

The World Nuclear University makes the world a just a little bit smaller

It has been a wonderful experience participating in the World Nuclear University (WNU) for the last 12 years. The best part has been meeting fascinating people who are interested in nuclear power in so many different countries.

I am involved in two WNU programs, the WNU 3-day short course – **Key Issues in the World Nuclear Industry Today** – and in the 5-week long **WNU Summer Institute (SI)**.

The short course takes place in countries all around the world (last year included Brazil, China, South Korea and the UAE) and brings together students, industry and government – arranging for both foreign and local experts to talk to them about key industry issues while also supporting increased networking as they discuss these issues amongst themselves. To date more than 3,500 people have participated in this program.

The longer Summer Institute is a comprehensive program focused on developing young future leaders (Fellows) in the global nuclear industry. WNU Fellows become part of an expanding global network currently consisting of more than 1,100 Fellows from 84 countries. This program also takes place in different countries from year to year. Last year it was held in South Korea. This year it is in Bucharest, Romania and Baden, Switzerland – and next year will be in Japan.



WNU SI fellows visit the Cernavoda CANDU Nuclear Power Plant in Romania

While my focus has been predominantly on the subjects that I lecture on, nuclear economics, and nuclear project structuring and financing, this year while attending the WNU SI in Bucharest, I had an aha moment. Previously I was focused on the words “nuclear” and “university” in WNU. But now I understand. The most important word of all is **“World”**.

We are living in challenging times and increased tensions amongst nations does have an impact on the global nuclear industry. This is an industry that is heavily politicised with most decisions taking place at the highest levels of government. Yet we all know that this is an industry that needs global collaboration to succeed. We all understand that what happens in one country impacts us all, as did the accidents at Chernobyl and Fukushima. Global organizations like the International Atomic Energy Agency (IAEA) as a governmental organization, and the World Association of

Nuclear Operators (WANO) as an industry association, work towards raising the bar so that we all benefit from continuous improvement. The results are obvious, the global nuclear fleet is operating at its best and we have one of the safest industries on the planet. And even though many of the world's nuclear plants are relatively old and near their end of life, it is through global cooperation that we are now striving to extend the lives of the global fleet, with great success.

I did my bit at this year's Summer Institute, with its 82 fellows from 39 countries, in the first week of July. Yes, you heard correctly, from 39 countries. And although nothing new, this year it struck me how important it is as these young future industry leaders build strong international relationships. Each day at SI starts with a good morning from fellows from one of the participating countries, where they share a little bit about their country, people and culture. This is warmly welcomed by the others, as they love learning a bit about places they likely have never been, and about which they know very little. I witnessed one of the many exercises performed by the fellows, where they learned about specific issues by talking about programs in different markets. One thing was absolutely clear. The discussion was about all different types of plants and markets – and the respect for each others' backgrounds and programs was profound. There is no doubt that each of these 82 men and women will go back home with increased knowledge and a newfound respect for those from the other 38 countries; and most of all, with new friends from around the world that will last them the rest of their careers.

I have been seeing this happen for years now, but somehow this year it made a big impression on me. Getting to know each other a little bit better is an important step that will make us all better off while building a stronger more vibrant global

nuclear industry.

Optimism is the way forward – Nuclear Power delivers

We had an important piece of good news this month as Sendai Unit 1 was restarted in Japan, ending a long period of no nuclear generation in that country after the Fukushima accident in 2011. Sendai Unit 2 is following close behind and Japan will continue to restart many of its nuclear plants as it moves to put the accident behind it and reap the benefits of nuclear generation once again. Recent experience without nuclear has led the country to import vast quantities of fossil fuels, increase its carbon emissions and damage its balance of trade. While difficult for many, the Japanese understand the benefits of continuing with nuclear power are essential to the well-being of their society.



Sendai

Nuclear Power Plant

Unfortunately as we have learned from this accident so far, it is fear of radiation that is having the largest impact on peoples' health rather than the radiation itself. To date no one has died from radiation at Fukushima and no one is likely to die from radiation in the future, yet fear is what is consuming these people and their lives – and the policy decisions being taken by government.

Of course, we must always think about those that were directly impacted by the accident. Many remain out of their homes and those that are permitted to return are often afraid. We must continue to understand their plight and work together to help them get their lives back and of most importance, once again have hope for their future.

A couple of weeks ago I was watching Fareed Zakaria on CNN

interview President Obama about the Iran nuclear deal. I don't want to talk about that here but I do want to share Fareed's thoughts on President Obama's optimism. He suggested that Obama is an optimist and noted that *"history suggests that it's the optimists who have tended to be right"*. He went on to say that *"today we are awash in pessimism, with people who see the world as a dark and dangerous place, where threats are growing and enemies are gaining strength."*

It made me think of our own world of nuclear power, where we are awash in pessimism; And it is easy to be pessimistic when articles such as the one by Michael Ignatieff, (who has previously run for Prime Minister of Canada) concludes after his visit to the Fukushima area with a message that seems to be the prevailing view of nuclear power to many. *"For the rest of us, outside Japan, we have moved on, more dubious about nuclear power than before, but still locked into the energy and economic system that requires it. Fukushima is now classed with Three Mile Island and Chernobyl in a trio of warning disasters, but so far none of these has persuaded the world, **at least so far**, to exit nuclear."* Clearly the message is – we need it for now, but when are we going to realize that the risk is just not worth the benefits?

It is easy to be pessimistic when there are documentaries that reach similar conclusions. In "Uranium – Twisting the Dragon's Tail" by Dr. Derek Muller, a physicist by training, the two part series focused on the bomb in Episode 1 and on the accidents at Chernobyl and Fukushima in Episode 2. Watching one can see that positive facts are presented such as radiation is not as dangerous as people think but the series is not about the benefits of nuclear power – rather it focuses on fueling the fear.

And there is no doubt the biggest issue is fear of radiation. As stated in Mr. Ignatieff's article, *"Today, Tokyo shoppers still won't buy rice, soya, or miso produced in the region and nobody will touch the catch from the local fishermen, even*

though the fish have been pronounced safe." On his visit to the region he says *"In the enclosed valleys, as our bus climbed up the winding roads towards the coast—still many miles from the nuclear plant—radiation rose to double the levels in Tokyo. We're told it's safe to travel to Namie but it's still not clear what safe means."* After this accident trust is in short supply and lack of trust definitely increases the fear.

What is also clear is that setting policy based on fear does not result in good policy. In Germany, they prematurely shut down safe, effective and economic plants much earlier than needed. Even while building a huge amount of renewable generation, the Germans had to also build new coal plants both increasing electricity costs and emissions. It doesn't take much to realize that even with a strategic goal of eliminating nuclear power, taking the time to build clean replacements and shutting the existing plants down more slowly would have worked just fine – but setting policy driven by short-term fear of radiation doesn't allow for sensible decisions. With over 200 nuclear plants throughout Europe, nuclear power has been a safe and essential element of electricity generation for decades without a single incident of harm.

Going back to what was said by Fareed Zakaria, *"history suggests that it's the optimists who have tended to be right"*, we definitely choose to be optimistic and here is why.

The world needs clean and abundant energy for a better future for us all. For those with limited or no access to a reliable source of electricity, providing this resource makes a huge positive impact in their standard of living. And while we all agree that in richer countries there is opportunity to become more energy efficient, just look how dramatically our lives are impacted if there is an outage for any sustained period of time. Nuclear energy meets that need. It provides clean, abundant, economic and reliable electricity. Its energy density is matched by none so it can provide huge quantities

of electricity from very small quantities of fuel, clearly what will be needed as the world population approaches 9 billion in the years to come.

The rapidly growing economies in the world like China and India are very aware of the benefits that come with robust nuclear programs as they embrace nuclear power to support their rapid growth in energy demand. Other energy-poor countries are also eager to move forward. The 67 units under construction around the world represents the largest new build program in decades and while many (25) are being built in China, the rest are distributed in 12 different countries.

But most of all what makes us optimistic about the future are the large numbers of energetic, bright and talented young people entering the industry. This month I had the opportunity to lecture at the World Nuclear University Summer Institute in Uppsala, Sweden. The current generation of young engineers and scientists have grown up in an era where they are strongly supportive of technology and believe that anything is possible if they put their mind to it. It did not take long to see that the future of the industry is in good hands.

The time has come to get off our hind foot and stand up proudly and proclaim what we know to be true – that nuclear power has an important place in the world and will continue to expand its role as we need reliable economic and abundant energy for society. It is an essential energy option of choice, not of last resort, that we shouldn't wish we could do without.

We are all talking to each other but is anybody out there really listening?

Was just in Oxford where I gave a lecture to the WNU Summer institute – a great group of young people who are committed to working in the nuclear industry and doing what they think is best for their and our collective futures. Oxford is a great place to quietly contemplate recent events and consider whether or not we are going in the right direction. (Not to mention I enjoyed having lunch in the “Harry Potter” dining hall).

As were many, I was interested in the recent paper written by Ten Hoeve and Mark Jacobson from Stanford University, ‘Worldwide health effects of the Fukushima Daiichi nuclear accident’ published in the journal Energy and Environmental Science basically predicting that there will be 130 cancer deaths globally from the Fukushima accident. While it would be easy to simply accept this outcome since the number of deaths is relatively low, especially in the context of the large number of deaths caused by the earthquake and tsunami in Japan, the study has been criticized as poor science – and very effectively by Mark Lynas. It is not the criticism that I find interesting but the comments on Mark’s blog by those both supporting and opposing the study, including the authors. Now I don’t want to spend my time discussing the study as in my opinion Mark did a fine job – but rather the implications of the two sides debating it.

I recently read “The Believing Brain” by Dr. Michael Shermer (as well as some other stuff) that helps to create some understanding of the situation that we find ourselves in. What I found fascinating about the debate on the Stanford study is not whether or not it is accurate or nonsense, but

the fact that independent of the facts, the chance of either side changing their opinion in any way based on the debate is effectively zero. Or in other words as clearly stated by Michael Shermer – beliefs come first – we then look for information to support these beliefs and the more we investigate the stronger we believe. We have natural filters to dismiss opposing views and carefully collect supporting evidence for our position.

The issue is important because we as scientists and engineers love to believe that if only we can better educate the public then they will come around to see what we so obviously see. Well, unfortunately nothing can be further from the truth. Most peoples' beliefs are so embedded that no matter how much more information is provided, they are most unlikely to change their point of view.

Let's come back to the fundamental issue of concern. The public generally believes that nuclear power is inherently dangerous. So what we really need to do is to try and understand where these beliefs come from and then work to get to the source and see if over time we can change some of these perceptions. And frankly as I have stated before, we are inadvertent contributors to this belief as we in the industry love to explain how difficult it is to manage nuclear power and how seriously we take safety thus reinforcing that it must be very dangerous indeed.

I visited the Atomic Test Site Museum in Las Vegas a couple of weeks back and it is obvious that the association of nuclear power with nuclear weapons is a powerful one. In the museum there was mention of TMI and Chernobyl as examples of when the peaceful use of this technology went wrong. And this even translates to popular culture. In the recent Batman movie, the core of a new advanced fusion reactor is designed for good to power the world and yet is removed and transformed into a weapon of mass destruction in mere moments by a very smart scientist (although apparently there is only one such smart

guy). While only a movie the connection between atomic weapons and power is simple and clear.

Going back to the debate over the Stanford study, let's consider other examples that I have used in the past. First we recently had the final report released on the cause of the Air France crash out of Brazil a couple of years back. It found root causes, suggested corrective actions and that was that. There is no "anti flying" group that came out and said, "see – look what happened here – clearly air travel is too dangerous and it should be abolished." In fact we laugh at the thought of it. Yet more people died on this one flight than the nuclear industry has killed in its entire history. This is because we fundamentally believe that air travel is safe. That's not to say that at some level of accidents, the public would stop flying – but where is this level? I don't know.

The same with the organic food farming incident in Germany. Killed 50 hospitalized 4000 and there is no anti organic food group writing reports on the dangers of organic farming and calling for an end to it.

Yet every nuclear incident is more proof of why nuclear power shouldn't exist. As told to me by my very talkative taxi driver in Vegas on the way to the airport- we have solar and wind, we don't really need nuclear power. The implication being that we all know nuclear power is dangerous and that if we have alternatives, we should use them first.

Of course the truth is actually the opposite. Nuclear power is economic, clean, efficient, reliable and concentrated using very little land. This makes it a great option for long term power production, not the option of last resort.

So if we can't change people's minds through education alone, what do we do next? Well, an unexpected event or crisis is what will cause some people to revisit their beliefs. In this

case the recent crisis is negative for the industry (Fukushima) so many are now questioning nuclear power. Yet somehow in a number of countries support for nuclear power remains strong.

In the UK, support for nuclear power is rising, even following Fukushima and with their close neighbours Germany deciding to abandon their nuclear program. Why is this? Well one thought is that the British understand that they are in dire need of electricity and are very concerned about being overly dependent upon gas from Russia (the crisis). Another contributing factor would be the post Fukushima conversion of George Monbiot to nuclear supporter. He is credible with the public and has taken tough stands on many popular issues. There is no doubt that if he changed his mind on nuclear that is food for thought to the public.

In the US, energy independence is an important issue. Americans do not want to be overly dependent upon middle eastern states for their energy and are looking for ways to be more self sufficient. Nuclear power is one option to help them solve this issue. But of course this support can be somewhat fragile unless we get to the root of the public's concerns. For example, now in the US, gas prices are low once again allowing another viable option to overtake increasing support for nuclear.

So what am I getting to here? Well let's put in one final quote from Dan Gardner's book "Future Babble" which is actually a quote from Leon Festinger. *"Suppose an individual believes something with his whole heart. Suppose further that he has a commitment to this belief, that he has taken irrevocable actions because of it; finally, suppose that he is presented with evidence, unequivocal and undeniable evidence, that his belief is wrong; what will happen? The individual will frequently emerge, not only unshaken, but even more convinced of the truth of his beliefs than ever before."* (I really liked this book and will cite it further in a future

post.)

So does this mean the situation is hopeless? Not at all but we must fundamentally change how we approach the problem. We need to make use of experts as do other industries to better understand the driving issues behind negative views on nuclear power and then address the root cause. We must accept that the task at hand is large and may take a generation to accomplish and most of all we must acknowledge that there will be setbacks along the way. We must bring credible opinion leaders on side and we must have a global concentrated effort to demonstrate the benefits of nuclear power with simple focused and effective messages; but most of all provide a better understanding of the risks and note that the doomsday scenario is for the comics and not for real life.

I would like to know your thoughts on how we should work together as an industry going forward to really make headway on this important issue of the power of belief. After all, as are those who disagree with us, we are all committed to our beliefs – so how can we make the progress we need to bring more understanding and support for our answer to global energy needs?