Reports about technology often contain errors: *Frontline* mis-reported the Fukushima disaster.

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Often people with little technology experience are not aware of their limitations.

Many technology projects involve physics, electronics, computing, or mechanical design, and often a combination of all four. Whoever expects to manage or document such projects successfully must have an extensive technical background in each of the subjects that apply. The necessary technical experience is briefly discussed in the *Futurepower* article, *Technology project leaders must have design and implementation experience*.

Those not having sufficient experience often make serious mistakes. Experience such as being elected to public office, making documentaries about technology, writing papers about the economics of technology, or writing news stories about technology is not sufficient.

Example of failure: The documentary *Nuclear Aftershock* by the PBS show *Frontline* presented information connected with the social and political implications of the Fukushima accident for U.S. nuclear policy. (PBS is Public Broadcasting System, a free TV system.)

http://www.pbs.org/wgbh/pages/frontline/nuclear-aftershocks/

The *Frontline* shows in general have an excellent reputation for providing better and more complete news coverage about some subjects than other media in the United States. *Nuclear Aftershock* contains valuable information. But the documentary also demonstrates a lack of understanding of technology. The documentary gives viewers wrong impressions that are socially destructive and difficult and expensive to counteract. Those who watched the documentary who aren't technically knowledgeable about energy generation may believe that they understand something important and that what they understand is complete. Those errors are now part of the foundation of public understanding in the United States. Anyone wanting to develop a clearer understanding is faced with the enormous challenge of counteracting many incorrect impressions.

Writers who aren't technically knowledgeable may realize facts in a vague way but because of their uncertainty they may not feel comfortable making strong statements about those facts. So, their writing is also weak.

Those who make documentaries about energy should help the public be clear about the following facts:

There is little similarity between the situation in the U.S. and Japan. Those with little or no technical understanding tend to assume that the instabilities in the earth that produce earthquakes are more similar than they really are.

One destructive effect of the *Nuclear Aftershock* documentary was to allow people to believe that there is a far greater similarity between nuclear power generation in the U.S. and Japan than actually exists. Most of the nuclear plants in the U.S. are located in the east, far from major earthquake activity, and most are far from an ocean.

Japan lies on the most unstable part of the earth. For example, on January 23, 2012, the first full day before this was first written, Japan experienced 10 earthquakes; two were of magnitude 5 and four of magnitude 4. That is the activity for *one day*, in a country 4% of the size of the United States.

http://www.jma.go.jp/en/quake/quake_local_index.html

See this map of earthquake zones:

http://upload.wikimedia.org/wikipedia/commons/b/b4/Plate_tectonics_map.gif

Scientists use a numbering system unfamiliar to most people. The earthquake that caused the destruction at Fukushima in Japan was 9.0 on a scale of magnitude. An earthquake of magnitude 9.0 is 10 times more powerful than an earthquake of magnitude 8.0, and *one-million times* more powerful than an earthquake of magnitude 3.0.

Unfortunately, there is no easy replacement for power from nuclear fission. Total energy use in the U.S. is far, far greater than most people understand. Oil, coal, hydroelectric power, natural gas, and nuclear power provide energy in the huge amounts needed for generation of electricity, for vehicles, and for heating of houses.

Nuclear fission is an important method of generating the enormous amounts of baseload electricity required, power that is available when needed. New York state gets 30 percent of its energy for generating electricity from nuclear power, Vermont 73 percent. Visit the *Frontline* map to see the percentage of energy in each state that comes from nuclear power:

http://www.pbs.org/wgbh/pages/frontline/health-science-technology/nuclear-aftershocks/how-much-electricity-does-my-state-generate-from-nuclear/

There is at present no attractive way to replace nuclear power generation in the U.S. with some other source. Coal, oil, and natural gas cause major pollution and will soon be nearer exhaustion and far more expensive. Avoiding building new nuclear fission power plants would eventually cause an economic breakdown, partly because it will be necessary to power more vehicles with electricity.

The U.S. Department of Energy says the same in its poorly edited April 2010 publication, *Nuclear Energy Research And Development Roadmap*.

http://www.ne.doe.gov/pdfFiles/NuclearEnergy_Roadmap_Final.pdf (Dead link.)

New nuclear fission plant designs are more advanced. There are many differences between the nuclear plants that exist now and those that will be built in the future. Some of the new designs generate far less waste. All protect themselves if there is a loss of power.

Wind and sun generation is inadequate. Wind and sun energy are available only when there is wind and sun, provide too little energy, and are too expensive.

Wind and sun energy generation is often hundreds of miles from cities where it will be used. The U.S. does not have the transmission lines necessary to delivering that power. Building the lines would be enormously expensive, costing far more than any wind or sun generation facility could pay. It would be necessary to put power lines across farms and towns; there would be extreme political resistance.

Radioactive waste is a huge drawback to using nuclear fission energy. Nuclear *fission* (not fusion) generates radioactive compounds that stay radioactive for thousands of years. There has been some progress in designing nuclear reactors that burn some of the nuclear waste, reducing the radioactivity. If the waste is not re-processed, the use of nuclear fission commits many generations in the future to keeping the poisons safe; part of the total cost of nuclear fission is moved to an unknown very distant future. Everyone who is technically knowledgeable agrees with that.

Waste and pollution from burning coal is also a huge problem. The waste from burning coal is also radioactive, and also contains poisonous substances such as mercury: *"The top 50 most-polluting coal-burning power plants in the United States emitted 20 tons of toxic mercury into the air in 2007..."*

http://www.ens-newswire.com/ens/nov2008/2008-11-21-092.html

Nuclear *fusion* is the only technology that could conceivably take the place of the major energy sources. There are no nuclear *fusion* power plants (not *fission*). At present fusion technology does not produce more energy than it consumes. All present fusion reactors are just experiments; if they become successful, they will be far cleaner.

Energy generation by nuclear fusion may eventually be available, but it is estimated that the biggest fusion project, the ITER, will be first tested in 2038, and it may not be successful in generating more energy than it consumes; it may be a complete failure.

http://www.iter.org/

The ITER is a project to build a very large Tokamak, a fusion reactor in a donut shape (a torus or toroid). There are about 24 Tokamaks operating today for research; none generate more power than they consume. The ITER researchers think their larger unit will possibly be successful.

Nuclear fission power plants should not be built close to ocean beaches. The plants need secondary cooling water, but that water can be piped inland more safely and reliably than a fission plant can be built near a beach.

Tsunami is a Japanese word; the Japanese have often experienced destructive tsunamis; somehow that problem was ignored when the Fukushima plant was built.

Nothing complete, no balance. News and documentary shows have apparently never given viewers a complete and balanced view of energy generation and use. Nuclear fission plants create hazardous waste that might, if there is a serious accident, be released into the environment. Burning oil and gas and coal puts hazardous materials into the air. The sun and wind system designs now available cannot supply enough energy for our needs. There are no happy options, only decisions about what methods are least destructive.

The problem must be solved in the coming decades or there will be economic collapse.

Shortcomings of the *Nuclear Aftershock* documentary

Those ignorant about technology typically don't detect their ignorance, don't think they need to know more, and don't understand criticism. Neil E. Todreas, retired Professor of Nuclear Science at MIT, tried to correct some of the faults in the *Frontline* documentary in a comment posted on the web page.

Frontline responded to Professor Todreas in a manner that the author of this article has found is typical for those who have little or no technical knowledge. The *Frontline* staff assumed that they understood his objections. Here are parts of the response, and some observations:

Frontline: *Indian Point is sited about one mile from an intersecting seismic line and the Ramapo fault zone. We felt it was within journalistic standards to characterize the proximity as "right on the fault," relatively.*

Observation: Professor Todreas did not intend to discuss the distance of the Indian Point nuclear plant from the fault. The important fact is that no earthquake has been shown to come from that fault. The fault is there, but there has been no evidence that it is active. Some volcanoes have not erupted in 100 million years.

Frontline: *We did not have time to include another geological expert, so we were careful to state that Dr Sykes' views are not shared by some other geologists, that many doubt the fault is active, and that Entergy maintain the plant is designed to withstand a 7.0 magnitude quake* (Should be "Entergy Corporation". Should be "maintains". No period at the end.)

Observation: What is important is what is communicated, which is that the situation at Indian Point is similar to that at Fukushima.

Frontline: *Dr. Todreas says that the story dialogue speaks of 'the' evacuation route for residents near Indian Point, when in fact there are multiple routes in various directions from the plant.*

Our reporting on the evacuation routes within the 10- Emergency Planning Zone (EPZ) from Indian Point Energy Center in Westchester County involved studying the official evacuation guide, interviewing local residents and officials in Buchanan about the evacuation guide and driving one of the two official evacuation routes for the residents of Buchanan to the evacuation center at White Plains High School. We repeatedly requested and were repeatedly denied access to interview Westchester County Officials to explain on-camera the course of action in the event of a radiological accident at Indian Point for Westchester County residents living within the 10-mile EPZ. It was important to address the fact that in Japan, residents were forced to evacuate beyond a 10-mile radius, and the NRC recommended that all Americans within 50-miles of Fukushima Daiichi should evacuate. To that point, we spoke with residents outside the EPZ and with Paul Feiner, the mayor of nearby Greenburgh, who is concerned the EPZ is not realistic, and has been calling for a mock evacuation for years, but with no success.

Observation: Yes, they did a lot of work, but that is not relevant. What is relevant is the shocking irresponsibility of the narrator turning to the camera and saying that, because of the busy traffic, he doubted that those who live near the Indian Point nuclear reactor would be able to evacuate in time. That was a comment from someone annoyed by the traffic he was experiencing; it should not have been part of the documentary. To the author of this article, that casual comment was the most intense and dramatic and memorable scene in the entire documentary. The comment implied "We know they will have to evacuate, eventually."

Frontline: *Finally, Dr. Todreas raises the issue of why we didnt include the very recently NRC approved AP1000 plants, to be built over the next 4-5 years in Georgia and South Carolina. These are the first new construction starts since the 70s, and an exciting development that raises the possibility of more advanced inherently safer reactors. We considered including mentioning this late breaking news. In the end, we decided that:*

(a) the projects were at too early a stage — the only thing to film was earth being moved; (b) the projects were special: sited in regulated energy markets in the south, where the enormous costs (underwritten by federal loan guarantees) could be paid for with energy tariffs.

Observation: In that comment there is no apparent understanding that nuclear fission power plants built in the future, anywhere, will be using designs that are very much improved. That is not *"late breaking news"*, it has been understood for years.

Funny, foolish quote: *"... the only thing to film was earth being moved..."*

Many people who make motion pictures think of themselves as artists, and their work as art with a value that exists separate from everything else. In a documentary, some don't care what is communicated, they care about their contribution. So it doesn't matter to them that they avoid an important subject when it doesn't contribute to their art. That is painfully misleading in this case, but a bit humorous also.

Frontline: *It also seems that the essential argument Charles Ferguson made that our aging fleet will be retired in 20 plus years, would only be challenged if a major building program gets underway. He said "Unless we make a decision to build new reactors, were headed toward a retirement cliff of our reactors 20 years from now." Four plants in the south are a start but hardly an answer to our impending nuclear phase-out.* [Should be "... Charles Ferguson made, that..." Should be "we are headed".]

Observation: New reactors have not yet been built because most people in the U.S. believe they should not be built. Political leaders lack technical knowledge, and the reporting that most citizens see is ignorant about technology. The U.S. has not been guided correctly.

The *Nuclear Aftershock* documentary gives the strong impression that nuclear power is not safe, and that more nuclear plants should not be built. The above answer indicates differently. Apparently those who made the documentary allowed it to give an impression that is different from what they later came to believe. That kind of confusion is typical in people who have inadequate technical understanding.

The kinds of mistakes made in the *Nuclear Aftershock* documentary are extremely common. In general, technology is not reported well. Those who report technology to the public are generally not those who understand it. Since they don't have understanding, they cannot possibly know how to choose someone to guide them. They also don't seem concerned about accuracy enough to ask for guidance.

Not complete. There is a strong need for more research about nuclear power, more complete information, and more careful editing than this article provides.

There are thousands like this. The kinds of mistakes made by the makers of the *Frontline* documentary can be seen in many, many other areas, such as in legislation, for example. CEOs of large companies often overestimate their technical competence; a few examples of that are given beginning on page 8 of our manual available on the ***Futurepower*®** web site.

No conflict of interest. The author of this article does not have any connection with those who profit from nuclear power.

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http://futurepower.net/leadership/leadership.html

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