

What is the cost of federal liability protection for nuclear power?

Determining the Price of Price-Anderson

BY ANTHONY HEYES

University of London

THE NUCLEAR INDUSTRY HAS ALWAYS been a political “hot potato.” Though not always for the same reasons, it has generated distinctly difficult questions for serious policy analysts. We like its promise of cheap, clean electricity, but we do not really know its downsides, let alone how to value and weight them in any sensible cost-benefit calculus.

The U.S. government has contributed to that uncertainty by removing a number of costly responsibilities from the nuclear power industry. For example, the government has taken on the responsibility for dealing with high-level radioactive waste. Probably the single biggest “public image” shadow hanging over the technology, though, is that associated with accident risk — the threat, real or imagined, that it might visit upon the United States a cataclysmic accident of dramatic scale. A Chernobyl-sized event could decimate the population of a city, leaving sterile large swathes of real estate, industrial and agricultural land, and capital. No technology is perfect. It could happen.

In the United States — as in the United Kingdom, Canada, France, and a variety of other countries — accident risk has primarily been managed through regulation. In the states, the Price-Anderson Act has, to a substantial extent, removed liability for offsite accident damage from individual operators.

Creature of government As a society, we cannot turn our back on any activity just because it imposes risks. All actions and inactions entail risk; that is inherent to the world we inhabit. What we could and should do is evaluate and take account of those risks in an appropriate way when making decisions, and create incentives and institutions for the management of those risks.

In general, private investors can — if exposed to the full consequences of their actions — be relied upon to pick winners from

losers. But those decisions are not allowed in the nuclear power industry. The nuclear sector has been fortunate to attract subsidy — much of it implicit (like Price-Anderson) and amounting to tens, perhaps hundreds, of billions of dollars — through the decades. Certainly, if such support is to continue, people should expect a more cogent case to be made for its costs.

WHAT IS PRICE-ANDERSON?

The Price-Anderson Act of 1957 provides indemnity protection to the industry in the case of nuclear accident and establishes a no-fault insurance regime for compensation of public damages. There are two levels of protection. Each reactor operator must carry primary liability insurance to the value of \$200 million. (That sum was last raised in the context of some 1988 amendments to the act.) Any damage done above the \$200 million mark is assessed equally against all operators up to a current limit of about \$88 million per reactor. With 103 reactors covered, that generates a total ceiling on potential compensation from the nuclear power industry of about \$9.5 billion.

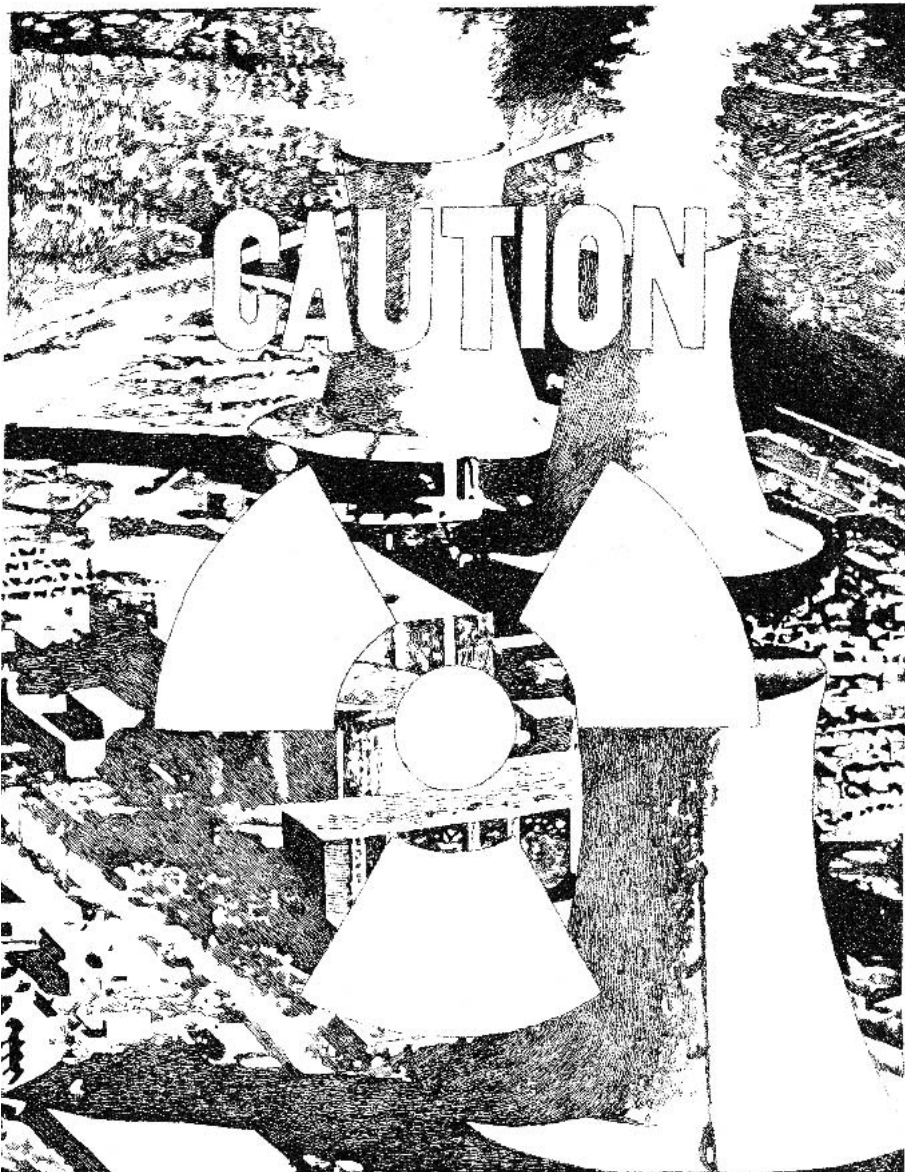
Now, \$9.5 billion sounds like a lot of loot, and it is. But the credible estimates of the offsite damages imposed by a serious nuclear event in the United States range into the hundreds of billions of dollars. In the context of a worst-case nuclear accident, \$9.5 billion would be close to peanuts. The U.S. nuclear industry, then, is all but protected from being held responsible for any big nuclear accident that might happen.

Lawmakers initially embraced Price-Anderson as a short-term protection for an “infant industry” — to provide some encouragement to see the fledgling activity up and running. Its anticipated life was 10 years, yet some 45 years later it lives on — both the House and Senate voted in 2002 to renew the act — and is regarded by many as close to a necessary condition for the continued health of the nuclear power sector in the United States.

THE ECONOMICS OF EXTERNALITY

Markets tend to work well when individual actors are responsi-

Anthony Heyes is a professor of economics at Royal Holloway College, University of London. He can be contacted by e-mail at a.hey@rhul.ac.uk.



MORGAN BALLARD

ble for their own actions or inactions. One of the most basic tenets of neoclassical economics is that individuals are self-interested. An externality arises when an actor's actions or omissions affect another in a way that is not "managed" by a market. Externalities are one of the basic forms of market failure, and there is a general presumption that getting rid of them — "internalizing the externalities" — is a good thing to do. Making the actor fully responsible for its actions induces the actor to take appropriate amounts of care in deciding whether to pursue a particular activity and at what scale, and to ensure that the optimal effort is put into ensuring the safety and cleanliness of its operations. Ronald Coase won the Nobel prize for economics in 1991 for that insight, and it underpins the "polluter pays principle" that is so fundamental to motivating policy decisions in many contexts and jurisdictions.

That basic tenet is also exploited in all sorts of market and organizational settings. Contracts and institutions are designed to correlate the interests of the agent with those of the principal, to encourage self-interested individuals to act in desired ways. Workers — whose diligence cannot be observed by their managers — are given contracts under which their reward depends on how they perform. Insurers induce drivers to oper-

ate their cars more safely by holding them responsible for the deductible when they receive a repair bill.

Second-best Armed with the textbook view of externalities, it appears easy to determine the winning side in the ongoing debate over whether or not to cap the liability of nuclear operators — that is, whether to systematically keep external a cost that could be internalized. We should not do it.

Of course, the real world is not like that. Neither is textbook economics, which also offers us the "Theory of the Second-Best." The textbook world does, however, provide an onlooker with a default position: If a proposed policy is to deliberately maintain externalities, then the onus is on whoever is proposing the policy to put together a compelling case for its adoption. The presumption must be that such a policy is ill-judged. Such a presumption is right and proper in a market-based economy in which the instinct of policymakers should be to non-intervention.

The murky world of "second-best" economics leads us to be suspicious of no-brain solutions, though. Coase's insight is proved in a "first-best" world — in a world with no other market failures — wherein eliminating one particular market failure is efficient. The U.S. economy in the twenty-first century is, however, distinctly second-best. The econo-

my is littered with other market failures — imperfect credit markets, regulation of all sorts, inflexible labor markets, energy markets in which players exert monopoly and monopsony power, numerous government subsidies in one guise or another, etc. Loosely speaking, the Theory of the Second-Best says that getting rid of one market failure in a world in which some other failure exists may not be a good idea. The idea is simple: The incentive effects of market failures may offset one another. Two wrongs may indeed make something close to right. One needs to proceed with care, however, because the failures may both push in the same direction, and the case for elimination may be strengthened.

Nuclear power and the second-best world Any case in favor of Price-Anderson or similar legislation, if it is to be coherent to an economist, has to be couched in the form of a second-best calculation: that distortion — in this case, the capping of liability — is justified because it serves to mitigate or counteract the impact of some other distortion. Such a case is difficult to formulate for nuclear power.

Historically, the case was that nuclear power was an "infant

industry” that needed protection in its early stages of development or it would never grow and flourish. That was, indeed, a stated aim of the original enactment, and a perfectly coherent line of argument back in the 1950s and 1960s. Sitting here in the year 2002, however, it is hard to claim that nuclear power is still fledgling. Indeed, there are many industries using less mature technologies, and they do not typically expect to be freed from the environmental risks that they impose. An alternative justification is needed if the Price-Anderson subsidy is to retain logic.

Certainly the oft-heard line that the protection is needed for the industry’s survival is not particularly useful. Vice President Dick Cheney’s assertion that, without renewal of Price-Anderson, “nobody’s going to invest in nuclear power plants” may be a statement of fact, but is not a case for renewal. We cannot subsidize an activity purely and simply because, in the absence of subsidy, no one would engage in it. The case needs to be made that the activity is worth pursuing, and a reason must be given for why the market either cannot see that case or cannot extract enough of that value to make participation worthwhile.

THE PRICE-ANDERSON SUBSIDY

Here is a fact: Capping the liability of nuclear operators (or others engaged in the nuclear sector) for accident damages confers a subsidy upon those operators. Capping liability — if there is any state of the world in which that cap can be binding, which is not disputed in the Price-Anderson context — helps operators financially. The act protects the industry from a substantial fraction of the costs associated with accident risk. In the absence of such a cap, there would be additional costs that the industry would have to pick up, either directly or through payment of additional insurance premiums.

No real subsidy? There has, over the years, been a surprising amount of wrangling over that apparently innocuous assertion. In 1992, for example, Benjamin Zycher claimed that Price-Anderson conferred no such subsidy. (See “Accounting for Costs and Cost Biases,” *Letters*, Vol. 15, No. 2; Spring 1992.) In making that argument, he exploited a subtle distinction between an expected subsidy with actual value and an actual subsidy. There would only be an actual subsidy if an accident requiring payouts beyond the Price-Anderson limit actually happened, Zycher claimed, but no such payout has ever occurred.

That is fuzzy thinking, in my opinion. The nuclear power industry receives a subsidy each and every quarter in which it does not have to buy insurance to cover the full risk associated with its activity. If the government were to offer to pick up my bill for car insurance, that would help me financially (by definition, a subsidy) whether or not I crash my car.

Last January, Marvin Fertel, senior vice president of business operations for the Nuclear Energy Institute, told the Senate Subcommittee on Transportation, Infrastructure, and Nuclear Safety, “The cost of Price-Anderson coverage is included in the cost of electricity; it is not a federal subsidy.” Fertel’s words are true enough; the cost for insurance against the liability that Price-Anderson places on the nuclear power industry is, presumably, passed on in part to consumers. But that is not the point — the point is that a part (perhaps a very substantial part)

of accident risk is not covered under the Price-Anderson coverage. It is that omission that implies subsidy.

A 1992 analysis of energy subsidies by the U.S. Department of Energy puts it clearly and correctly:

These liability limits provide a subsidy to the nuclear industry to the degree that private insurance premiums paid by operators of individual plants are reduced. In a 1983 study, the [Nuclear Regulatory Commission] concluded that the liability limits were sufficiently significant to constitute a subsidy. However, a quantification of the amount of the subsidy was not attempted.

The Price-Anderson arrangements do, then, subsidize the production of nuclear electricity. We can (and will) argue over how big that subsidy might be, what the incentive implications of the subsidy are, and whether its continuance is warranted. But we cannot argue that it does not exist. Of course, the nuclear industry’s lobbyists know that and, one can only conclude, think that the subsidy is a big one. Why else would they spend so much time, money, and political capital on getting the thing renewed?

HOW BIG IS THE SUBSIDY?

Subsidizing an activity can have a variety of incentive implications. It can encourage an excess of the activity — investment in nuclear power when such investment would not be profitable absent subsidy, extension of the economic lives of existing plants beyond what they should be, etc. Depending upon how that subsidy is conferred, Price-Anderson might also affect incentives for how well operations are managed.

The size of those incentive effects will largely depend on the size of the subsidy. Before thinking too hard about possible implications, it is sensible to take a preliminary view on how big that subsidy is. If the value of the subsidy is trivial, then its incentive impacts will likely be trivial as well.

Given the scale of the debate that has surrounded Price-Anderson issues for so many years — and the claims from people as senior as Dick Cheney regarding the significance of Price-Anderson to the future of the whole industry — one might think that the size of the subsidy is understood. One might think that policy advisors, academics, environmental groups, industry bodies, and other stakeholders would have generated all sorts of different methodologies to estimate its size and impacts. And one might think that they would have come up with all sorts of varying estimates, the respective merits of which would have been robustly debated in academic, industry, and policy circles.

Academic attempts One might think those things, but one would be mistaken. In fact, to the best of this author’s knowledge, there have been only two formal attempts to quantify the size of the subsidy conferred by the Price-Anderson Act: Jeffrey Dubin and Geoffrey Rothwell’s 1990 article “Subsidy to Nuclear Power through the Price-Anderson Act,” and Anthony Heyes and Catherine Liston-Heyes’ 1998 article “The Price-Anderson Subsidy Reconsidered.” Both use the same methodology — one that we will soon find is open to criticism. What is more, the latter article is merely a correction of the former

and is only three pages long. So really, there is only one set of estimates by academics.

Dubin and Rothwell developed a very neat approach to trying to derive estimates for the amount that nuclear operators would have to pay for offsite insurance in the absence of the Price-Anderson limits. The technique involves extrapolation from the premiums that operators now pay for the portion of liability that they still bear under Price-Anderson. Their estimates of the size of the subsidy ranged up to \$33 million (2001 dollars) per reactor per year of operation.

Heyes and Liston-Heyes noted an error in the way in which Dubin and Rothwell interpreted current insurance arrangements, and reapplied their methodology corrected for the reinterpretation. Heyes and Liston-Heyes' correction reduced the estimates of the subsidy substantially — by a factor of about 10, in fact.

The two works have been cited in places as disparate as a fact sheet issued by the Safe Energy Communication Council, a Renewable Energy Policy Project research report, and the website for the employees of Duke Energy. The two estimates are (to the best of this author's knowledge) the only two estimates offered in congressional testimony during the recent Price-Anderson renewal debate.

Secret knowledge? I will let you in on a little secret: The two estimates and the methods used to generate them are, at best, unreliable and, at worst, deeply flawed. I can say that because I am one of the authors. I know squat about nuclear power. Do not get me wrong, the two papers are competent pieces of academic research and they deserved to be published in the reputable peer-reviewed academic journals in which they appeared. But the approach that they utilized is very much an experimental one, and one whose results can be highly sensitive to changes in underlying assumptions.

Based on extrapolation, such approaches look to uncover information “hidden” in things that can be observed. Revealed approaches are popular in economics in contexts where information is asymmetric. So we might infer something about an individual's preferences (which he knows, but we do not) between apples and oranges by observing the choices he makes when in the fruit section of his local supermarket. Embedded deep in the Dubin and Rothwell methodology — and, by implication, that of Heyes and Liston-Heyes — is an assumption that premiums for current risks are set at their “correct” levels. Somewhere inside the insurance company is an individual who knows what the real probability-consequence profile looks like, and has set an actuarially appropriate premium on the basis of that knowledge. All we have to do is determine from the premiums what the private knowledge must be. Of course, no such person exists.

However neat and elegant the methodological superstructure, that foundation will always be weak. It is not a context in which the prevailing problem is asymmetric information; rather it is one of symmetric ignorance. For use in informing policy, results from studies such as these should be heavily salted.

The results of Heyes and Liston-Heyes suggest an implicit subsidy one order of magnitude smaller than Dubin and Rothwell. Do Heyes and Liston-Heyes think that the true number might actually be 10 times bigger? Sure they do. Do they think

that their number is closer to the truth than Dubin and Rothwell's number? No, they do not. One of the authors of the other study — Geoffrey Rothwell from Stanford, a notable economist who has done really excellent work in understanding the economics of nuclear power — has also noted that “it is time to reexamine the Dubin and Rothwell approach,” and that results “depend crucially on assumptions.”

Know, Canada? Interestingly, a similar debate arose in a high profile legal case in Canada in the mid-1990s. A group of plaintiffs (including the City of Toronto) challenged the constitutional basis for a similar liability cap that the Canadian government gave to that nation's nuclear plant operators in the 1970 Nuclear Liability Act, and the court was forced to consider the value of the subsidy conferred. Could the Canadian deliberation offer us insight into the value of the Price-Anderson subsidy? Well, no. Expert witnesses in the case referred back to the Dubin and Rothwell study.

Q. (McClenaghan, examining): Professor Winter, you and Professor Trebilcock argued that the Nuclear Liability Act liability limit provides the nuclear power industry with a subsidy. Do you have any estimate of the magnitude of that subsidy?

A. (Professor Ralph Winter, University of Toronto): We have not undertaken the estimate for Canada. We do refer in our report to an estimate that's been done in the U.S. context: the Price-Anderson Act. This is a study by Professor Dubin and Rothwell of the subsidy implicit in the Price-Anderson Act in the U.S. They arrive at an implicit subsidy of \$22 million per reactor-year. That translates into a subsidy of roughly half the capital costs of nuclear reactors.

So, we do not really have a clue how big or small the subsidy might be. Yet, on both sides of the fence, people are willing to take very definitive views that its impacts are likely to be very big or very small. My own view is that it could be anything between 0.5¢ and 30¢ per kilowatt-hour of electricity produced. But that does not narrow things down very much. The size of the subsidy makes a big difference to all of the impacts that might concern us.

INCENTIVE IMPLICATIONS

The most obvious implication of any subsidy is that it makes an activity more attractive. Subsidizing nuclear power grants a competitive advantage to that form of generation. Heyes and Liston-Heyes' analysis suggests the subsidy equals perhaps 2¢ to 3¢ per kilowatt-hour. Of course, other energy sources also get subsidies (explicit and implicit), so one has to compare one set of subsidies to another. There is no space here to range into useful comparatives between fuels.

More worrisome, perhaps, is the possibility that the protections will discourage safe operation of plants that are in place. Again, there is little or no hard empirical results in that area. Despite that, people feel free to take positions on the question.

There seems little logical doubt that a rational, profit-maximizing plant operator will put more effort into preventing a catastrophic accident if the plant is subject to greater liability expo-

sure. The Price-Anderson limitations — like similar limitations in Canada and other countries — reduce that loss, and so reduce the incentive to exert effort. That is what economists refer to as “moral hazard.” Corporate moral hazard is a direct implication of the assumption of profit-maximizing firms, and there is compelling evidence of the reality of its effects in all sorts of contexts.

There are two points worth making here. First, the financial cost imposed on any operator by an event at one of its plants is likely to be enormous even with Price-Anderson once onsite damage, reputation costs, etc., are accounted for. But the key point is that the penalty will come nowhere close to the \$100 billion of damage that a worst-case accident could impose. Of that, there can be no doubt.

Second, incentives are not everything. An operator might have the incentive to cut corners, but not have the opportunity to do so because of the presence of regulators. In that sense, command-and-control style regulation can be seen as a potential alternative to a liability-based regime. Certainly, with Price-Anderson shielding operators almost entirely from liability for major accidents, the onus is shifted back onto the federal Nuclear Regulatory Commission to ensure that the temptation to cut corners does not become a reality. How attractive that approach is depends upon how much faith you have in regulatory agencies. I tend to be a skeptic.

But those things are, again, difficult or impossible to quantify. Again, we can learn from two short extracts from the Canadian court case:

Q. (McCleneghan, examining) Now, my question to you, Professor Winter, is whether this statement supports your assumptions about the incentives that Ontario Hydro responds to?

A. (Professor Ralph Winter) Yes. This memo supports our assumptions in two ways. First of all it supports the assumption that Ontario Hydro has discretion in safety decisions even under regulation. Secondly, it indicates that Ontario Hydro is conscious of cost involved in increasing safety, and looks for alternatives to the expenditure on additional safety if those alternatives are available.

Further,

Q. (Finkelstein, cross-examining) Professor, if somebody gives you a probability of an accident, then in coming to that probability don't you think they would consider all the factors that would bear on that probability of accident?

A. (Professor Ralph Winter). I would assume they're basing the probability on the current standards of care and regulation.

Q. Right. And that would include regulation.

A. That's correct.

Q. Now, you have no idea what those probabilities would be if there was no Nuclear Liability Act, do you?

A. I can conclude that those probabilities would be higher. Can I conclude that they would be 13 percent higher, 35 percent higher? No, I can't. I cannot make a precise judgment. I can conclude that the risk of a nuclear accident is higher when nuclear operators are liable for only a few cents in the dollar of potential accident costs. I cannot give you, nor do I believe it's possible to provide, a precise estimate of the impact, the quantitative impact of that that effect.

The general lessons are likely to apply internationally. Unless you operate a regulatory straitjacket that leaves plant operators no discretion over safety issues — which might be tantamount to having the Nuclear Regulatory Commission operate the plant itself — then profit-maximizing firms will have the opportunity to cut corners in safety. If they are then substantially removed from private liability for the implications of accidents, then there will inevitably be temptation to exploit those opportunities. Those effects are real, even if we do not know how to quantify them.

CONCLUSION

Leaving aside issues of the links between money, patronage, and the political process, we can broadly accept the view that governments are democratic. If we do not like what is happening, we vote differently next time around. One can question why government leaders think they can pick winners better than the market — and why those leaders sometimes sell themselves as defenders of free markets. But if they want to promote a particular activity, that is their prerogative.

The least that we might expect is that, if subsidy is to be given, it be given in the least costly and least distorting way. The Price-Anderson Act is a backdoor way of channeling finance to a particular corporate interest group. Economists have long trumpeted the benefits of lump-sum transfers on the grounds that they do not distort incentives. If government wants to favor the nuclear power sector over other generators, then it should just go ahead and send the sector a big pot of cash but leave the incentives for safe operation intact. I wonder how the populace would feel about that? **R**

READINGS

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