

PUBLIC ATTITUDES TO NUCLEAR ENERGY: SALIENCE AND ANXIETY

JOOP VAN DER PLIGT*

University of Exeter, Exeter, U.K.

Abstract

During the last decade there has been a significant increase in public concern about nuclear energy. This paper presents a brief overview of trends and developments in public opinion since the late 1970s. One possible reason for this increased concern is the public's perception of risks. Research has shown a considerable divergence in public and expert assessment of the risks associated with nuclear energy. It will be argued that qualitative aspects of these risks play a crucial role in the public's perception of nuclear energy, and that reactions such as fear and anxiety are the major determinants of attitudes to the building of new nuclear power stations in one's neighbourhood. It is also clear, however, that differences in the perception of these risks do not embrace all the relevant aspects of public acceptance of nuclear energy. Public reaction is also related to more general values and beliefs, and the issue of nuclear energy is firmly embedded in a much wider moral and political domain.

Introduction

The economic and political significance of energy supplies has dramatically increased since the 1973-74 energy crisis. Until then the debate on nuclear energy had largely centred on 'technical arguments about technical issues' (White, 1977, p. 647). Changes in public awareness and involvement have led to the recognition that public acceptability of nuclear energy will play an important role in the future of this technology.

Over the past decade public support for nuclear energy has gradually been eroded. This increased opposition to nuclear energy was accompanied by the growth of the environmental movement. Since the mid-1970s the environmental movement has matured in organization, has broadened its membership and gained in political significance. Media interest in environmental issues has also increased. The press has shown substantial concern over nuclear safety; a number of accidents and the issue of nuclear waste have been widely reported. Although there is no necessary causal link between media coverage and public attitudes, the increase in media attention was accompanied by increasing public concern over potentially catastrophic accidents and radioactive wastes.

Various developments reflect this increase in public concern. For instance, several national referenda on the issue of nuclear energy have been decided by very narrow margins (Austria, Switzerland and Sweden). Other countries organized national discussion and/or information campaigns (e.g. Austria, 1976-77; The Netherlands, 1982-83) in an attempt to involve further the public in the nuclear debate. The increasing length of public inquiries into the issue of nuclear energy is another example

*The author is now at Free University, Institute for Environmental Studies P.O. Box 7161, 1007 MC Amsterdam, The Netherlands.

of the public's concern about this technology. Finally, public concern is clearly reflected in the growing number of public opinion polls on the issue. The next section presents a brief overview of developments in public opinion in both the U.S.A. and Europe.

Public Opinion

Prior to the mid-1970s survey data showed consistently high levels of support for nuclear energy. The place of nuclear energy as a source of electrical power seemed assured. This majority was eroded in the 1970s. Although the slippage was apparent prior to the Three Mile Island accident in 1979, it has been accelerated by that event. Immediately following the Three Mile Island accident, support in the U.S.A. decreased, uncertainty about taking a stand on nuclear power decreased and opposition towards nuclear power increased. Although there has been some rebound towards pre-Three Mile Island levels of support and opposition, the return has not been complete. Recent figures show that the percentage of the U.S.A. public that supports the continued building of nuclear power plants in the U.S.A. is, on average, 5–10% more than the percentage of the public that opposes such construction. This small pro majority is composed of a strong *majority* of men and a *minority* of women. Furthermore, a majority of the public believes that more such accidents are likely to happen (Rankin *et al.*, 1981). Finally, a large majority of the public (about 80%) now says that it is concerned about waste management issues (Kasperson *et al.*, 1980).

The above trends are also apparent in Europe and the U.K. Public opinion in The Netherlands has shown an 'anti-nuclear' majority since the late 1970s. Opinion poll data for the U.K. show a slow but steady increase in public opposition to nuclear energy since the mid-1970s. Whereas in 1980 there was hardly any difference between the number of opponents and supporters of nuclear energy, a National Opinion Poll survey conducted in October 1981 showed that 33% of the public was in favour of expanding the number of nuclear power stations in the U.K., while 53% were opposed.

Recent EEC surveys provide a more complete picture. Table 1 gives an overview of public opinion trends in the 10 member states since 1978. Averaged over the 10 member states 38% of the public favours expansion of nuclear energy, with 37% opposing further development. In 1978 these figures were 44 and 36%, respectively.

Results of public opinion surveys in both the U.S. and Europe show that people are less willing to approve construction of a new reactor close to their community than to approve the construction of these energy facilities in general. Support for local nuclear power plants has been in decline since the mid-1970s. In the U.S.A. support decreased from 47% in 1977 to 28% in 1980 (Rankin *et al.*, 1981). Our survey of three small communities in the South West of England confronted with the possible building of a nuclear power station showed a considerable majority opposing the plans (van der Pligt *et al.*, 1985).

A number of surveys have either compared levels of acceptance of a nuclear power plant amongst people who live near one with that of people who do not, or they have monitored the local climate of opinion in a locality where the possibility of a nuclear power plant being constructed gradually becomes a reality. Overall, there is mixed support for the idea that familiarity leads to greater acceptance of a nuclear

TABLE I
Attitudes to further development of nuclear power in the 10 EEC member states^a

	Percentage of respondents indicating worth of further development					
	Worthwhile			Unacceptable risk		
	1978	1982	Difference	1978	1982	Difference
Belgium	29	27	-2	39	37	-2
Denmark	37	25	-12	34	49	+15
France	40	51	+11	42	31	-11
Federal Republic of Germany	35	37	+2	45	30	-15
Greece	—	15	—	—	50	—
Ireland	43	13	-32	35	47	+12
Italy	53	34	-19	29	43	+14
Luxembourg	35	32	-3	31	49	+18
The Netherlands	28	34	+6	54	48	-6
United Kingdom	57	39	-18	25	37	+12

^aTotal sample size 9700 (1982). Greece was not included in the 1978 survey. Respondents were presented with four response categories to indicate their attitude concerning the development of nuclear power stations, these were: 'it is worthwhile', 'no particular interest', 'the risks involved are unacceptable' and 'don't know'. This table is based on findings reported by the Commission of the European Communities (1982).

power plant in one's community. Melber *et al.* (1977) mentions eight studies which followed local acceptance of a nuclear power plant as it was being constructed. Only two found a significant increase in acceptance over time, and one locality showed a significant increase in the level of opposition. Results are equally mixed concerning the relationship between living near a nuclear power plant and acceptance of nuclear energy in general (see Thomas and Baillie, 1982). Our own surveys (Reference Note 1) showed a marginally more favourable attitude towards nuclear energy in general around Hinkley Point (the site of two existing nuclear power stations in the South West of England) than in three small local communities that were shortlisted by the CEGB as possible future sites. Other research on local attitudes did not support the notion that familiarity leads to more favourable attitudes (e.g. Warren, 1981).

Unfortunately, opinion poll data are usually based on one simple question on the issue of nuclear energy and do not allow clear and firm conclusions about the various beliefs underlying public attitudes. The influence of the wording of opinion polls provides a further cautionary note (see, for example, Roiser, 1983). The opinion polls do show, however, that the public is divided, both in Europe and the U.S.A. Research on public perception of the various benefits and risks of nuclear energy is likely to provide further information on public concern about this technology. A number of surveys indicated that people's perception of risks is an important component of the public's concern over nuclear energy. The issue of risk perception has been extensively studied in recent years, partly with the aim of helping to formulate policy decisions on risk regulation and risk-bearing technologies.

Risk Perception

Although the experts' assessment of the risks of nuclear energy indicate that these

are no greater than, and perhaps substantially less than, those of other generally accepted technologies, the public distrust of nuclear energy is substantial. Opinion polls consistently report qualms about the release of radioactivity, potential catastrophic accidents and the disposal of nuclear waste. Both operational hazards and possible adverse environmental impact are seen as major risks of nuclear energy. Our own research in the South West revealed a similar pattern; the nuclear waste issue and risks to the environment played a major role in public perception and acceptability of the building of a nuclear power station.

It is clear that the lay public defines risks in much broader terms than the expert. Early research on risk perception aimed to discover the basis of the public's distrust, given expert assessments of the extreme low probability of serious accidents and the negligible consequences of routine emission to both health and the environment. The experts' risk assessments were regarded as objective and quantifiable, and public fears were interpreted as biased and irrational. Public disagreement among scientists over the risks of nuclear energy, however, led to the realization that even the experts' assessments are less 'objective' than previously assumed. Recent research has paid more attention to the study of how people think about risks. A number of studies have revealed that nuclear power, as compared with other technologies, elicits an extraordinary level of concern, particularly because of the characteristics of the hazards that it poses (see, for example, Fischhoff *et al.*, 1978, 1981). Most prominent among these are the potentially catastrophic and involuntary nature of possible accidents, and the fact that it is an unknown hazard. Compared to other technologies nuclear energy emerges as the most extreme in terms of the size and seriousness of a potential accident.

The public's concept of risk, therefore, seems to be heavily influenced by the characteristics and seriousness of the possible consequences of nuclear energy. These factors play a more important role than the assumed probability of the possible negative consequences.

The concept of risk, however, does not embrace all the relevant terms of public acceptance. The public's perceptions of risks are built on values, attitudes and sets of attributes which need not be similar to the representations of the experts and policy makers.

Beliefs and Values

Attempts to analyse the structure of people's attitudes towards nuclear energy are usually based on expectancy-value models of attitude formation, which broadly assume that the more a person believes the attitude object has good rather than bad attributes or consequences, the more favourable his or her attitude tends to be. In other words, people's attitudes towards nuclear energy are assumed to be a function of beliefs about the possible consequences of its use. Most of the work in this area is based on the expectancy-value model of attitude formation proposed by Fishbein and his colleagues (Fishbein, 1963; Fishbein and Hunter, 1964), which analyses attitudes in relation to the anticipated consequences accompanying the attitude object. Results of these studies show that individual attitudes are based upon perception of various potential negative and positive aspects of nuclear energy (e.g. Otway and Fishbein, 1976; Sundstrom *et al.*, 1977, 1981).

A further conclusion of this research is that separate dimensions of the issue of

nuclear energy appear differentially salient for different attitude groups. Otway *et al.*, (1978) report the results of a factor analysis on 39 belief statements about nuclear energy. Results of this work pointed at a number of dimensions underlying the way people think about nuclear energy. Otway *et al.*, (1978), summarized these dimensions as follows: (1) beliefs about the economic benefits of nuclear power, (2) beliefs about environmental and physical hazards due to routine low-level radiation, and possible accidents, (3) beliefs about the socio-political implications of nuclear power (e.g. restrictions on civil liberties), and (4) beliefs about psychological risks (fear, stress, etc.). Subgroups of the 50 most pro- and 50 most anti-nuclear respondents were then compared in order to determine the contribution of each of the four factors to respondents' overall attitudes. For the pro-nuclear group, the economic and technical benefits factor made the most important contribution, whereas for the anti-nuclear group, the risk factors were more important.

Woo and Castore (1980) also found that nuclear proponents attached greater value to the potential benefits of nuclear energy, while the nuclear opponents were more concerned with potential health and safety issues. Results obtained by Eiser and van der Pligt (1979), and van der Pligt *et al.*, (1982), provide further support for the view that individuals with opposing attitudes tend to see different aspects of nuclear energy as salient and, hence, will disagree not only over the likelihood of the various consequences but also over their importance. In other words, each group has its own reasons for holding a particular attitude; the proponents stressing the importance of economic benefits, while the opponents attach greater value to environmental and public health aspects. An important finding of these studies was that the overall attitude of respondents was more closely related to ratings of—in their view—important aspects than to their ratings of subjectively less important aspects. Thus, a consideration of both the perception of the various consequences and the subjective importance or salience provides a more complete picture than could be obtained from a consideration of either factor alone. These studies (Eiser and van der Pligt, 1979; van der Pligt *et al.*, 1982) suggest that the attitudinal differences apparent in controversies of this kind require a conception of attitudes that takes account of the fact that different aspects of the issue will be salient to the different sides of the debate, and that such differences in salience may be at least as clear-cut and informative as differences in the likelihood and evaluation of the various potential consequences. As argued elsewhere (van der Pligt and Eiser, 1984), the finding that separate dimensions of the issue appear differentially salient (both subjectively and in their contributions to the prediction of overall attitude) for the different attitude groups, has important practical implications for theories of attitude and our understanding of why people hold different attitudes towards nuclear energy.

The above studies, however, focus on public attitudes towards nuclear energy in general. More recently we attempted to investigate the relationships between people's attitudes towards the building of a nuclear power station in their locality, their specific beliefs about the local consequences and their perception of the importance of these consequences. This study was conducted in localities that were short-listed by the Central Electricity Generating Board as possible locations for a new nuclear power station in South West England. The sample of respondents was drawn from the electoral register for three communities which were close to the three possible locations. A total of 450 people received a questionnaire by mail. Of this sample,

24 respondents had moved from the area and 300 persons agreed to participate in the study; a response rate of 70%. The sample contained an equal number of males and females, and most respondents had lived for a considerable time in the area (nearly 30 years, on average).

The questionnaire was closed-ended and was preceded by a short introduction describing the Central Electricity Generating Board's announcement concerning the possible locations for the next nuclear power station in the South West of England. The questionnaire assessed subjects' attitudes towards building more nuclear power stations in the U.K., the South West of England and their locality. Respondents were also asked to indicate their attitude towards various other industrial developments in their locality and, finally, to indicate their attitude towards nuclear energy in general, their involvement with the issue, whether they had attended any public meetings on the issue and which aspects should receive most attention in a public inquiry on the possible building up of a new nuclear power station. A more detailed description of the study can be found in van der Pligt *et al.*, (1985).

In the present context we will summarize the findings concerning the perception of the various potential costs and benefits of a nuclear power station in one's locality. Participants were generally opposed to the construction of a nuclear power station in their neighbourhood. It needs to be added, however, that most respondents were also opposed to other industrial activities such as the building of a chemicals plant. These findings indicate a more negative attitude towards large-scale industrial developments than those obtained in some of the literature on the impacts of rapid growth of communities (e.g. Freudenburg, 1984).

In order to investigate people's perception of the various potential costs and benefits of a nuclear power station we presented subjects with two sets of 15 potential consequences. The first set contained 15 immediate effects of the building and operation of a nuclear power station in the locality, while the second set focused on long term consequences. Subjects were split into three attitude groups on the basis of their answer to the question whether they were opposed to or in favour of the building of a new nuclear power station in their locality. A discriminant analysis revealed that the three attitude groups (pro, neutral and anti) differed significantly in their assessment of a number of immediate consequences. The aspects that were most differentially perceived concerned the area of land fenced off, the conversion of land from agricultural use and the prospect of workers coming into the area. Opponents generally thought these developments to have an adverse impact on the quality of life in the locality, while proponents thought the impact of these factors would be relatively minimal.

We also asked people to select the five (out of 15 immediate consequences) aspects they thought to be the most important. Results showed three aspects that were rated very differently as a function of own attitude. Of the pro subjects, 67% regarded road building an important aspect, while only 20% of the anti subjects selected this item among the five most important. A similar difference was obtained concerning the prospect of workers coming into the area (53% of the pros and 18% of the antis). The antis, on the other hand, attached greater importance to the possible conversion of land from agricultural use than the pros (58% vs. 27%).

The mean ratings by the three attitude groups of the 15 (mainly long-term) effects of the building and operation of a nuclear power station in their neighbourhood also showed highly significant differences. Again, we conducted a discriminant

TABLE 2
Perceived consequences of the building and operation of a nuclear power station as a function of attitude

	Impact ^a			Importance ^b		
	Pro (N = 30)	Neutral (N = 40)	Anti (N = 209)	Pro (N = 30)	Neutral (N = 40)	Anti (N = 217)
Economic factors						
Employment opportunities	8.3	7.6	6.0 ^c	73	57	15 ^c
Business investment	6.7	6.0	4.2	27	28	11
Environmental factors						
Wildlife	4.7	2.6	1.5	40	57	67
Marine environment	5.1	3.6	2.3	13	17	38
Farming industry	4.6	3.0	1.9	17	45	56
Landscape	4.3	2.6	1.3	23	50	66
Public health and psychological risks						
Health of local inhabitants	5.0	4.4	2.6	20	29	48
Your personal peace of mind	5.4	4.3	1.7	27	17	47
Social factors						
Social life in the neighbourhood	6.9	5.7	3.9	30	7	11
Standard of local transport and social services	6.8	6.3	4.9	40	17	5
Standard of shopping facilities	6.6	5.8	4.9	20	14	4

^a Possible range of scores from 1 (consequence will affect life in the neighbourhood very much for the worse) to 9 (very much for the better).

^b The scores represent the percentage of subjects selecting each factor among the five most important.

^c The differences between the three attitude groups were significant in all cases ($P < 0.05$) as indicated by the linear F -term.

analysis to find out which aspects most distinguished the three attitude groups. The results revealed three aspects which had considerable predictive power in separating the three attitude groups. These were the perceived effects on one's 'peace of mind' and the effects on the environment and wildlife. The first aspect corresponds to what Otway *et al.* (1978) called 'psychological risk', while the other two aspects are related to what these authors termed 'environmental and physical risk'.

Again we asked the respondents to choose the five consequences they regarded most important. The results showed very marked differences between the three attitude groups. The most striking difference concerned the possible effects on employment opportunities, 73% of the pros selected this item among the most important, while only 15% of the antis considered this aspect as important. Overall, the pro respondents stressed the importance of economic benefits, while the antis stressed the risk factors (both environmental and psychological risks). Table 2 presents a summary of these differences in the perception of the various long-term consequences and their importance. A closer inspection of these differences underlines the importance of including both beliefs and salience in one's conception of attitude. Even though the attitude groups, for example, showed relatively minor differences in their evalua-

tion of the effects of potential employment opportunities in the locality, a majority of the pros found this aspect important, while only a small minority of the antis regarded this aspect as being of importance.

Results of this study showed that the major differences between the attitude groups concerns the less tangible, more long-term nature of the potential negative outcomes. Our findings further suggested that the perception of the psychological risks are the prime determinant of attitudes as indicated by the very high correlation (0.80) between this factor and attitude towards the building of a new nuclear power station. Other studies (e.g. Woo and Castore, 1980) did not find such a strong relation between psychological risks and attitude. One reason for this could be that our research concentrated on people living very close to the proposed nuclear power station (all within a five-mile radius). Most other studies used much wider areas around proposed nuclear power stations.

In summary, opponents and proponents of nuclear energy have *very different* views on the possible consequences of nuclear energy. Our research indicates that this applies to both the general issue of nuclear energy and to the building of a nuclear power station in one's locality. The most significant difference, however, concerns the perception of psychological risks (anxiety, stress). This factor becomes more important when people are (or will be) more directly exposed to the risks, for instance when their locality is shortlisted as a possible site for a nuclear power station.

These findings also suggest that the different perceptions of the possible consequences of further expansion of the nuclear industry are related to more general values. Eiser and van der Pligt (1979) addressed this point and asked 47 participants attending a one-day workshop on 'The Great Nuclear Debate' to select the five factors which they felt 'would contribute most to an improvement in the overall "quality of life"' from a list of nine. Table 3 summarizes some of their findings.

Results showed marked differences between the two groups, with pro-nuclear subjects stressing the importance of 'advances in science and technology', 'industrial modernization', 'security of employment' and 'conservation of the natural environment'. The anti-nuclear respondents put even more emphasis on the last factor and stressed the importance of 'decreased emphasis on materialistic values', 'reduction in scale of industrial, commercial and governmental units' and 'improved social welfare'.

TABLE 3
The importance of general values as a function of attitude^a

	Percentage of respondents selecting each factor	
	Pro-nuclear subjects	Anti-nuclear subjects
Decreased emphasis on materialistic values	36	100
Reduction in scale of industrial, commercial and governmental units	22	86
Industrial modernization	68	6
Security of employment	77	40
Improved social welfare	31	80
Conservation of the natural environment	77	100
Advances in science and technology	82	13

^a Adapted from Eiser and van der Pligt (1979), p. 532.

More recently, we presented a sample of the Dutch population with a similar list of more general values (van der Pligt *et al.*, 1982). Results were in accordance with the above study and showed that pro-nuclear respondents stressed the importance of economic development, whereas anti-nuclear respondents put more emphasis on conservation of the natural environment and the reduction of energy use. Finally, the anti-nuclear group thought the issue of increased public participation in decision making to be more important.

Not surprisingly, we also found a relation between these value differences and respondents' position on a political left-right dimension. Political preference was significantly related to these differences in values, and to the respondents' attitudes to the building of more nuclear power stations in The Netherlands. Opinion poll surveys conducted in The Netherlands when this study was being carried out confirmed this relationship between political preference and attitudes towards nuclear energy (see van der Pligt *et al.*, 1982).

Discussion

The present research has demonstrated that the public is divided over the issue of nuclear energy. Public opinion data from the U.S.A. and Europe show marginal differences between the percentages of people opposed to further expansion of this technology and those in favour. Survey data also indicated that safety issues play a crucial role in public attitudes. Research on public perception of risks has pointed out a number of characteristics of the risks of nuclear energy that elicit an extraordinary level of concern.

Both public disagreement among scientists concerning the likelihood and magnitude of potential risks of reactor operation and waste storage and the frequent mention of possible health hazards will reinforce public distrust of nuclear technology. Since safety-related issues play a crucial role in public acceptance of this technology, it seems necessary to improve the relations between the expert and the lay public. For the lay public this poses an important challenge: to be better informed and to be aware of the qualitative aspects that strongly affect their perception of risks. For experts it seems necessary to recognize the limitations and fallibility of risk assessments, and to be aware of the fact that important qualitative aspects of risks influence the responses of lay people. However, it is also clear that the risk concept in itself is not sufficient to explain public reactions. Risk perception is not the only issue of importance. Public reaction is also related to more general beliefs and values, and the issue of nuclear energy is firmly embedded in a much wider moral and political domain.

Individuals with opposing attitudes tend to see different aspects of the issue as salient, and hence, will disagree not only over the likelihood of the various consequences but also over their importance. In other words, *opponents and proponents have different reasons for holding their particular attitudes*. The supporters see the potential economic benefits as most important, while the opponents attach greater value to environmental and public health aspects. Present findings further suggest that people's attitude towards the building of a new nuclear power station in their neighbourhood is very closely related to their perception of the psychological risks of such a development.

Results concerning the perception of the importance of more general social issues

were in line with the above findings, and indicated that attitudinal differences towards nuclear energy are embedded in a wider context of attitudes towards more general social issues. Public thinking on nuclear power is not simply a matter of perceptions of risks but is also related to more generic issues such as the value of economic growth, high technology and centralization. It seems impossible, therefore to detach the issue of nuclear energy from questions of the kind of society in which one wants to live.

The fact that public attitudes are relatively stable *and* embedded in a wider context of values suggests that large-scale attitude conversion may be more difficult than often assumed. People may, however, change their attitudes as a function of serious accidents that attract widespread attention, especially if they have not committed themselves strongly to one of the two sides. With regard to safety-related aspects of public acceptance of nuclear power, it seems much easier for nuclear attitudes to become suddenly more anti-nuclear because of a major accident or a series of smaller accidents (e.g. the recent events at the Sellafield reprocessing plant, see Reference Note 2) than it would be for nuclear attitudes to become more pro-nuclear as a longer-term result of an extensive period of safe operations. Changes in a pro-nuclear direction are more likely to result from events related to energy supply, e.g. developments that would make non-nuclear energy much more expensive.

Reference Notes

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