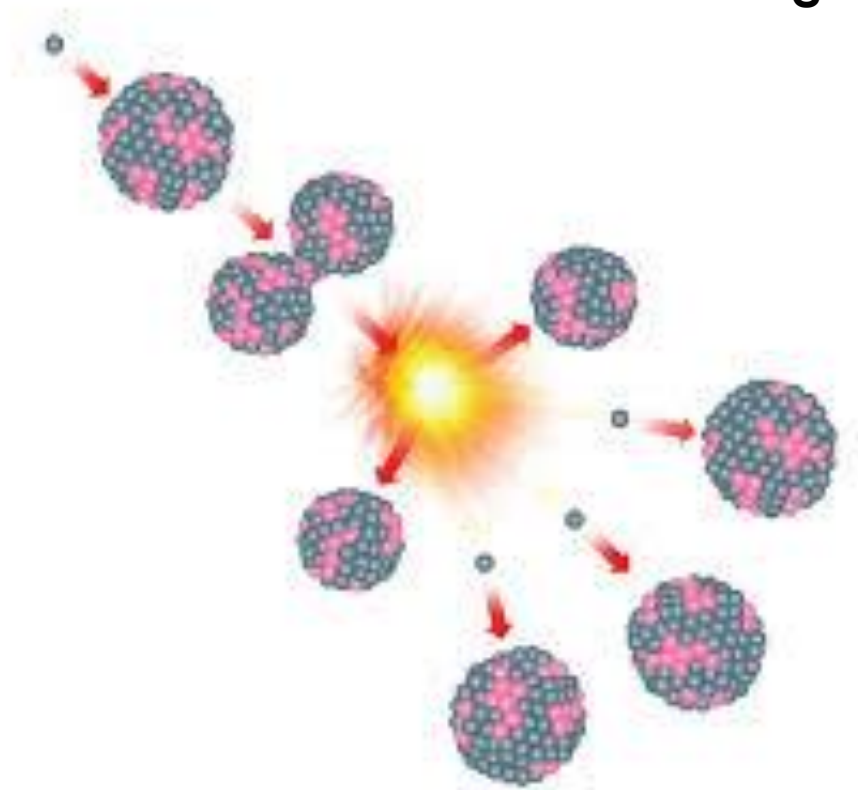


Public Understanding of Nuclear Energy: it's not (just) about the science

Malcolm Grimston, Imperial College

University of Bath Online Webinar, October 13 2020

Why is the safest large-scale energy source regarded as the most dangerous by significant numbers of people?



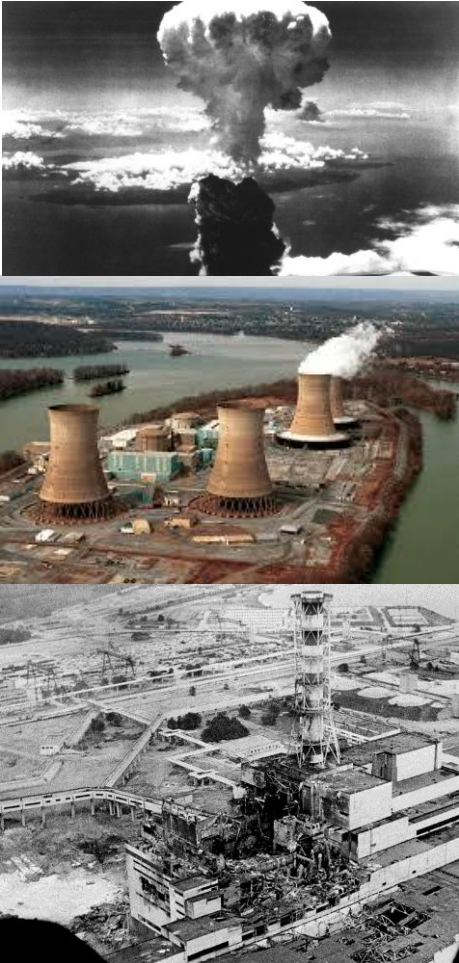
How did Fukushima, a middle-ranking industrial accident of the kind that happens perhaps eight or ten times every year somewhere in the world, become a major and ongoing human tragedy?



Starting point (1)

At Three Mile Island, Chernobyl and Fukushima the radiological damage of the radiation was significantly outweighed by the psychological and social damage of the 'response' – including the atmosphere created by years of miscommunication and misunderstanding (to the point of irrationality) by the 'nuclear family' – i.e. the industry, its regulators and its supporters.

Starting point (2)



But the general public is broadly rational (which is not the same as saying it is always correct) – in the sense that it is very rare that opinions form for no reason whatsoever.

Its beliefs about radiation have also formed for a reason: people need to be able to make sense of the world.

In doing so they use “commonsense,” as a generally far more reliable guide to understanding and action than abstruse science.

Most obvious conclusion: something about the way the industry and its friends communicate about radiation has created a fear in the single specific instance of civil nuclear energy.

The Industry Response

Traditional nuclear industry response:

“There is an irrational fear of radiation among an ignorant public.”

“Someone (probably in the media or the Big Green industry) is going round misinforming people about radiation and thereby causing fears.”

“All we need to do, in ‘dialogues’ with (or at) the public, is to tell them that nuclear power is safe, and other ‘facts’, and they’ll support it.”

In other words, there’s something wrong with the public.



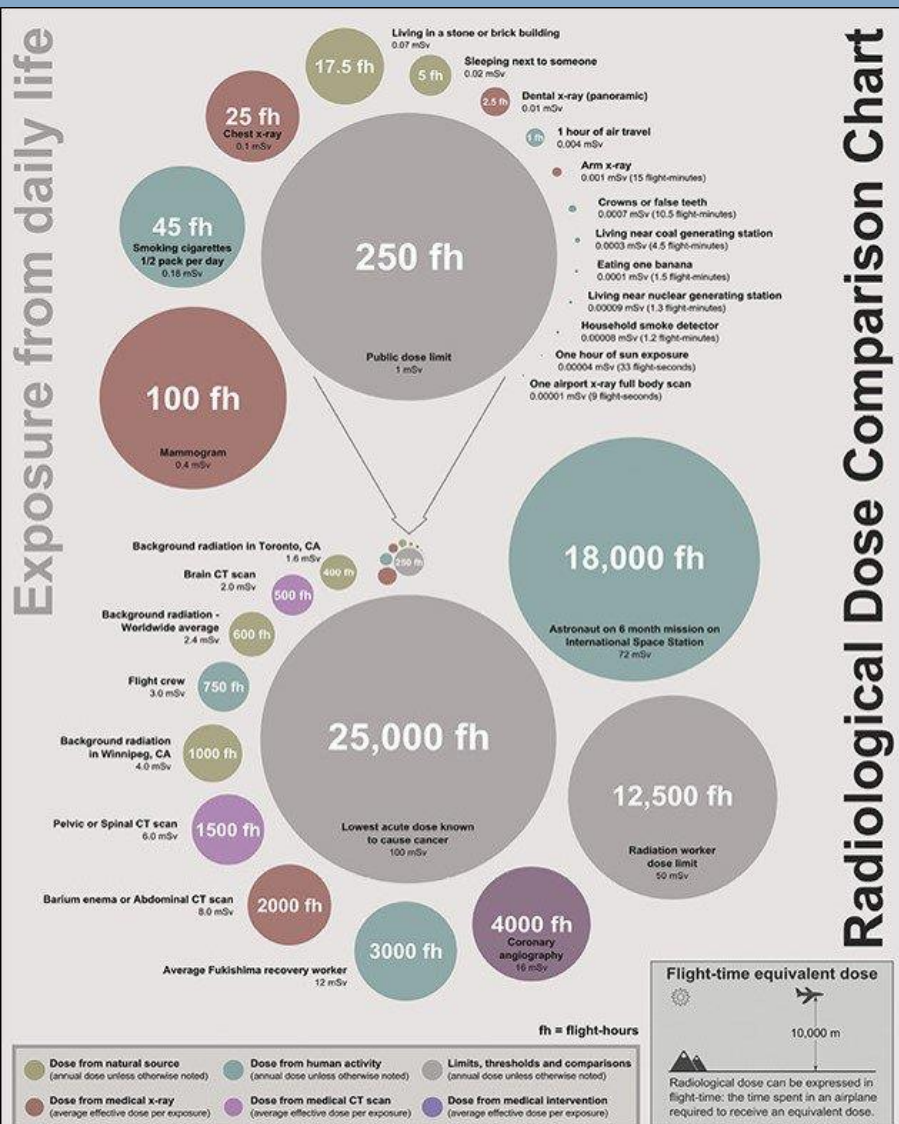
The Industry Response ...

Statements like the following have characterised the nuclear industry approach for decades.

- “Your fear of radiation is irrational.” (2015)
- “Educating the public is key to reclaiming our nuclear heritage.” (2014)
- “The irrational fear of radiation.” (2009)
- “The principal problem in public acceptance of nuclear power is irrational fear of radiation ...” (1996)
- “The first principle underlying the irrational fear of nuclear power ...” (1983)
- “Today irrational fear predominates.” (1971)
- “Public education most urgent, reactor-site experts agree.” (1965)

Exposure from daily life

Radiological Dose Comparison Chart



And yet there is no noticeable radiophobia around medicine, air travel, natural radon etc.

So is it just a fear of radiation?

Country	Year	Number exposed	Number exposed to high doses	Number of deaths
Mexico (Mexico City)	1962	?	5	4
China (Anhui Province)	1963	?	6	2
Algeria (Setif)	1978	22	5	1
Mexico (Juarez)	1983	≈ 4,000	5	0
Morocco (Casablanca)	1984	?	11	8
Brazil (Goiania)	1987	249	50	4
Ukraine (Krematorsk)	1980s	?	17	6
China (Xinhou)	1992	≈ 90	12	3
USA (Indiana)	1992	≈ 90	1	1
Thailand (Bangkok)	2000	?	10	3
UK (London)	2006	?	1	1
India (Mayapuri)	2010	?	8	1

Some non-power incidents involving radiation but no long-term panic

Is it just a fear of radiation?

Example: Budapest 2011

2011 public scare over detection of iodine-131 in airborne samples, with fears that it might have come from the Paks nuclear plant, or another further afield.

After investigation it was found that the material had been released from the Institute of Isotopes between September 8 and November 16

Collective sigh of relief – it was not the nasty type of iodine-131 (connected with nuclear power) but the nice kind, used in medicine.

Paks Nuclear Power Station, Central Hungary




VS.



Institute of Isotopes, Budapest

So is it just a fear of radiation?

The oft-claimed observation that people are afraid of radioactive waste is only partially true – there seems to be no fear (and no antinuclear campaign) concerning the production and storage of radioactive waste associated with medical (or indeed industrial) uses of radioactive materials.



In communicating with the public, the nuclear industry often makes two key mistakes:

It overestimates the *level of knowledge* in the public.

It underestimates the *intelligence* of the public.

If you want somebody to focus on possible danger, a very good way of doing it is to lead your communications by saying how safe you

A tricky starting place

Birth in the weapons programme

Slovic *et al.* factors which mediate between real and perceived risk:

- unfamiliarity/undetectability;
- out of voluntary control, imposed;
- potential to affect large numbers of people including future generations.

Race mythologies – Eden myths, ‘small boy playing with fire’, Frankenstein (but also man taking dominion over the earth).

People and risk

Three common assumptions

- People get worried because they see things to get worried about.
- Every time something is made a bit safer people feel a bit less worried about it.
- Giving people accurate information will make their perceptions more 'rational' – even if those messages do not make sense when set against what the industry actually does.

An alternative look at risk perception

- Each of us lives our life at a fairly constant level of anxiety and casts around our world for justifications or ‘candidate risks’ onto which to hang that anxiety.
- ‘Risk perception’ more a matter of finding risks to justify our anxiety than actually being frightened by a particular risk.
- Times of ‘real’ threats to safety and security e.g. wartime, natural disaster, often result in a degree of societal comfort – low suicide rates etc. – as a ‘solution’ can be imagined.
- Times of real safety cause us to find more obscure justifications for our anxiety with no clear solutions.

Risk perception

Each of us lives our life at a fairly constant level of anxiety and casts around our world for justifications or ‘candidates’ onto which to hang that anxiety.

What makes a good candidate risk?

- Messages do not conform to common-sense.
- High profile – if I am not constantly reminded about a risk I’m unlikely to get worried about it.
- Relevance – I can see how this risk might impinge on me.
- Few or no apparent benefits – if I get worked up about this risk I’m not going to have to start feeling guilty about the benefits it brings.
- ‘They aren’t like us’ – representatives do not look and sound like they understand us and our concerns – in fact they speak down to us and always think they are right.

Who is the more rational?

It is often the 'public' (including the media) who are rational and the industry irrational in communication issues. Some examples of where it can be argued that the industry has 'got it wrong':

Who is the more rational?

‘Radioactive waste is not very dangerous but we are going to bury it 800 metres underground.’

Industry’s irrational belief – people will be reassured by this.

Public’s rational response – this is the most dangerous stuff mankind has ever produced (we don’t bury anything else 800 metres underground), so we should be scared. And what’s more these jokers must think we are idiots if they expect us to believe it is not very dangerous at all, so we won’t believe them ever again. Help!

Who is the more rational?

‘Safety is the top priority.’

Industry’s irrational belief – people will be reassured by this.

Public’s rational response – if safety really is more important than generating electricity or cost, for example, then why not just stop doing it? This is incomprehensible – what do these people really think?
Help!

Who is the more rational?

‘We have spent a fortune on a monitoring system that can pick up radioactivity many thousands of times below danger levels.’

Industry’s irrational belief – people will be reassured by this.

Public’s rational response – this simply cannot be true. Either they have wilfully wasted a vast amount of my money, so shouldn’t be trusted, or they are lying about the dangers involved. **NOBODY** would spend a fortune on detecting something that can do no harm. Help!

Who is the more rational?

If you knew that there was a new UK nuclear solution that is:

intrinsically one million times **SAFER**,

more than two thirds **CHEAPER** and

ultimately one thousand times **CLEANER**

than conventional solid-fuel nuclear generated power;

wouldn't you prefer to have it?

Who is the more rational?

‘The new reactors are a million times safer than the old and we are putting a huge amount of resource into training people in safety culture.’

Industry’s irrational belief – people will be reassured by this.

Public’s rational response – well, at least he is admitting that existing plants are a million times more dangerous than [something], but if the new ones are so safe why do operators need so much training? Presumably even the new ones are subject to human error? Help!

Who is the more rational?

'Over 100,000 people cannot return to their homes near Fukushima because we are 'erring on the safe side'.'

Industry's irrational belief – people will be reassured by this.

Public's rational response – radiation must be hugely dangerous or they would not be destroying our lives by keeping us from our homes. A nuclear accident must be the worst thing that can possibly happen. So obviously we can't risk reopening existing nuclear stations in case this happens again.

Who is the more rational?

Great care must be taken to ensure that those designing communication are aware of the commonsense interpretation of what they are saying and that it helps not hinders!

MORAL – human or psychological rationality is different but not inferior to ‘technical’ rationality. All communication should put psychological rationality first.

Who is the more rational?



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A case study

JAIF Conference 2014 – one speaker bemoaned how the Japanese public did not realise that man-made radiation was the same as the natural radiation all around us. A huge effort was needed to correct this misimpression, so making nuclear power more acceptable, including educating the media to understand this.

A case study (2)

What does the well-informed Japanese member of the public know (or at least what unarguable facts are in the public domain)?

First and foremost, almost 100,000 people were banned from living in their homes in a 20 km radius zone around Fukushima Dai-ichi for many years, causing untold misery. In much of the zone doses from radiation (from all sources) are below 5 mSv per year, with fallout doses below 1 mSv per year.

Secondly, there are areas like Ramsar in Iran (average 130 mSv per year) and Guarapari in Brazil (peak levels on the beach of 40 μ Sv per hour, equivalent to 350 mSv per year) which are not evacuated. Indeed, there are areas of Japan (e.g. the Misasa spa area) where natural doses are above the total dose in some part of the exclusion zone.

A case study (3)

What could the well-informed Japanese member of the public make of this?

Three options:

1. The authorities have either gone stark staring mad (or are deeply wicked) by blighting so many lives and incurring such vast costs for no very good reason
2. The authorities are simply lying about the levels of contamination in the exclusion zone in an attempt to cover up the seriousness of the accident.
3. Man-made radiation must be significantly more dangerous than the 'same amount' of natural radiation, so comparisons are meaningless.

A case study (4)

Assume that the Japanese nuclear family is successful in persuading the media and the people that their perfectly understandable rationalisation of the undisputed facts in front of them (option 3) is incorrect.

The facts don't change, so a new rationalisation is needed. It is not immediately obvious that a switch to believing 1 or 2 would improve people's faith in the industry or in the concept of nuclear power.

So – far from people being misinformed by malign influences, including the media, into believing man-made radiation is more dangerous than it actually is, people may actually come to this view in an attempt to rationalise what they see in front of them, i.e. the entirely irrational behaviour of the authorities.

Ironically, one suspects that this 'irrational' behaviour on behalf of the authorities was adopted in an attempt to reassure people.

Personality

Evidence suggests that there are systematic psychological differences between ‘the type of people who go into industries like nuclear power’ and ‘the general public’. Of course there are many individual exceptions on both sides but broadly speaking the respective personality types, in Myers-Briggs Type Indicator (MBTI) terms, can be characterised as follows.

Personality (2)

‘Nuclear types’ are much more likely to view the world in terms of analysis of things rather than gut feelings about people – ‘thinking’, T, rather than ‘feeling’, F – than is the population at large, which splits quite evenly. (There are very significant gender differences in the general population, with about $\frac{2}{3}$ of men being predominately ‘T’ and a similar proportion of women being predominately ‘F’, but women in science, technology and management are still very likely to be T rather than F.)

Personality (3)

‘Nuclear types’ (especially those who communicate) are notably more likely to see the world in terms of theories and future possibilities (a ‘top-down’ approach), rather than building up a picture of reality from what comes in through the senses with the stress on the here and now – ‘intuition’, I, rather than ‘sensing’, S – than is the population at large. ‘Commonsense’ is a big watchword for the S personality.

Personality (4)

‘Nuclear types’ are a little more likely to seek ‘the answer’ to an issue whereby they close down discussion and try to make the world conform to this answer, rather than being comfortable or even embracing uncertainty and the world’s quiriness – ‘judging’, J, rather than ‘perceiving’, P – than is the population at large.

A different world view

People with different MBTI profiles genuinely see the world as a different place and are attracted towards different kinds of profession or activity. So, while stressing again that there are many exceptions and that these are all matters of degree rather than category, the ‘typical’ nuclear personality type – INTJ, sometimes characterised as the ‘architect’ or the ‘strategist’ – tends to:

- focus on the big picture, rather than the details;
- make logic-based decisions and follow intuition;
- set ambitious goals for themselves and others;
- pursue deeper understanding of complex topics rather than a cursory knowledge of a wide range of topics;
- be more comfortable with written communication than oral.

A different world view (2)

By contrast the 'typical' member of the public – ESFP, sometimes referred to as 'performer' or 'entertainer' – tends to:

- be very practical and resourceful, preferring to learn through hands-on experience;
- live in the here-and-now and sometimes be less interested in how current actions will lead to long-term consequences;
- prefer verbal to written communication;
- be understanding and perceptive when it comes to other people;
- like new experiences and 'things going wrong' (within reason).

A rare breed

Research suggests that around 43% of the population are in the SF quadrant while only around 10% are in the NT quadrant. Just over 17% of the population are in the SFJ categories (ESFJ and ISFJ) while only 4% are in the NTP categories (ENTP and INTJ).

People with different MBTI profiles to a degree (instinctively) presume everyone else either does (or should) see things in broadly the way they do.

Heroes and Villains

In the classic media set-up of an ‘expert’ with 30 years of experience in the statistics of a particular field and an individual who is convinced that their child’s illness was caused by the activity in question:

- the NT is strongly influenced by the ‘expert’;
- the SF is strongly influenced by the ‘person’.

The 'education/public information' myth

- So pumping people full of 'facts' about how safe nuclear power is may cause fear rather than allay it, especially if it stresses the mammoth efforts and costs directed towards nuclear safety.
- The core irrationality is believing that if you announce that you have made something a bit safer people will be a bit more comfortable – they may well decide you have discovered it is a bit more dangerous and so get more worried.
- The message on nuclear safety is simply not credible.
- The media have a responsibility to reflect this.

The 'education/public information' myth

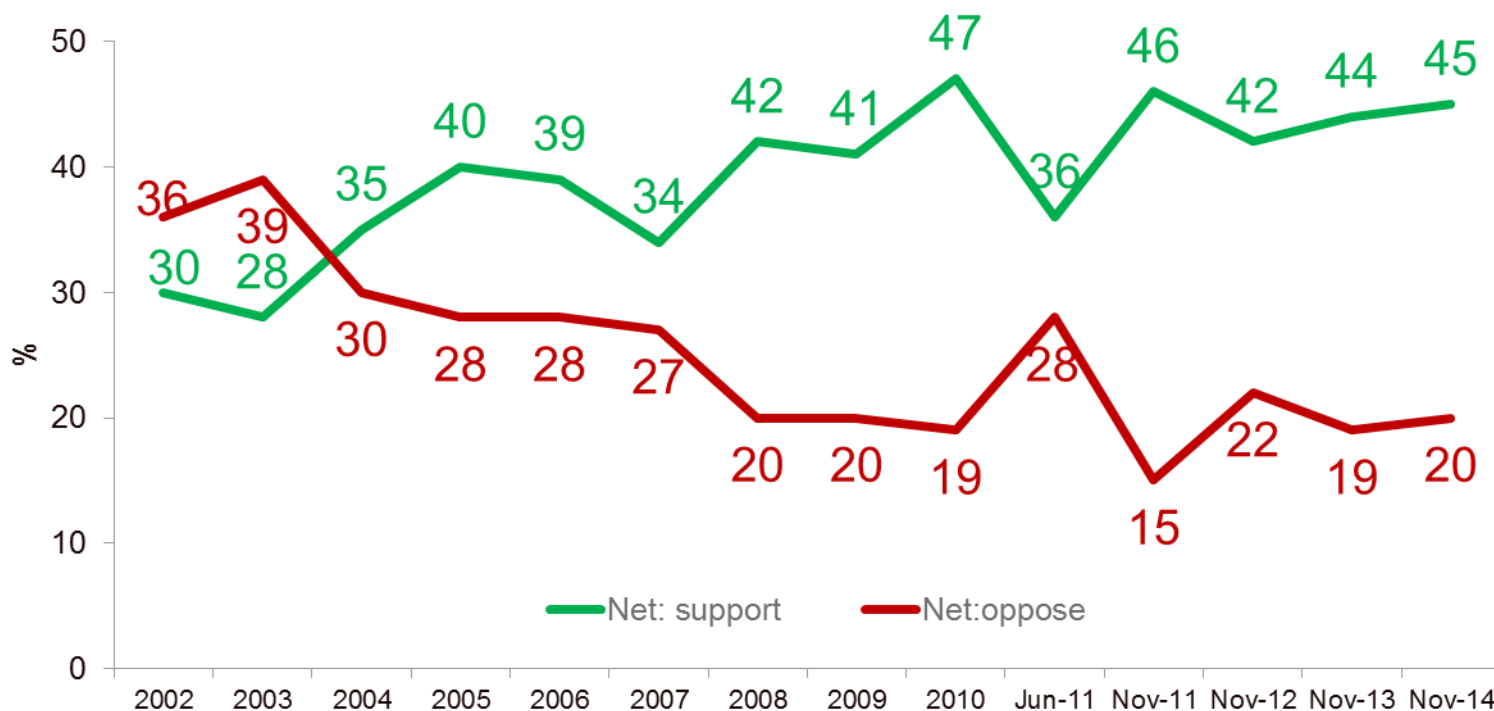
- **It is simply a non-starter** to imagine that a significant, or even a noticeable, proportion of the population can be 'educated' in nuclear engineering, health physics, radiobiology etc. etc. to the extent that they can come to an independent viewpoint about the merits say of reopening nuclear plants.
- Why should people not directly affected be interested in learning about nuclear power rather than say mobile phone masts, vaccination, cancer treatments, education policy and so on?
- In practice, may get their attention only by making them sufficiently scared of nuclear power that they think they ought to know something about it.

Making nuclear ordinary: EDF – Zingy (and friend)



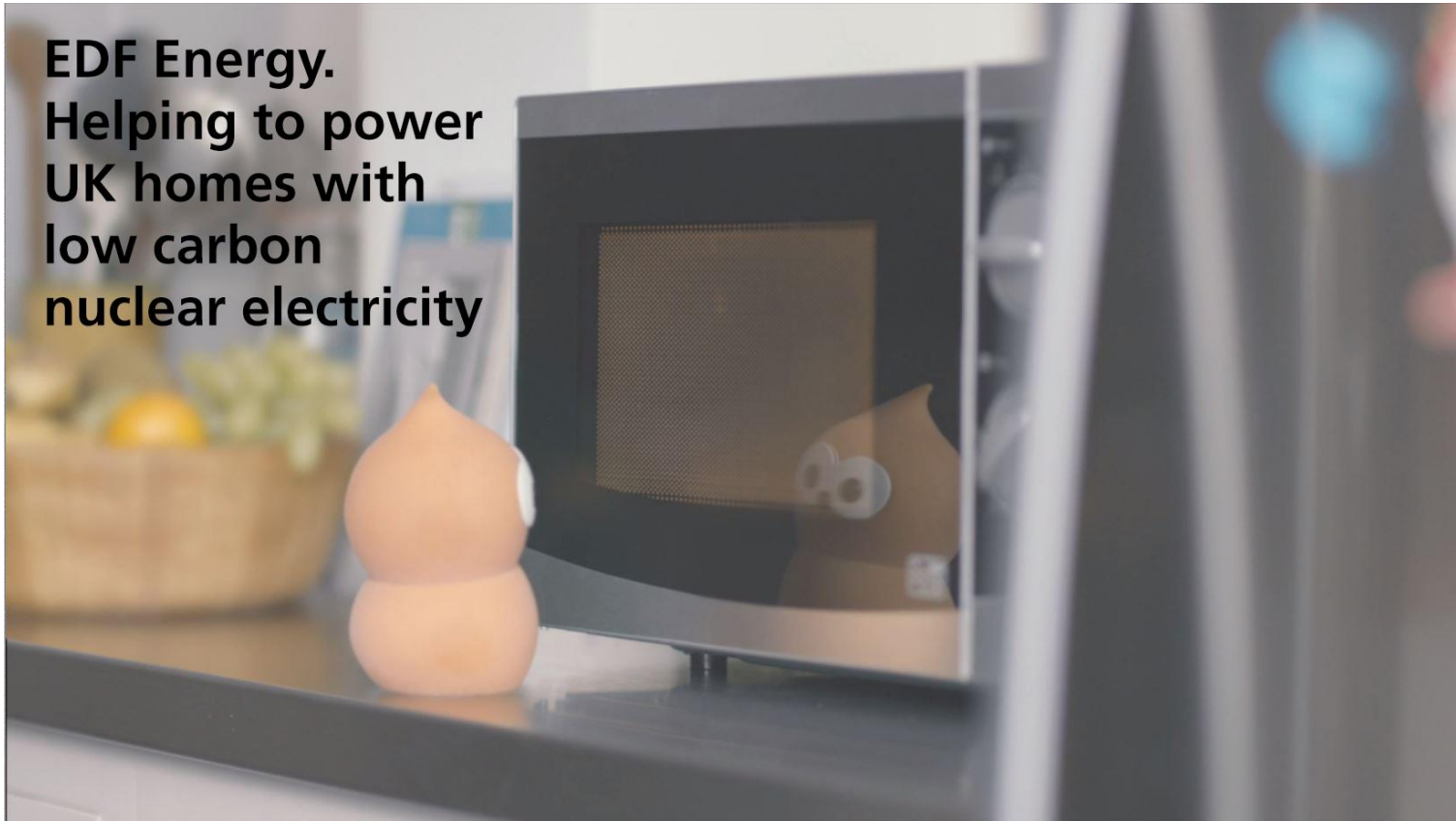
Attitude to nuclear new build in the UK

To what extent would you support or oppose the building of new nuclear power stations in Britain TO REPLACE those which are being phased out over the next few years? This would ensure the same proportion of nuclear energy is retained.



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A final thought

- Better communication – e.g. not banging on so much about safety – would undoubtedly help to put nuclear power into a proper perspective.
- But while the industry (and, dare I say it, its regulators) continue to treat nuclear power and radiation as if they are vastly more dangerous than they actually are – in the vain hope that this will put people's minds at rest rather than inevitably doing precisely the opposite – then only truly irrational members of the public will be convinced.