total distrust had now fallen, and for the first time in history, an aspect of our science and knowledge — radiation and nuclear energy — now seemed to many people a wholly evil thing.

If you wanted to see what radiation from bomb tests can do, American and Japanese filmmakers were glad to show you. Ever since the 1950s many popular films have featured monsters created by radioactivity — gigantic ants, crabs, spiders, squids, even grasshoppers. It still goes on today, with cartoons about giant cockroaches or whatever. Of course radiation won't really make things bigger! What we see here is the ancient myths about rays as bearers of magic life-force. In this case, a force that translates into monsters: here is pollution writ large.

Another obvious symbolism was in the monsters released by bomb tests. When Godzilla stomped Tokyo flat he was acting like a surrogate atomic bomb. These are just updated versions of the magician's demons and mad scientist's creatures: the monsters that have always served as warnings — as the movies said explicitly — against men who went too far, men who tried to grasp more than is proper. The implicit risk was authority, overweening, grasping for power. The urge to master, to conquer, to destroy — this is what is embodied in the symbol of the monster; this is what is in reality embodied in nuclear weapons; and this destructive power-drive is what people hated, now more than ever, in authorities.

The protestors made it clear that their fight was with military and political authority. These were dedicated, honest people, and they were right to protest against the spread of radioactive dust from bomb tests. But most people, including the protest leaders themselves, agreed that fallout was far from a leading cause of death in the world. Fallout was really a stalking-horse for the problem of nuclear war itself.

This was sensible enough; the protesters made radioactivity a dirty word because they thought that a moratorium on bomb tests could be a first step towards slowing the nuclear arms race. Unfortunately, the tactic failed. It turned out to be possible to continue to conduct bomb tests underground. And when atmospheric fallout ceased, so did the protests — out of sight was out of mind. Of course the fears remained: so long as nuclear weapons might kill us all in the next half hour, the word "nuclear" would carry a burden of deep, scarcely admitted anxieties.

Opposing the authorities

There was another aspect of nuclear energy that could not be shoved under the rug: civilian nuclear energy. This began in the crusade to bring the technological utopia, the transformation of society, the Atomic Golden Age. There were more rational arguments for promoting nuclear reactors, of course — and rational arguments for opposing them, too. Yet images made a difference.

The image of radioactivity, once it was linked with bombs and fallout, came to seem supremely monstrous and polluting. By around 1970 this had transferred over to civilian uses of radioactivity. Of all kinds of industrial waste, it was the radioactive wastes that stirred the deepest anxieties.

So radiation had come to seem the most cosmic pollution — but that wasn't the only force behind the outcry against reactors. Even more important images were at stake. Nuclear energy had become a supreme symbol of science and modern technology in general. Scientists had worked to make it so. But with atomic bombs hanging over everyone's heads, modern technology no longer sounded so wonderful. The leading opponents were perfectly clear on this: they opposed nuclear energy as a way of opposing all complex centralized power — of fighting military, industrial, bureaucratic authority in general.

Nothing represented this authority so perfectly as the old US Atomic Energy Commission (AEC), and its counterparts in other countries —

which now came to stand for all that people distrusted in government. That distrust had to do first with nuclear weapons, but the old AEC and some other agencies made things worse by earning a reputation for arrogance, indifference to the public, and secrecy. The commissions seemed to be saying, "We're the experts, the masters of cosmic force, we cannot share these great secrets with the public."

That carried over into the reactor controversy, where nuclear leaders often took a sort of "father-knows-best" attitude. This was not the sort of father, the sort of authority, people wanted. The critics in return began to call the nuclear industry arrogant, secretive, heartless, and dangerous. The image of the overweening expert and his uncanny monster — those were now attached to the whole system of authority. Nuclear energy wasn't just a symbol of the worst features of technology, but of all the problems of modern bureaucracy and industrial power.

How did this come about? If you study the process of symbol-making in detail, you'll find, and it seems natural, that the main role was played by people whose special expertise was in just such work — people whose careers were based not on industrial production, but on communications. I mean, for example, journalists, public interest group leaders, professors, movie stars, and cartoonists. Some sociologists call such people a "new class". Notice that these are people whose position, whose power in society, would be more enhanced, the more they could discredit the traditional, industrially based structures of authority. In a totally level democratic society, policy would be set most of all by expert communicators. And surveys have shown that it is indeed people who work in these professions, not in the traditional industrial and governmental hierarchies, who most oppose nuclear reactors.

The purest case can be seen in Eastern Europe, where the new class is now coming to power. Poll results from the USSR show tremendous public opposition to nuclear reactors. They're dead in the water. We can't blame this on Western-type opponents: there was 40 years of pure and undisputed pro-nuclear propaganda. Some people say, "Rather than have a reactor, we'll live in the forest with candles—like we did during the War".

By now nuclear energy had come to carry quite a burden. There were images associated with weird radiation and mad scientists, and alongside that, all the destruction of modern war, and everything people disliked about technology, impersonal and manipulative authorities. Behind that always stood the magical and cosmic forces of life and death.

These negative associations had become inseparable from the most seemingly rational discussion. For example, in 1989 the atomic energy authorities in Taiwan launched an elaborate and expensive "risk communication" programme to promote public support for building a new reactor. Surveys showed that if the programme made any difference, it was to increase public worries about reactors. Simply to be reminded of nuclear energy's power, even in the most reassuring context, was to become more anxious.

A special kind of power

To sum up, what has given nuclear energy its special power? Its remarkable ability to serve as a focus for a tremendous variety of things, ranging from ancient archetypal images to modern political concerns? There are four levels of explanation. First are the technical realities — after all, reactors really are a fantastically condensed source of power, radiation really can cause horrible mutations, and so forth. From these realities particular facts have been selected out and stressed. That is because of the second level: nuclear energy has acquired social and political meaning, including especially ideas involving modern technology and the authorities that control it. Reactors became a condensed symbol for all modern industrial society. Why were they singled out for this role? I think largely because of a third level: old myths about divine secrets, mad scientists, dreadful pollution, and cosmic apocalypse. All these gathered around nuclear energy from its very birth, far more than they have connected up with any other technological development. And the fourth level, providing a deep anxiety underlying everything: the threat of nuclear war, never for a moment really forgotten.

It is hard to handle such problems rationally. When we take nuclear energy as a surrogate for all the problems of warfare and industry, of modern society and technology at large, we are not picking up something simple. The instant you grasp it you drag up a tangled web of ancient images. Whenever we form a picture in our head of a nuclear weapon or a reactor, we should imagine a sign posted across it: "CAUTION—GREAT SYMBOLIC POWER!" Nuclear energy has become a full symbolic representation for the entire bundle of themes involving personal and social destruction and rebirth — transmutation.

There is an opportunity here. If we can deal with these strong feelings, then we will have gone a long way toward handling feelings about science and technology and modern social authority in general. Dealing with these feelings does not mean enticing people with gorgeous promises or terrifying them with apocalyptic

visions. That propaganda tends to defeat its own purposes, keeping alive everything irrational.

No, the way to address people's hopes and fears is to respect them, to take on the genuine problems of reactors, and of weapons. This means working toward true fail-safe setups in industry, and foreign policy too. We must work a step at a time, modestly making our systems for power production and military security better in all their complex effects.

It will be fruitless to do that through some sort of totally rational authority, some scientist or bureaucrat who decides what is best for everyone. The only solution will come when the

people who expect to benefit from a technology are led to routinely respect the rights of the people who might be hurt by it. A familiar example is charging people who use radioactive materials and must dispose of the waste, then giving the money to people who live near the waste repository — money they can use, if they like, to hire their own experts and monitors. In the long run the way to a solution is to give people a share of power. Until ordinary people feel that they have a genuine say in decisions about which technology is deployed for whose benefit, we cannot expect them to respond to the technical realities alone.



Public attitudes about the fuels used to generate electricity are increasingly influenced by environmental considerations. (Credit: NorEnergi)