

# A strategy for nuclear communications – listen

Not a day goes by when we don't read something about the public acceptance problem in the nuclear industry. A recent article preaching the end of the nuclear era had a pretty strong statement that sums up like this – *“Nuclear looks ever more like a 20th-century dinosaur, unloved by investors, the public, and policymakers alike.”* While I don't believe this is actually the case, I am sure that many in the public would not find much to fault with it. And that is the challenge we face.

For more than 30 years we have been hearing that the public just don't understand the nuclear message – that we need to better educate them – and that while we are all smart folks we are very bad at communicating. Yawn.....

As an industry, we pride ourselves on maintaining detailed OPEX from around the world and learning lessons to foster continuous operations improvement. Yet, while there has actually been a lot of recent good work on communicating with the public, in this non-technical area we are much slower in leaning the lessons we need to learn.

Beliefs about nuclear power are well entrenched in society. Most of the concerns come from its weapons origin and a significant fear of radiation that will not just go away with a simple explanation or better education.

This fear translates into fears about nuclear power plants. It is a common belief that we are safely operating doomsday machines. i.e. that a nuclear accident can have such far reaching consequences that it can literally destroy the world. If that is one's belief how can you convince him or her to support this technology? Talking about low



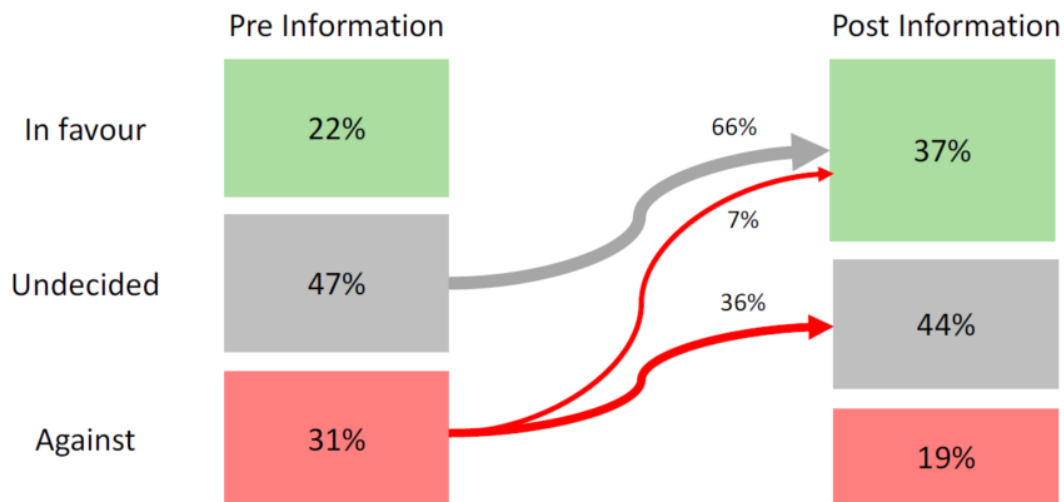
probabilities is of little interest when the perceived consequence is so dire.

Yet, there is hope. There is generational change coming and this new generation is not afraid of technology, but rather sees it as the solution to everything. They have other issues on their minds such as climate change – they likely don't think much about nuclear power at all.

In our home country of Canada, a recent small study shows very interesting results. Without any scene setting, a simple question on whether the public is in favour of nuclear power shows about a fifth in favour, a third against and the most, about half in the undecided column. This probably demonstrates that nuclear power is not a top of mind issue for many Canadians. However, what is important about this study is that once the question is asked again, if prefaced by some scenarios providing information – such as today nuclear provides 17% of electricity in Canada but less than 1% of carbon emissions; or that Canada has more than 50 years of operating nuclear plants safely; or that small reactors may provide much needed energy to help in Canada's remote communities; then the result is quite different. The chart below suggests that given a positive reason to think about nuclear power, people are likely to change their view with support growing and opposition declining. The lesson here is that people can be open to a new discussion about nuclear power BUT this must be on the basis of them considering that it is a possible solution to an issue of relative importance to them.



## CAN IDEAS SHIFT OPINION?



Or to be more clear, the first step is not trying to reduce the fear of nuclear. Without giving people a reason to listen you may as well be talking to yourself. What is needed is to LISTEN, understand what issues are important to the public and demonstrate that nuclear power is a possible solution. Whether their issue is climate change, energy poverty in the far north, energy innovation, high quality job creation, or just electricity reliability; it is only by addressing these issues that there will be an appetite for listening to us to find out more.

A great example is the group Environmental Progress in the USA. Here is a world renown life long environmentalist, Michael Shellenberger, taking up the fight to support nuclear power as a tool to meet environmental goals. I don't know Michael personally but I would guess that he didn't just wake up one day with a huge aha moment and decide nuclear power is a fantastic technology that he wanted to support; but rather he looked for solutions to what is important to him, the environment. This is clearly set out in the EP mission – *"Nature and Prosperity for All – Environmental Progress (EP) was founded to achieve two big goals: lift all humans out of poverty, and save the natural environment. These goals can be*



*achieved by mid-century – but only if we remove the obstacles to cheap, reliable and clean energy.”* I expect that over time, in his quest to improve the environment, he came to consider nuclear as an option and became open to listening and learning more about whether this option would help to achieve these goals.

I have read many of the posts by EP and they are excellent. But what is of interest to me as an industry person is that the arguments being made in support of nuclear power are not new. In fact, they are mostly the same arguments we have been making for the more than the 35 years we have been in this industry. So, what has changed? The dialogue. Once there was a clear goal that is not directly about nuclear power, there became an openness to learn more about those options that can help meet that goal. And then the facts can be discussed and as we know, the facts tell a good story.

What do we learn here? We have a huge opportunity today to change the discussion about nuclear power, but the first step is to stop and listen. It's not about talking about safety and the LNT model for radiation protection; it's about understanding the issues of importance to a new generation and then having a conversation to show that nuclear can be part of the solution. Just trying to educate has taken us nowhere. But once we listen, then we can expect others to open their minds and listen too. Only then can we say that nuclear power is not a 20<sup>th</sup> – century dinosaur; but rather is a technological wonder able to produce the huge amounts of clean reliable energy required for the 21<sup>st</sup> century and beyond.

**Note:** This is one of a series of posts to engage in a healthy discussion on public acceptance and nuclear advocacy. As we think about these issues we would like to point out an excellent book by Meredith Angwin, *“Campaigning for Clean Air: Strategies for Pro-Nuclear Advocacy”*. If you are at all interested in nuclear advocacy, this is a must read.



---

# **In an era where facts no longer matter, consequences still do**

Over the last few years, we have written extensively about the strength of peoples' beliefs and how difficult it is to change them. In spite of this, I thought we were making progress with a push to more evidence-based decision making. For something as polarizing as nuclear power, facts-based decision making is critical to increasing support. (I understand the paradigm of fear of radiation is more emotional than fact based and I agree that we need to appeal to emotions to create the change we need – but let's leave that to a future discussion. In any case it certainly doesn't hurt to have the facts on your side.)

With the populist surge in 2016 we have seen an accompanying rise in complete disregard for facts; all the way to the propagation of absolute lies (or "alternative facts") to support peoples' beliefs. I don't want to get into a political discussion nor take sides on right versus left. What I do want to do in today's post is to discuss something more fundamental – i.e. that although we are free to believe what we want – that beliefs have consequences – and that consequences matter.

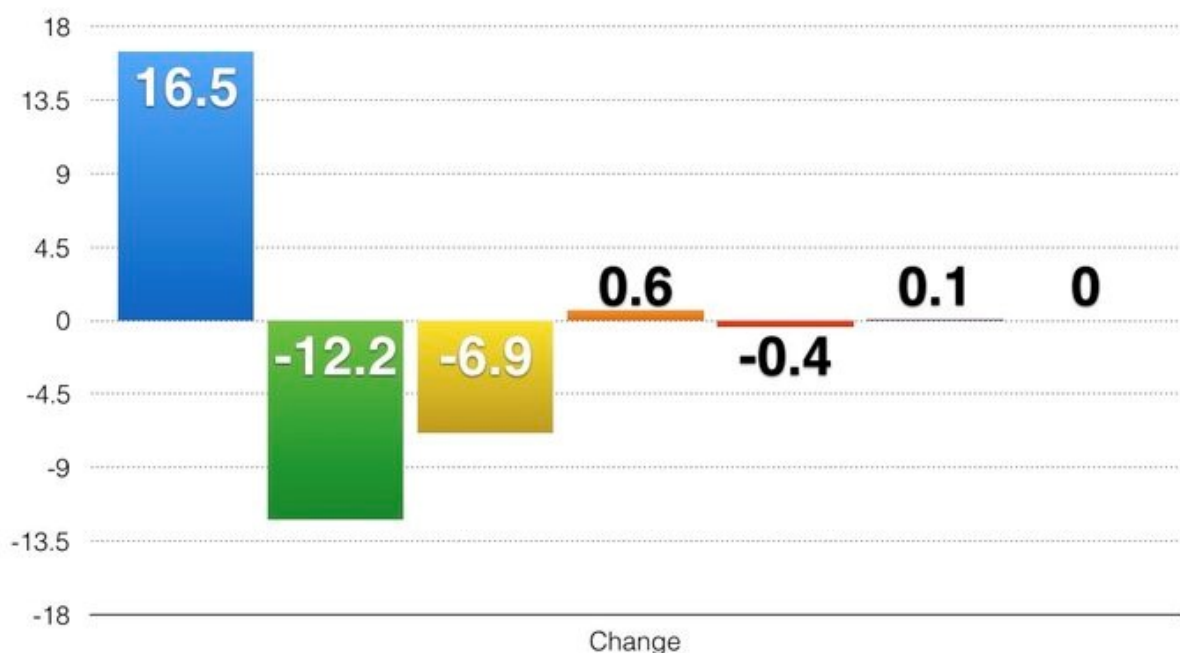
So, let's look at what happens when countries believe they can eliminate nuclear power from the mix and replace it with more wind and solar power. Of course, I am talking about Germany. Reducing carbon emissions is a reasonable goal as evidence (alternative facts notwithstanding) shows that climate change is impacting our environment and has long-term implications



for our entire society. On the other hand, removing a low-cost low-carbon source of energy like nuclear power because of safety concerns is based on a strong element of fear rather than evidence. In fact, Germany's nuclear plants are likely some of the safest in the world and there is no reason to suspect they will result in a catastrophic accident that means the end of Germany as we know it – yet that is what people fear.

So, what happens in a case like this? The results are in. Fossil fuel use is increasing in Germany, carbon emissions are going up and so is the cost of energy. The German people are paying more money for an outcome that does more damage to the environment and hence, their health. Frankly, it's a high price to pay for the piece of mind that comes from eliminating the perceived risk of nuclear. Or in other words, the extreme fear of nuclear is driving policy more than concern for either energy cost or the environment.

## Closure of Nuclear Plant Wiped out Emissions Reductions from Less Coal Power





As shown above, closure of another nuclear plant in 2015 resulted in increased emissions in 2016 (the first full year it was out of service) even though there was a substantial substitution of gas to replace coal.

And after adding 10 percent more wind turbine capacity and 2.5 percent more solar panel capacity between 2015 and 2016, less than one percent more electricity from wind and one percent less electricity from solar was generated in 2016. So, not only did new solar and wind not make up for the lost nuclear, the percentage of time during 2016 that solar and wind produced electricity declined dramatically. And why was this the case? Very simply because Germany had significantly less sunshine and wind in 2016 than 2015.

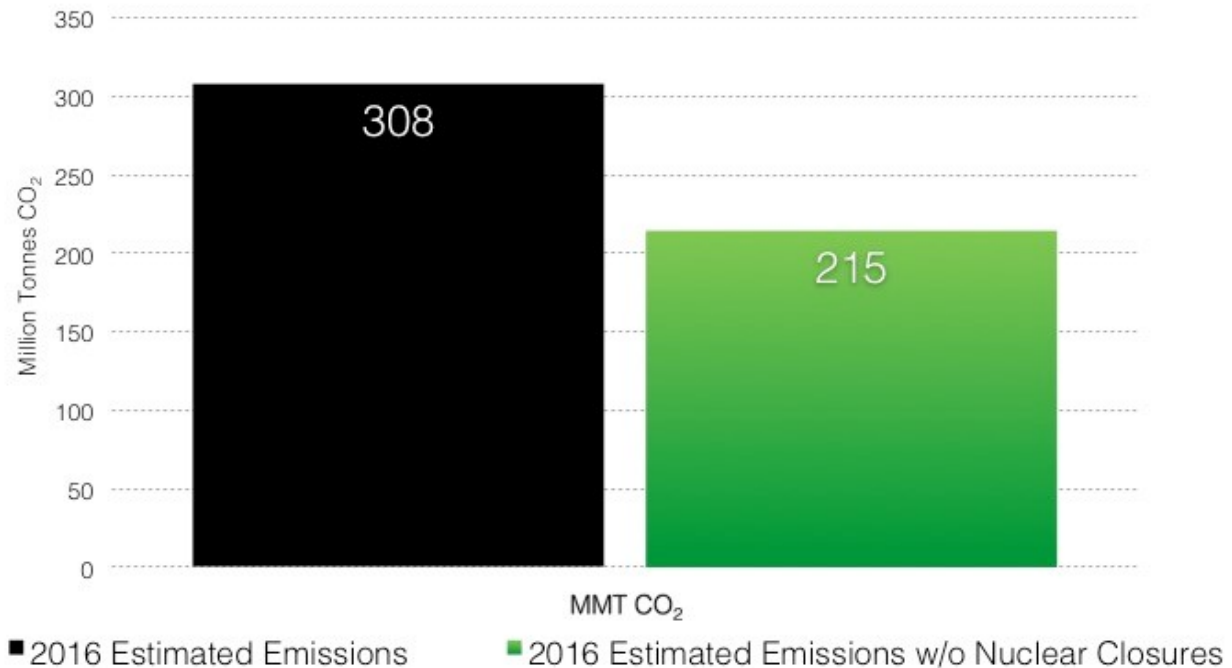
This analysis was done by Environmental Progress and shows that the intermittency of these renewable sources of electricity both throughout the day and from year to year mean that even huge increases in capacity of these forms of generation will continue to require fossil backup in the absence of nuclear power making 100% renewables an unachievable goal. Another study shows that to achieve a 100% renewable system in Germany would require a back-up system capable of providing power at a level of 89% of peak load to address the intermittency.

Comparing Germany to France, France has more than double the share of low carbon energy sources and Germany has more than twice the cost of energy as France.

So, trying to decarbonize by also removing nuclear from the mix at the same time is simply too high a mountain to climb. The following shows that German emissions were 43% higher in 2016 without the nuclear plants that have been already shut down. Keep in mind that they still do have operating nuclear and with more plants to shut down, the future trend is not likely to change.



## 2016 Germany Electricity Emissions 43% Higher Without Electricity From Closed Nuclear Plants



**Source:** EP analysis using preliminary 2016 electricity production data from Fraunhofer ISE; nuclear production assumed to displace lignite, hard coal, and natural gas production proportionally to the share of each on the grid in 2016



It's not just about Germany. As Japan struggles to get its nuclear plants back on line after the 2011 Fukushima accident, its use of coal has skyrocketed. In 2015 its use of fossil fuels for electricity generation was 82% compared to 62% in 2010 when the nuclear plants were in operation. And now Japan plans to build 45 new coal plants (20 GW) over the next decade to meet its energy needs.

Finally, we can also look at South Australia, a nuclear free zone. Recent blackouts due in part to lower wind availability and the inability of thermal plants to make up the shortfall are also leading to questions on 'how much renewables is too much'.

So, we can all continue to hold our beliefs very dearly and only listen to those that support them, while vilifying those that do not. However, please keep in mind that in a world where the farcical becomes reality, results still matter. And



for now, the results are clear, taking nuclear power out of the mix in Germany is not achieving its political-planners' goals. Yet these results are also not likely to change any German minds when it comes to nuclear power. But hey, why worry about the outcome when you know you are right or as said by comedian Chico Marx in the famous Marx brothers movie Duck Soup "Who you gonna believe – me or your own eyes?"?

---

## **Fighting for the environment – keep nuclear in the mix**

Earlier this month I enjoyed a week of vacation sitting on the beach in front of a beautiful camp (or cottage, cabin or country house, depending on where you are from) staring at a stunning view of the north shore of Lake Superior, the world's largest fresh water lake. This is pretty far north (at the 49<sup>th</sup> parallel), and this year the summer has been very hot. Once again, July has been the hottest month ever recorded.





It's times like this of quiet reflection that the issue of environment comes to the forefront. Contrast this idyllic view to that of some of the world's cities where pollution is rampant and health is impacted every day. This is the short term need – make the air breathable for all those that are having their health impacted negatively by pollution primarily coming from burning coal to generate electricity and from burning fossil fuels in cars each and every day. And then there is the issue of climate change. Harder for many to understand as the consequences are not as easy to see in the short term; but clearly the environmental issue of our time.

Let me start by saying that I am not one of those people that believe we should directly tie the future of nuclear power to climate change but rather that the case for nuclear needs to be made on its merits – reliability, economics, sustainability and yes, its environmental attributes. In fact, today environmental attributes of any generation technology should be the price of entry – low carbon and low polluting technologies are the ones that should make the list to be considered for deployment. However once on the list it is the other attributes that need to be considered when planning



and implementing a robust electricity supply system.

Looking at this beautiful view, I find it hard to understand how so many are trying to disadvantage the environment by excluding nuclear power from the list of technologies that are environmentally friendly. And not just for new generation, but many are fighting to close existing plants that have been providing clean, economic and reliable electricity to the grid for decades. Examples abound.

In California, a decision was recently taken to shut down Diablo Canyon in 2025 rather than extend its life and replace it with renewables and demand management. This decision has recently been severely criticized by Dr. James Hansen, one of the world's most prominent climate scientists who has asked the Governor for a debate on the issue stating *"Retirement of the plant will make a mockery of California's decarbonization efforts. Diablo Canyon's yearly output of 17,600 gigawatt-hours supplies 9 percent of California's total in-state electricity generation and 21 percent of its low-carbon generation. If Diablo closes it will be replaced mainly by natural gas, and California's carbon dioxide emissions will rise..."* [Read the entire text of the letter [here](#)]

In New York state there has been an important victory as nuclear has been included in the clean energy standard as legislators have acknowledged the important role that nuclear plays in reducing carbon emissions; and in fact accepts that meeting carbon objectives is simply impossible without nuclear. However, this is just a first step. It protects existing nuclear but also maintains the future target of 50% renewables, making nuclear a bridge to the future. Well if existing nuclear is good, then so should new nuclear – but that fight is for another day.

Of course the battle to include nuclear as a low carbon energy option is not uniquely a US issue. A new study \* by the University of Sussex and the Vienna School of International



Studies suggests that *“a strong national commitment to nuclear energy goes hand in hand with weak performance on climate change targets”*. While the authors do note that *“it’s difficult to show a causal link”*, this does not stop them from suggesting it is likely there. It is easy to say that Germany has done a good job and reduced its carbon emissions by 14% since 2005. What is not said is that Germany’s carbon reduction efforts have really struggled since it closed a number of nuclear plants in 2011 after the Fukushima accident and has yet to get back on track; which was likely a key factor in Sweden where the Greens have accepted the need for continued nuclear operation to meet its climate goal.

Here in my home jurisdiction of Ontario Canada, we had the largest carbon reduction in all of North America as coal was removed from the generation mix in 2014. This was not done by replacing coal with renewables although renewable generation has increased, but was made possible by refurbishing and returning nuclear units into service.

I have written extensively about peoples’ belief systems over the years and this is what is standing between nuclear and success. Ask anyone in the street about clean electricity and you will hear that renewables, primarily wind and solar, are what is needed to transform our energy systems. Ask about nuclear and the response is much more likely to be mixed.

It is great news that many environmentalists are now seeing the necessity of nuclear in the mix. As concluded by James Hansen in his letter *“It would be a tragedy if we were to allow irrational fear to harm the climate and endanger the future of our children and grandchildren.”* So if we are to avoid a tragedy, we in the nuclear industry have a lot of work to change the narrative and continue to increase public support. The agreement in New York is a good beginning but the hard work has only just begun.

**\* The study referenced above was retracted by the authors on**



November 25, 2016 as they admitted mistakes in the analysis.  
The link to the retraction on Retraction Watch is [here](#).

---

## **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.

---



# **A nuclear future means clean, reliable and economic electricity; yet fossil fuels reign supreme**

This past month, following the fourth anniversary of the Fukushima accident, it is good to see there is less emphasis on the nuclear accident and more discussion of the significant natural disaster – the tsunami and earthquake that killed some 20,000 and destroyed so much, leaving 300,000 homeless. It is now clear that the nuclear accident will not be a cause for radiation-induced cancer, food is not contaminated, and most people can return to their homes should they so desire. While there continues to be a big mess to clean up and many important lessons in managing nuclear accidents to learn, there is no disaster in terms of either immediate or long-term health impacts. Yet we still see news such as was reported this week- that Fukushima radiation has reached the west coast of Canada – one then has to read the report to find out it is so minute as to be a non-event.

So now 4 years on, if we look at China one could conclude the nuclear industry is booming. CGN reported 3 new units were connected to the grid in March, with 2 more expected to be connected within this year. Overall China now has 24 units in operation and another 25 under construction targeting 58 GW in service by 2020 and then accelerating from there to bringing as many as 10 units per year into service in the 2020s targeting about 130 GW by 2030. Two new reactors have just been approved in the first approvals for new units post Fukushima. In addition to this, China is now developing its Hualong One reactor for export as it strives to become a major player in the global nuclear market.





China Hongyanhe 3

completed

China's commitment to nuclear power is strong and unwavering. An important reason for this rapid expansion is the need for clean air. Pollution in China is a real and everyday problem for its large population. The Chinese see nuclear power as path to ultimately reducing their need to burn coal and hence help the environment.

On the other hand, in Germany a decision to shut down some nuclear units in 2011 immediately following the Fukushima accident and to close the rest by 2022 has led to a large new build construction program of lignite-fired units to meet short term energy needs. With several under construction and some now in operation, coal is producing about half of Germany's electricity. Keep in mind that these new plants will likely be in service until about 2050. This is while Germany supposedly is focusing its energy future on ensuring a cleaner environment using renewables. I would expect their goal would be easier to reach without a number of new coal-fired units going into operation to replace clean carbon free nuclear energy.





### The lignite coal fired power plant Frimmersdorf

It is with these two extremes in mind that I noted when attending the Nuclear Power Asia conference in Kuala Lumpur this past January that while almost all South East Asian countries are planning to start nuclear power programs, they have had little success in getting them off the ground. Currently Vietnam is in the lead and countries such as Indonesia and Malaysia are continuing with their plans, but with little progress. For example, Indonesia has been talking about nuclear power for more than 30 years. With a need for 35 GW of new capacity in the next five years and an annual expected growth of 10 GW per year after 2022, it is easy to ask why a decision for new nuclear seems perpetually stalled while there has been no problem building new fossil plants.

While in Malaysia I couldn't help but think – why is it so difficult to make a decision to invest in new nuclear plants, especially for first-time countries? Is it a fear of nuclear itself and the issues associated with public acceptance – or is it the commercial aspects whereby nuclear plants have relatively large capital expenditures up front raising



financing and risk issues? Or, more likely, a combination of the two.

At the same time as decisions on new nuclear seem to be so difficult to take, literally hundreds of coal plants and thousands of gas fired plants are being built around the world. If the environment is actually important, why is it so easy to invest in fossil stations and so hard to invest in nuclear? One simple answer is the size of the global fossil industry. Countries like Indonesia and Malaysia have huge industries with fossil fuel development being an essential part of their economies. The public is comfortable with this industry and many either work in, or profit from the industry in some way. The same is even true in Germany, where coal and lignite mining is entrenched. While committed to reducing hard coal use over time, once again this is an important industry in the short term.

For a country looking at nuclear for the first time, like those in South East Asia, there has to be a strong base of support to get the industry off the ground. They need to be serious about their consideration of the nuclear option, not just dabbling with little real interest. While these countries have modest research and other programs, there is simply not enough going on nor a strong belief that there are no alternatives to garner the political support to move forward. Starting a nuclear program is a large undertaking and the fear of securing public support and concerns about safety and financial ability to support the program are paramount. This makes it difficult for decisions to be taken. A strong and committed view from within government is needed and this can only be achieved with a strong need for energy and an even stronger belief that the public is on side.

China has passed this milestone and now has a large and vibrant domestic industry. Government support is assured so long as the industry continues to thrive. To the Chinese, the issue is clear. Nuclear plants are economic and their



environmental benefits are essential to helping solve their huge environmental issues. The Chinese have CONFIDENCE in their ability to deliver safe, economic and reliable nuclear power stations.

On the other hand, the Germans have decided their fear of nuclear is stronger and more urgent than their need to reduce their carbon emissions in the short term even though they had a large and strong domestic nuclear industry. In this case, Germany is an outlier and to this end they justify building new coal units even when their overriding goal is environmental improvement.

I am confident that nuclear plants will expand their already important role in the future electricity mix of the world and, as such, the industry needs to find new and innovative ways to make taking a nuclear decision easier. This includes ways to gain a higher level of public support, ensure that project risks are manageable and that costs can be kept under control. In some future posts, we will talk about some of these ideas and how we can unlock the global nuclear potential.

---

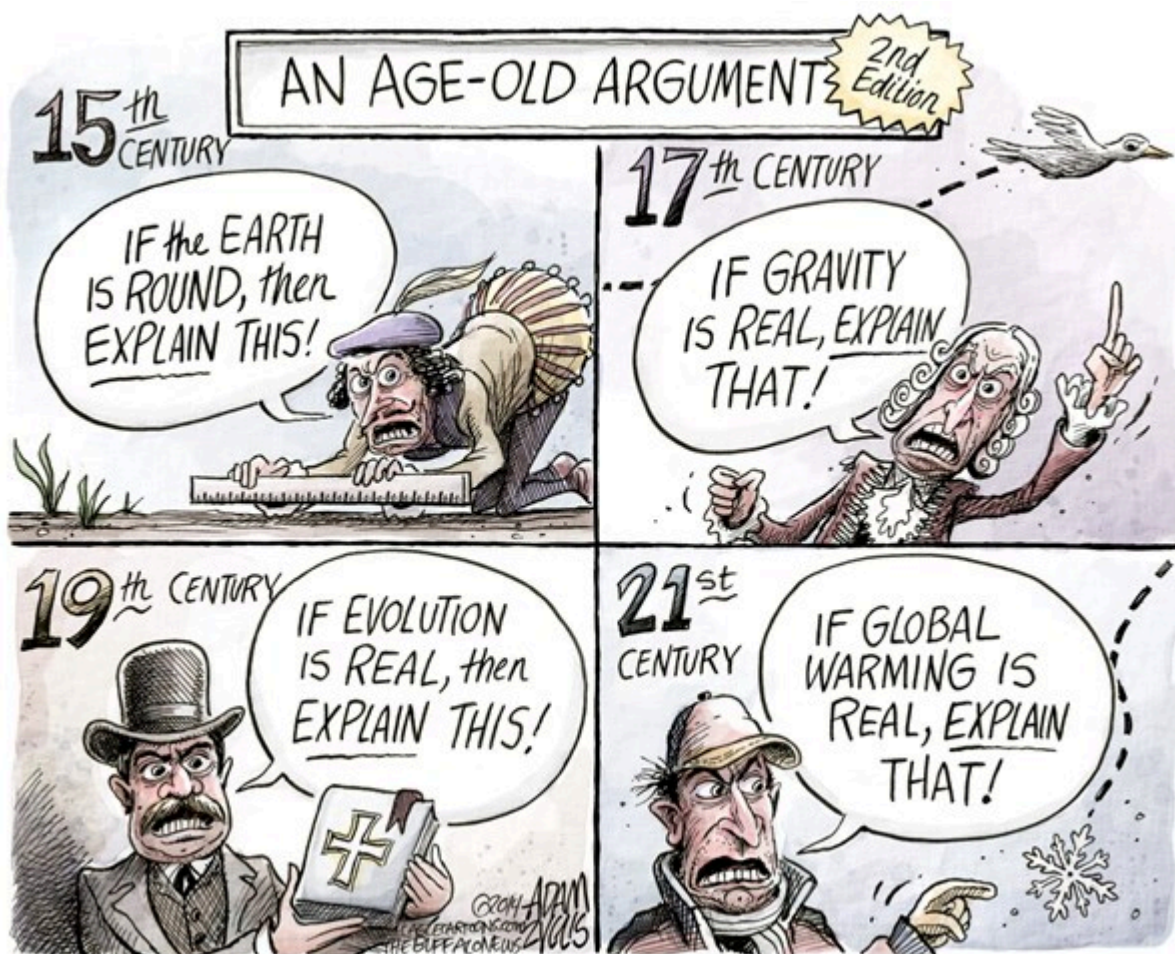
## **How can Nuclear Power Build Trust in a time when denying science is rampant?**

Recent public outcry as a measles outbreak has managed to impact much of North America has once again showed the nature of public deniers of science. In this case it is concerns about vaccinations that have led to numerous children falling sick with measles. While not considered a highly risky disease, some children get very sick and some may actually



die. The main concern is that it is very contagious so that without vaccinations it moves quickly within a community to infect large numbers of people, greatly increasing the public risk.

This is only the most recent large scale public outcry where science is ignored. It is the same as those who deny climate change and those who deny the safety and benefits of nuclear power.



The role of nuclear power in combating climate change has once again been demonstrated in the most recent update of the IEA Nuclear Power Roadmap.

- Based on the 2 degrees Celsius (°C) scenario (2DS) – nuclear power would continue to play a major role in lowering emissions from the power sector, while improving security of energy supply, supporting fuel diversity and providing large-scale electricity at



stable production costs.

- Global installed capacity would need to more than double from current levels of 396 gigawatts (GW) to reach 930 GW in 2050, with nuclear power representing 17% of global electricity production and a formidable growth for the nuclear industry.
- Governments have a role to play in ensuring a stable, long-term investment framework that allows capital-intensive projects to be developed and provides adequate electricity prices over the long term for all low-carbon technologies. Governments should also continue to support nuclear research and development (R&D), especially in the area of nuclear safety, advanced fuel cycles, waste management and innovative designs.

This means that a larger commitment to nuclear power is an important element of any strategy that has a chance of getting climate change under control.

The report also notes that public acceptance continues to be one of the major impediments to a stronger commitment to nuclear power in many markets. Concerns about safety, costs and waste disposal continue today; the same issues as they were back when I started work in this industry more than 30 years ago. While science can clearly demonstrate that nuclear power has benefited the environment, by avoiding significant amounts of pollutants and carbon emissions; is very safe; and that waste management is more of a social issue than a technical one: public attitudes remain very hard to change.

Generally the public has very different views on key issues than scientists. In this year's annual meeting of the American Association for the Advancement of Science (AAAS) a significant number of discussions were about how the public thinks about science issues and how scientists communicate about their work. On key issues the difference in opinion according to PEW research is striking. While 57% of the public believe that eating GMO food is unsafe, 88% of scientists



believe the opposite. Only 68% of adults believe vaccinations should be mandatory while scientists are at 86%. And finally only 50% of the public believe that climate change is man-made while 87% of scientists believe in man-made climate change. Clearly there is a huge gap between science and public beliefs. We in the nuclear industry are not the only ones to suffer from this lack of effective communication.

I have long noted when told the industry must better educate the public that in reality, the public does not want an industry science lesson which tends to be the approach most used in the past. In fact, when this approach fails, experts just shake their heads and try again. In reality what the public want to know is that the industry is safe, and that this safety is in the hands of experts that they trust to deliver upon this promise. We see that one of the largest impacts of the Fukushima accident in Japan is the loss of trust in both the utility and government by the population. The impact to the public of this is significant – the health impacts of the fear of radiation and the accident is far larger than the actual health impacts of any radiation to the public.

Trust is not something that is built overnight. It takes years, even decades to develop trust with the public – and only a moment to destroy it. People are skeptical (as they should be) and unfortunately are always ready to believe stories that discredit those they don't trust.

So why do I bring up the measles outbreak? Because we finally have an incident where the public seems outraged at deniers and supportive of science. Measles vaccinations are safe. Millions of doses have been safely given to children over decades. They save lives. And those that disagree have been putting not only their children at risk but also the children of their neighbours and colleagues. One has to ask, how can any educated, concerned adult put his or her own children at risk? Clearly they believe that the risk of vaccination is



higher than the risk of the disease. In the midst of all of this, recent news surveys are showing that significant numbers of people still believe the vaccination can put their children at risk. This is just not the case given the science.

It was said best by a mother in Pickering Ontario who has already lost a young child to illness and who now has her baby at risk, *"If you have chosen to not vaccinate yourself or your child, I blame you," she writes. "You have stood on the shoulders of our collective protection for too long. From that high height, we have given you the PRIVILEGE of our protection, for free. And in return, you gave me this week. A week from hell. Wherein I don't know if my BABY will develop something that has DEATH as a potential outcome."*

It is essential to understand these words. It is easy to oppose something when you are already benefiting from it. Yes, don't vaccinate your child because you know the risk of disease is low since all others are vaccinated, oppose GMO foods when you have ample safe food to eat while others are starving, and oppose climate change while you have reliable electricity and relatively clean air while others can't breathe and are the first to suffer the consequences.

There seems to be a large scale shift from public good to individual good in society these days. Trust in government, scientists and other institutions is very low. The public is not willing to accept that these institutions have their back so they quickly rush to beliefs that are not supported by science with the resulting ultimate negative impacts on society. To be fair these beliefs come because many of these institutions that were trusted in the past have let the public down. And in this day of instant news and social media, it is easy to attack, but then interest is lost by the time the truth comes out and only a small subset of those who read the original story of concern remain interested enough to see the truth when it comes out.



Trust – it is essential for the future of nuclear power. The public must trust the industry to deliver on its promise of developing and operating safe, reliable and economic nuclear plants. They must trust the government to provide a strong regulator to oversee the industry and ensure public safety. This industry is dependent upon this trust if it is to flourish.

Building trust in science is a task that goes well beyond the nuclear industry. Yes, scientists have much work to do to build that trust with the public and government, but governments must then ensure that they use science as a basis for policy. While it remains reasonable to question the results of science, it is not reasonable to base policy on the assumption that science is wrong. Government in all countries need science advisers in key positions to ensure that real science is heard when policy is being made.

The media is also part of the solution. Poor reporting looking for the sensationalist point of view is not helpful. Science journalists must be the ones to cover science issues and they must take the time to report on them correctly. Just this week there was a fascinating editorial in the Canadian newspaper, the Globe and Mail when a reader complained about the lack of “balance” on the vaccination issue. The response by the Globe is important reading, *“The reader is correct that news stories should be fair and balanced, but if The Globe were to include someone “credible” from the anti-vaxxer community, that would be false balance....False balance is when journalists twist themselves into a knot to try to balance scientific and expert views with someone whose views are not fact-based, expert or scientific..... False balance is not only poor journalism, it can harm the readers’ understanding because it suggests there is a balance between the views. In politics, for example, it is important and responsible to offer fair weight to different parties’ views. It is not responsible to offer equal weight to science versus flimsy beliefs.”*



The issue is that most people today listen to those they are familiar with and trust and discount those they don't know. Therefore nothing is more important than the scientific community listening to and speaking with the public in a way that earns their trust. Getting this done is essential to all of our futures. The work ahead of us all to build trust in science is huge and it will take a long time but we must be relentless in our efforts to make this happen.

Given the public push back in this measles outbreak, we can ask – is this the beginning of a new opportunity for dialogue on issues that are supported by science? Is the public starting to understand that their beliefs may be hurting them more than helping? If so, then we need to ensure that the nuclear industry is continuing to deliver open, honest and transparent information in support of its benefits while clearly explaining the magnitude of the risks. Science is on our side. Now it's time to make a strong case to the public.

---

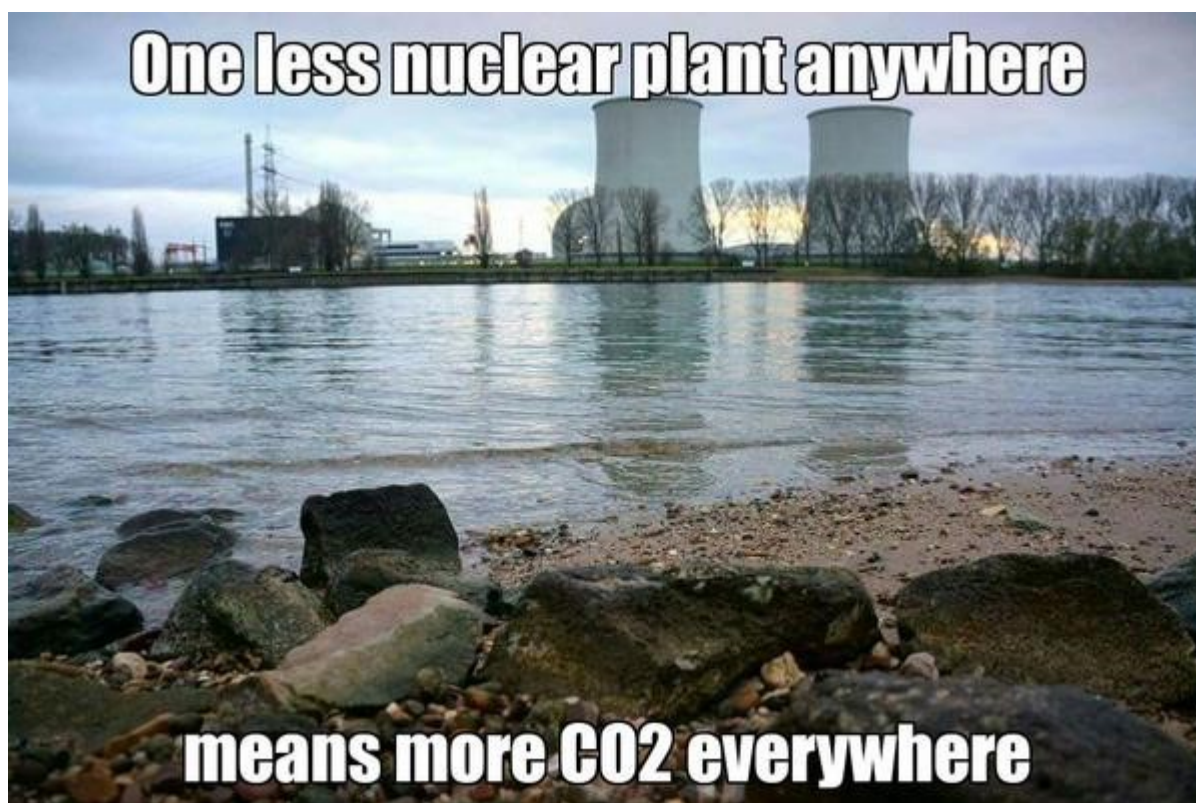
## **As 2014 comes to a close, nuclear power is at a crossroads – again!**

The world needs nuclear power – so says the latest edition of the World Energy Outlook (WEO) issued in November. *“Nuclear power is one of the few options available at scale to reduce carbon-dioxide emissions while providing or displacing other forms of baseload generation. It has avoided the release of an estimated 56 gigatonnes of CO<sub>2</sub> since 1971, or almost two years of total global emissions at current rates.”*

Yet looking back at 2014, the industry has had its ups and



downs. There were setbacks as France formalized its intention to reduce its reliance on nuclear going forward, Sweden pulled back after its most recent election, and in Finland the Olkiluoto 3 project was delayed once again. In the US, the most recent plant to be shutdown is the Vermont Yankee plant; shutdown after 42 years of operation as not being economic, yet its shutdown will definitely raise electricity costs for its consumers and impact the local economy as a result of its closure-related job losses.



Vermont Yankee shuts down

There was good news in Japan as the first units were approved for restart since the 2011 Fukushima accident, although the actual restarts are taking longer than expected. The re-election of the Abe government also bodes well for Japan's nuclear future. In the UK, there was a big win as Europe approved the project at Hinkley Point as not contravening state-aid rules; but once again progress is slower than most would like.

And then there are places where nuclear power is booming.



China brought new units into operations and approved numerous new units with a larger-than-life target for its nuclear share in 2020 and beyond. The Chinese also approved its first Hualong One reactor, the evolution and combining of designs from both CGNPC and CNNC, as they plan for future exports. Korea approved new units and its first new site in decades. Russia continues to grow both domestically and continues to be very aggressive in the export market.

Given the importance of nuclear power, it is the first time since 2006 the WEO includes a special chapter on nuclear – in fact this time 3 full chapters performing a detailed in-depth analysis of the nuclear option. It clearly demonstrates the benefits of nuclear power in addition to being one of the only generation options at scale available to reduce carbon emissions; it also plays an important role as a reliable source of baseload electricity that enhances energy security. Clearly the benefits and the need for more nuclear is becoming clearer than ever. So why is there this continuing imbalance as we look around the world at various countries' policies for nuclear power?

The WEO notes two significant issues holding back a large-scale nuclear renaissance. These are public concern and economics. Both are valid and need to be better addressed by the industry. We have written much over the past year or so on the importance of improving public attitudes and, in fact, in many countries we now see improvement. But we also acknowledge there is a long way to go to reduce public fear about nuclear power. For example, even though the main objective of Germany's Energiewende is to reduce carbon emissions; their even stronger emotional response against nuclear is causing a short term increase in carbon emissions .i.e. their fear of nuclear is stronger than their desire for a cleaner environment.

On the cost side, concerns about high capital costs and completing projects to cost and schedule are valid. The



industry has more work to do on this issue as evidenced by some recent projects. At the same time we see that countries such as Korea and China, who are building series of plants in sequence and are achieving the benefits of replication and standardization resulting in lower costs and improved certainty, are completing projects to cost and schedule. Yes, it can be done. But even these countries are not immune to public concerns.

The real problem is that these concerns tend to overwhelm the discussion even amongst energy professionals. For example the summary in Chapter 12 of the WEO, "The Implications of Nuclear Power", starts *"Provided waste disposal and safety issues can be satisfactorily addressed, nuclear power's limited exposure to disruptions in international fuel markets and its role as a reliable source of baseload electricity can enhance energy security...."* Renewables are always addressed with hope and little concern for their very real issues while discussions about nuclear are most often focused on its challenges.

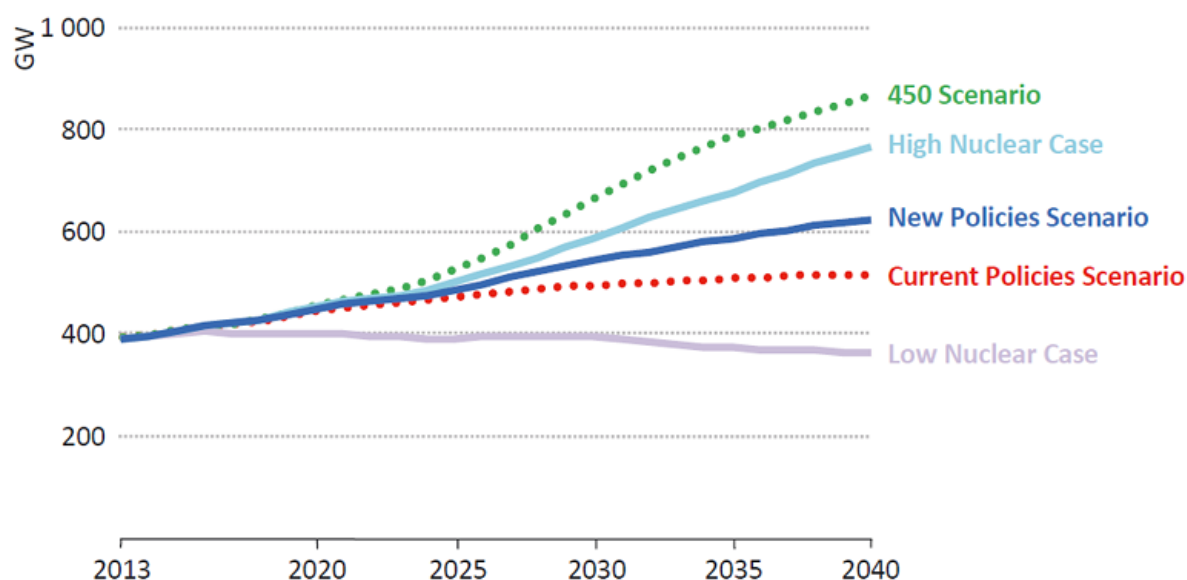
Yet even at Google, engineers have come to a conclusion that the challenges to achieving climate goals with renewables are very large. Two Google engineers assigned by the company to show how renewable energy can tackle climate change each came to a blunt conclusion: It can't be done. As stated, *"Trying to combat climate change exclusively with today's renewable energy technologies simply won't work; we need a fundamentally different approach."*

The following figure sums it up very clearly. In the case that doom and gloom overwhelms good policy and decision making, we may end up with the Low Nuclear Scenario. But this scenario has real implications – *"taken at the global level, a substantial shift away from nuclear power, as depicted in the Low Nuclear Case, has adverse implications for energy security, and economic and climate trends, with more severe consequences for import-dependent countries that had been planning to rely relatively heavily on nuclear power."* Of more



importance, at the other end of the spectrum is the 450 Scenario which the IEA believes we need to achieve to truly have an impact on climate change. And in this case, even more nuclear power than the so called “High Nuclear Case” Is needed.

**Figure 11.12** ▶ Global nuclear power capacity by scenario and case



So there it is, the best way to economically and efficiently address climate change is with a substantial contribution by nuclear power. This year's WEO lays out the challenge very clearly – once again nuclear power is at a crossroads. The options range from a slow decline to a more than doubling of nuclear power in the next 25 years. Nuclear power must be an important part of any future low carbon energy system but there are beliefs that are very well entrenched in the minds of both the public and even many global energy professionals that must be addressed once and for all. It is our responsibility to take on these challenges for a brighter future. It's time to go big and work together to build a strong base of global support for nuclear power. Beliefs are hard to change, but change them we must if we are to have a sustainable, abundant and economic energy future for us all.

And as 2014 comes to a close, I want to thank all of you for continuing to read our blog and contribute to the discussion.



Wishing you all a very happy, healthy and prosperous 2015!

---

# **If we are serious about carbon free electricity – there must be more nuclear power**

Last month, we wrote about the ongoing push by the United Nations to combat climate change and its underwhelming support for nuclear power as an important part of the solution. To no one's surprise, the final volume of the current IPCC report on climate change issued November 1 is no different. Yet this report is very clear in its conclusion that limiting the impact of climate change may require reducing greenhouse gases emissions to zero this century. So while the world is focused on developing a range of new technologies to meet this challenge, fossil fuel use continues to grow. In reality, the answer is right in front of our eyes. What the world needs is a massive increase in nuclear power.

While many will write about this most recent IPCC report, we want to bring some new perspective and once again discuss the role of nuclear power as an essential tool to reduce carbon emissions. There are a few new studies and announcements this past month that show the paradox of current policies.

First there was a study released in Nature that suggests that even though natural gas emits about half the carbon of coal, abundant natural gas alone will do little to slow climate change. The study's lead author Haewon McJeon, an economist at the US Department of Energy's Pacific Northwest National

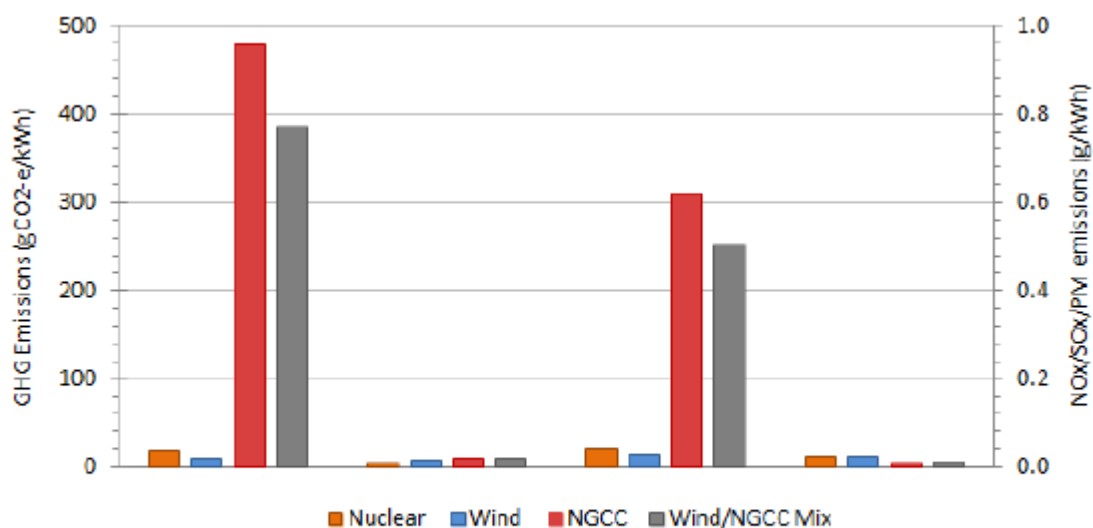


Laboratory said, *"Global deployment of advanced natural gas production technology could double or triple the global natural gas production by 2050, but greenhouse gas emissions will continue to grow in the absence of climate policies that promote lower carbon energy sources."* This is in contrast to many who believe that gas is an important part of the solution. We have no issue with gas and believe it can be an important part of a diversified electricity system; but according to this study, it is not a great tool in the fight against climate change.

Of even more relevance to the discussion, a recent report issued by Hatch Ltd. in Canada, *"Lifecycle Assessment Literature Review of Nuclear, Wind and Natural Gas Power Generation"*, demonstrates the challenges of relying too much on wind to drive down emissions. This report notes that wind as an intermittent resource is usually backed up by gas. So if wind generally operates about 20% of the time, the gas backup would be operating the other 80% continuing to emit carbon. Therefore nuclear emits some 20 times less carbon than a wind/gas combination (see figure below). Most of us in the energy industry know this is why gas producers are often strong supporters of wind and solar. While the public believe wind is good for the environment; it's even better for the gas industry.

Even the wind industry acknowledges these results. They note this is only one scenario and that there are more plausible scenarios where wind would be supported by demand side management, storage and other means of clean generation. This is indeed a laudable goal for the future, but the reality remains, today most renewables are backed up by gas.





**Figure 18. Summary of Total Lifecycle Emissions**

All of the above would suggest that there should be more support for nuclear as a very important element for a solution to climate change. It is effective and available today and most of all can provide large amounts of clean reliable electricity.

In fact, the public is quite aware of this. A just released study in the USA is showing eighty-two percent of those surveyed agree with the statement, “We should take advantage of all low-carbon energy sources, including nuclear, hydro and renewable energy, to produce the electricity we need while limiting greenhouse gas emissions.” Further 75 percent of those polled said nuclear energy will be “very important” or “somewhat important” in meeting America’s future electricity needs. Seventy-three percent of those surveyed associate nuclear energy with clean air. Clearly a very important step in securing the support required to increase the use of nuclear energy.

On the other hand, we have also seen more negative political views. In Sweden, after reconfirming the need for more nuclear power in 2009; the outcome of the most recent election had the new government stepping back in order to gain support from the Greens. Social Democrat leader Stefan Lofven said “Sweden



*has very good potential to expand renewable energy through our good access to water, wind and forests. In time, Sweden will have an energy system with 100% renewable energy."* Reality clearly has no place in politics.

And of even more concern is the recent vote by the French parliament to reduce the use of nuclear energy from 75% to no more than 50% by 2025. They must remove a plant from service when Flamanville comes into service in the next year or so as the amount of nuclear power cannot increase. And it looks like the French president himself will take the decision on which plant to shut down. Taking safe clean reliable power out of service prior to its end of life purely as policy seems foolish at best. The Hatch study shows this strategy will most likely lead to increased use of fossil fuels and thus higher carbon emissions at least in the short to medium term. This is exactly what we have seen in Germany. Taking a large amount of nuclear out of service is requiring the construction of new coal generation even though Germany is expanding renewable generation at a very high rate.

So what does this all mean? As we have said many times before, removing and / or reducing nuclear strictly for policy reasons, especially in the case of successfully operating units means only one thing – that there remains an overriding societal belief that nuclear is not safe – and therefore less is always better than more. While some environmentalists now realize this is not the case; this truth has not yet caught up with the public at large and hence is not always supported by their politicians.

The IPCC report is clear that the world must take action to combat climate change. Nuclear power is the only large scale source of clean abundant reliable electricity generation available and that should make it an essential part of the solution. Trying to generate all electricity with zero carbon emissions without making extensive use of nuclear power is simply making what is already very difficult, pretty much



impossible.

---

## Changing the discussion – It's all about people

*"It's always amazing when a United Nations report that has global ramifications comes out with little fanfare." So starts an article in Forbes talking about the most recent UNSCEAR report on the consequences of the Fukushima accident in Japan. Three years after the accident, UNSCEAR, the United Nations body mandated to assess and report levels and effects of exposure to ionizing radiation has reported and its result could not be more clear. **"The doses to the general public, both those incurred during the first year and estimated for their lifetimes, are generally low or very low. No discernible increased incidence of radiation-related health effects are expected among exposed members of the public or their descendants."***

This result is in stark contrast to a number of more recent accidents in other industries, all with a large number of fatalities. Whether it is a plane lost in Malaysia, a ferry sinking in Korea, an oil explosion in Quebec; the list goes on. Unfortunately there is no shortage of examples of terrible accidents resulting in loss of life. And yet, in comparison to these many tragic events, it continues to be nuclear accidents that many people fear the most.

But the reality is quite different. When it comes to nuclear power, we have now seen that even in the worst of the worst nuclear accidents (Chernobyl and Fukushima), we can protect people and minimize fatalities from radiation. In other



words, the decades old belief that nuclear accidents are very low probability but exceptionally high consequence; effectively resulting in the end of the world as we know it (i.e the doomsday scenario), is just not the case.

For those that have been reading my blog for a while, it was about a year ago that I wrote about the need for a new paradigm to communicating the risks and benefits of nuclear power for the future with an emphasis on refining the message to reflect current reality. The message on safety should be:

- The risk of a nuclear accident is very low and is always getting even lower
- In the event of an accident the risk of releasing radiation to the environment is also very low; and
- Even in the unlikely event that radiation is released, the public's health and safety can be protected.

Of course, this does not mean we should become complacent.

Certainly the industry is doing the right things to make sure a similar accident cannot happen again. Many improvements have been made in plants around the world to both reduce the risk of an accident and in the event of a severe accident, reduce the risk of radioactive releases.

For example, here in Canada, we have broadened our safety objective to ***“Practically eliminate the potential for societal disruption due to a nuclear incident by maintaining multiple and flexible barriers to severe event progression”***. Setting societal disruption as the measure is definitely something new as move forward post Fukushima.

As an industry, we are excellent at learning from every event and making improvements to reduce the risk of a similar event in the future. The global nuclear industry should be proud of its unwavering commitment to safety.

But that being said, while making technical improvements and reducing the risk of future accidents is essential;



unfortunately this will be unlikely to result in the public feeling safer. I would argue that in general, the public already believe the risk of an accident is low – the problem is they also believe the consequence of an accident is unacceptably high. So no matter how low we make the probability, they will remain afraid of the consequences. In other words, as we continue to talk about improving technology to reduce risk; we need to enhance the discussion to talk about people and how to both keep them safe (the easy part); and of even more importance, feel safe (now here is the challenge).

Therefore an important lesson from Fukushima, is that accidents, however unlikely are indeed possible. And it is because of the perceived consequence of an accident that the public continues to be afraid. In fact, fear is an understatement. We know that nuclear accidents cause not only fear but outright panic. And this panic is not limited to people in the immediate area of the plant but is experienced by people all over the world. Not a week goes by when there is not some news item on how radiation from Fukushima is about to land on the North American west coast. While there is little risk of any radiation issue, to the public, it continues to stoke fear.

So now that we know that there is little to no health impact from radiation after Fukushima, does that mean the discussion is over? No, the next step is to address the real health consequence of a nuclear accident – mental and social well-being. Fear of radiation is a complex issue. While people will happily accept significant doses of medical radiation as they believe (quite rightly so) this will improve their health, they remain terrified of radiation from sources such as nuclear power plants.

In their report UNSCEAR noted, *“The most important health effect is on mental and social well-being, related to the enormous impact of the earthquake, tsunami and nuclear*



*accident, and the fear and stigma related to the perceived risk of exposure to ionizing radiation. Effects such as depression and post-traumatic stress symptoms have already been reported. “*

*They continue, “The evacuations greatly reduced (by up to a factor of 10) the levels of exposure that would otherwise have been received by those living in those areas. However, the evacuations themselves also had repercussions for the people involved, including a number of evacuation-related deaths and the subsequent impact on mental and social well-being (for example, because evacuees were separated from their homes and familiar surroundings, and many lost their livelihoods).”*



And this is where we need to do more. Once we accept that even after implementing our best efforts, there may well be another accident someday, there needs to be increased focus on accident management and recovery. This means clear guidelines on when to evacuate, what is required to remediate a contaminated area and when it is safe to go home again. A huge source of fear is the unknown and after a nuclear accident, people impacted are very worried about their futures. They want to know – will I get sick, how about my children and grandchildren – can I go home again – and if so when? And basically how and when will I be able to resume my



normal life?

UNSCEAR noted that *“estimation of the occurrence and severity of such health effects are outside the Committee’s remit”*. Given these are important and significant health impacts; it is time for the industry to take action. As an industry we have long been leaders in industrial safety. Now we have the opportunity to be leaders in post-accident recovery psychological research. We need new research to better understand the impact to people in affected areas following nuclear accidents so we can better plan how to reduce their fear and indeed, have a happy and healthy future. This will lead to better decisions following events based on science rather than short term fear issues. It is important to understand that protecting people means much more than emergency planning to get them out of harm’s way when an accident happens. It also means meeting their needs right up until they can resume their normal lives.

The most important lesson from Fukushima is not technical. Of course we will learn how to avoid similar accidents in the future and make plants safer. But if we really want to change the dialogue and increase public support for the industry, we must also recognize the future is all about people – building confidence and reducing fear.

---

## **It’s passion that will lead to brighter nuclear future**

Last month I talked about innovation in the nuclear industry focusing on the perception that nuclear is not innovative. Since then I attended the Canadian Nuclear Association annual



conference. Its theme this year was "Developing the next generation" which in this case focused on developing the workforce of the future.

While the discussion at the event was about Canada, the theme can be applied to many countries. Essentially, it was noted that the industry has numerous opportunities that offer well paid interesting work for the long term. And, of more importance it was made clear that the industry is only as good as its people; hence the need to attract the best and brightest.

With all the good discussion, what caught my interest was the guest breakfast speaker, Taylor Wilson, known as the boy who played with fusion. At 19 years old, he gave a great talk (already having given two TED talks) about his passion for all things nuclear. I am not going to discuss Taylor's achievements or strong technical skills, both of which are certainly impressive; and he is also extremely articulate proving that scientists can indeed communicate well. But what really got me excited was his passion for nuclear science. This passion ignited the audience by reminding us all of our own passion for the industry.

I remember being a young student studying nuclear engineering at RPI in Troy New York during the 1970s. What drove me to go into nuclear was the mystery and excitement of this still relatively young industry. I wasn't looking for a job; I was looking for a future. The oil shocks had happened and it was clear that the world needed alternate energy. Being able to provide almost limitless energy to power the world, nuclear power seemed to be the solution and I wanted to be part of it.

I was not unique. Many of my colleagues; many of whom (older than me) were the pioneers of nuclear energy, were inspirational in their dedication and passion for nuclear power. I am not talking about the early great scientists who harnessed the atom, but rather the next wave of people, both



technical and political who drove the industry forward securing commitments to, and then building the 400 plus Generation II reactors in service today. This past December was the sixtieth anniversary of President Eisenhower's Atoms for Peace speech to the United Nations. This speech launched a new industry around the world. I would name some of those who contributed but they are too many and I don't want to leave anyone out. Rather, I invite you in your comments to note who inspired you either to enter the industry or along your career to keep on moving forward. (Some of the pioneers of the Canadian industry are listed here.)

And they succeeded. They developed one of the most important energy technologies known to man. In less than fifty years, an idea was turned into a commercially viable energy technology meeting about 12% of global electricity. And that number, of course, is deceptive since about half of the countries that rely on nuclear energy use it for 20% or more of their electricity supply.

Of course there have also been numerous challenges along the way that saw the industry slowdown in the latter part of the twentieth century. Recent developments as the world looks for solutions to climate change has re-ignited interest in nuclear power as a part of the solution. This is also in the context of the 2011 accident in Japan which once again raised fears of the industry and its potential negative impacts.

For most of us who have spent our careers in the nuclear industry, we remain just as passionate today as we were when we were young and our belief in the benefits that nuclear energy bring to society continues to be strong. There are others who have been worn down by the relentless effort required to sell these benefits and the years of attacks against the industry. The result is a defensiveness along with a weariness that has reduced efforts to move forward as many in the industry focus on survival. It is now time for a new generation of passionate young people like Taylor Wilson



to take this industry into the future. I know they exist. There is the nuclear Young Generation Network (YGN) with chapters around the world. For those of you YGN members who read this, please give your views.

It is not just about opportunities for employment, but rather about opportunity to make a difference. The question becomes, not how do we find the nuclear workers of the future – but how do we inspire the passion in a nuclear future that we all had (and continue to have) when we started our careers to attract the best and brightest to our industry going forward? I would guess that if you went to any university graduating class and asked for the 10 most innovative and exciting industries of the future, we would likely not make the list.

I talk about communications in this blog quite often. But most of the time I talk about how we can promote the industry and reduce the fear of radiation in the public. But we must also consider how to communicate to a new generation of potential nuclear industry professionals the excitement, innovation and societal imperative so that they can develop their own passion.

I love working in this industry and I wouldn't change my experiences for anything. Now it's time to help build the industry of the future – and that means inspiring young people to take a leap of faith and jump on board.