The nuclear industry approach to managing waste is a model for all

This month, as we continue our short series on energy economics, our focus is the nuclear industry's commitment to safely managing its wastes. More specifically how this commitment ensures the cost of managing waste is included in nuclear power economics and how funds are set aside to pay for it.

As we have noted before, almost every article on nuclear energy, including the supportive ones will comment on the *enduring problem of nuclear waste.* This waste "problem" is often presented as insurmountable. Yet, the world is full of toxic wastes from human activities. Everything from mining to chemical processes to simple garbage thrown out from everyday household products are cause for concern.

Caption: If all your energy was produced from nuclear power for your entire life, the resulting waste would fit into a pop can Source: iStockPhoto.com

Every form of electricity generation creates waste products. Even renewable sources of electricity like solar and wind contain toxic substances in their panels and turbines and result in a need to manage their waste. The International Renewable Energy Agency (IRENA)'s official projections assert that "*large amounts of annual waste are anticipated by the early 2030s*" and could total 78 million tonnes by the year 2050.

You would be led to believe that nuclear waste is the worst of the worst (In this case waste is referring the used fuel coming out of the reactor). But is it? The reality is nuclear waste is in a solid form, the volumes are relatively small, are easily contained and well managed. There has never been a fatality due to the storage of nuclear waste.

From an economic perspective, it has long been required by regulation to accommodate the cost of managing waste and the

cost of decommissioning the nuclear plant at its end of life into the cost of electricity production. In other words, every operating plant is required to charge a fee for every MWh produced to create a fund to pay for waste management. In most jurisdictions this fund is required to be segregated and funded (rather than just an item on the owner's balance sheet) so that in case the owner is no longer solvent when the plant reaches end of life, the fund will be there to pay for waste management and decommissioning.

In the International Energy Agency's (IEA) Projected Cost of Electricity report, the assumed cost of managing used fuel waste is $2.33 / MWh. The fee for decommissioning is even smaller in the $0.1 / MWh range. This compares to about $7.00 / MWh as the fuel cost and a total Levelized Cost of Electricity (LCOE) of about $70 / MWh (or 7 cents/kWh). Therefore, accounting for the cost of managing waste and decommissioning requires adding about 3% to the cost of electricity throughout the unit's operating life. One reason this is relatively small is once again due to the high energy density of nuclear fuel. Or in other words, a very small amount of fuel produces a very large amount of energy. Each jurisdiction has its own method for calculating the amount of money to put aside. Here in Canada, the cost to manage waste is updated every five years and then the amount collected in the cost of electricity is adjusted to ensure the fund remains adequate to pay for final disposal.

If only other forms of energy managed their wastes so responsibly. We have issues in western Canada with oil rigs abandoned with no one to clean them up. Coal burning pollutes with much of its waste being airborne particulates that cause significant harm to our health. And as solar panels and wind turbines reach their end of lives there is going to be a large volume of waste that will need to be safely managed.

The nuclear industry has always focused its efforts on ensuring it provides reliable economic electricity while

minimizing any impact to the environment. This approach has the industry taking full responsibility to manage its waste. Rather than being concerned about nuclear waste, this model of ensuring that fully funded plans are in place to safely manage waste should be a standard applied to all forms of energy production. This is the path to a sustainable future.

The war in Ukraine has raised concerns about global energy security as well as the safety of nuclear reactors under siege. On the one hand, the safety concerns have stoked fear; and on the other, energy security issues support discussions of increasing the use of nuclear power as an option to reduce dependence upon imported fossil fuels. We will comment on these issues in future posts.

Forget about public acceptance for nuclear power – it's time for public enthusiasm!

Nuclear power can provide almost limitless economic, reliable, low carbon electricity to power the world, yet it continues to struggle to achieve the respect it so desperately seeks. For 40 years we have been hearing the same thing – that for nuclear power to achieve its potential we must work harder on securing public acceptance. This is seen as a one of the main impediments to future nuclear growth. As technocrats, we often think that if we can just educate the public on the technology, they will see the light and come to accept us. After years of effort and somewhat limited success, the time

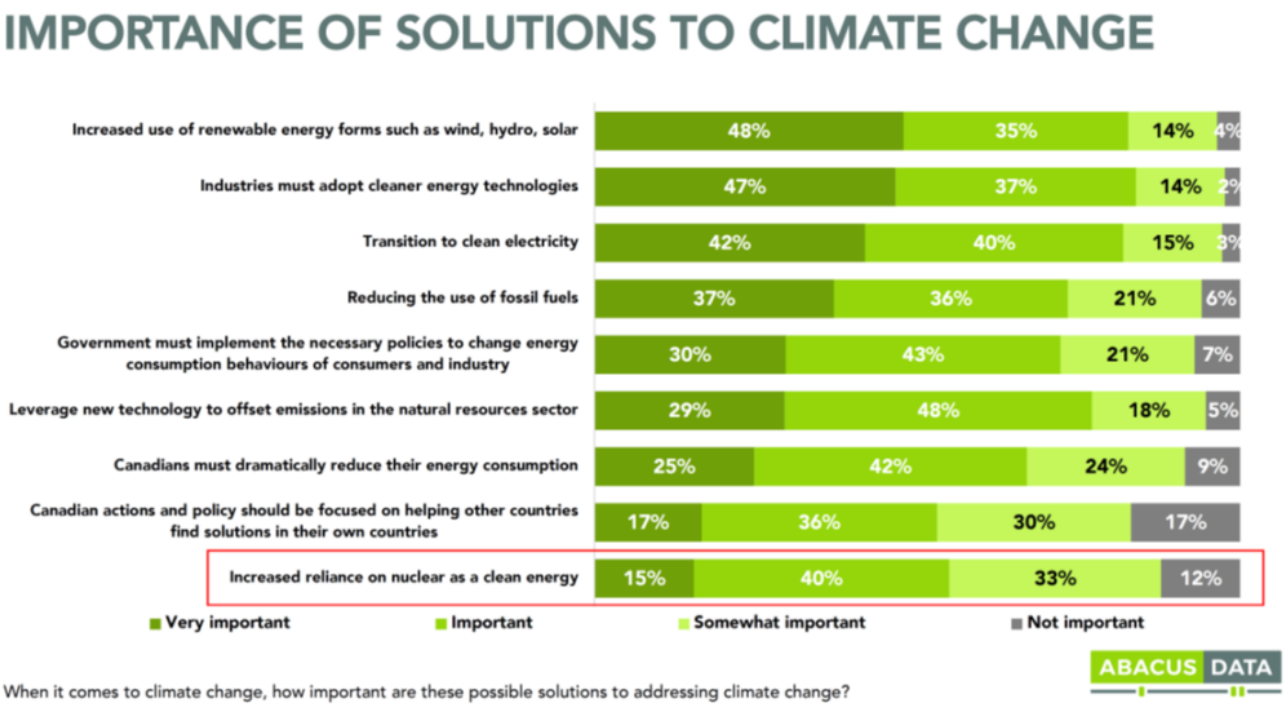
has come to refocus and set the bar even higher. Let's forget about trying to convince people to "accept" nuclear and strive to create true public enthusiasm for a technology that has the potential to solve the issues they care about most.

And we won't get there until we focus on the right things. After all, why should anyone even think about nuclear power, never mind come to love it? It is definitely not by explaining all the reasons they shouldn't worry about it; where it really starts is by having a clear understanding of the issues that are top of mind.

So, what are people concerned about?

A recent study from the Canadian Nuclear Association suggests that climate change continues to be a top of mind issue, with concerns not falling even though we are in the midst of a global pandemic. The large majority (82%) of Canadians are somewhat, very, or extremely concerned about climate change. Almost 8 in 10 (76%) feel that climate change or global warming are issues we currently face that are at least

"serious" and a majority (57%) rate that the impact of climate change or global warming on themselves or their loved ones has been "Extremely/Very much".



The challenge is that even with these concerns most people are completely unaware that nuclear power can be a solution. 68% of Canadians had no idea that nuclear power is the country's second largest source of low carbon electricity (15% of total generation) after hydro power. This is then re-enforced as nuclear is at the bottom of the list in solutions to solve climate change (although support remains strong). Keep in mind that Canada is a very nuclear-friendly nation with more than 60% of the electricity in the province of Ontario and more than 30% in New Brunswick coming from nuclear. So, it should be of no surprise this lack of awareness is not unique to Canada. A similar recent poll in the US showed that nuclear power is a very unpopular form of electricity generation, second only to coal. And even in the country with the most nuclear power in the world, France, most think nuclear contributes to, rather than is a solution to, climate change.

We first discussed how we need to take back the narrative from nuclear opponents in August of 2019. The industry has been

complicit (although well intentioned) by endlessly trying to defend nuclear by explaining ad nauseum how safe it is and why people shouldn't be worried about nuclear waste. This strategy has failed because the more time spent talking about why people shouldn't worry about these things, the more they understand there must be something to worry about. Rather, the priority should be on the important benefits nuclear brings – **reliable, economic, low carbon electricity in vast quantities to fuel an energy hungry world – and the many high-quality jobs and the positive economic impact to communities that support nuclear power plants.** This is what can get people excited, and only then, will they be willing to have a discussion on those aspects of the technology where they have concerns.

And yes, we are making progress. It is becoming clear that renewables alone cannot fuel a decarbonized world and that nuclear power is an important option to help meet the energy needs of the future. It has been recognized by global institutions like the International Energy Agency and most recently, Holland, with its single operating nuclear power plant, has joined the growing list of countries expressing interest in considering nuclear for the future.

Here in Canada, the Minister of Natural resources has been extremely clear – reaching net zero carbon emissions without nuclear is simply not feasible.

But this is not enough. People love the idea of renewables and strongly support them as THE solution to climate change (although they may feel somewhat different when a wind project is promoted in their backyard – but that is another story.) Many are eager to spend their hard-earned money to install solar panels on their roofs or buy electric vehicles even if they are expensive. This is because they know they are doing good in the battle for the planet and they accept and support that these technologies are the future.

While it is common to express concerns with nuclear power such as asking about nuclear waste for example, these questions are never considered when talking about renewables. Solar waste? Low energy density land use? Variable generation dependent upon resource availability requiring not yet available storage solutions, mining of rare earths and other needed minerals? These are just silly questions that get in the way of environmental progress. Smart people will solve all. This is the strength of "knowing" that going down a given path is simply right. We don't want to hear about challenges for solutions we believe in, while we are happy to question those options we are suspicious of.

The world can only close its eyes to the truth for so long. As more people start to accept that renewables cannot be the sole solution, support for nuclear is rising as its potential as a low carbon option is being better understood. However, it is important that nuclear be considered because it is an excellent solution to climate change as well as providing reliable economic energy to society, not because the favoured options are falling short, forcing us consider this less desirable option of last resort. Accepting nuclear should never be like taking your bad tasting medicine. You accept it may be good for you, but you hold your nose while taking it and wish you didn't have to.

And positive change is in the air. We see many amazing groups, primarily a new generation of younger people who are making the positive case for nuclear power. There are pronuclear demonstrations, funny videos explaining nuclear on YouTube and even a pro nuclear rap song. If you are part of a group that is driving support for nuclear, please let us know in the comments below.

We live in a time where there are many that question technology with some causing more fear than others. We are in a horrific pandemic yet fear of vaccines is making many worried about taking one when available. There are even

people who think 5G mobile technology is causing covid. Therefore, after decades of anti-nuclear activism, it should come as no surprise that many are concerned about nuclear technology. And while more and more environmentalists are now seeing the opportunity to fight climate change that nuclear brings, many are still fundamentally opposed. Here in Canada, famed environmentalist David Suzuki said “I want to puke” in response to the Minister’s support for new nuclear.

We live in a time of both science skepticism and a lack of belief in facts. But we should not be daunted as both the facts and the science are clear. We have a great story to tell. Nuclear power is AWESOME and can help to save the world. So, let’s stop talking about public acceptance and all work together to generate a real sense of public enthusiasm to support this technology as a path to a better world where energy is economic, reliable, abundant and has little impact to the environment.

The world needs more nuclear – and it needs it now

The world is burning – or it’s about to – so says the Intergovernmental Panel on Climate Change (IPCC) in its special report considering the benefit to the planet if we manage to keep the increase in temperature to 1.5 C rather than the target most often discussed of 2 C.

This report concludes, most often with high confidence, that the impact to the world will be considerably greater with only 0.5 degrees of difference in temperature.

It projects that by 2100:

- Global sea level rise would be 10cm lower with global warming of 1.5 C compared with 2 C.
- Extreme heatwaves will be experienced by 14% of the world’s population at least once every five years at 1.5 C. But that figure rises to more than a third of the planet if temperatures rise 2 C
- Arctic sea ice would remain during most summers if warming is kept to 1.5 C. But at 2 C, ice free summers are 10 times more likely, leading to greater habitat losses for polar bears, whales, seals and sea birds.
- If warming is kept to 1.5 C, coral reefs will still decline by 70-90% but if temperatures rise to 2 C virtually all of the world’s reefs would be lost.

Coal plant belching out pollution in Poland while climate is discussed at COP24

It also concludes that time is of the essence stating urgent and unprecedented changes are needed to reach the target, which it says is affordable and feasible. It notes that there must be dramatic change by 2030 (carbon reductions of 45% compared to 20% in the 2 C scenario) with carbon emissions eliminated completely by 2050.

Quite the message – and yet, the world has somehow become immune to this constant and ever-increasing threat. The sky is falling – yet many seem to not care.

There are those who choose to not believe it at all, and there are those who don't believe it is our fault. There are those that do believe it but also believe its consequences are too far in the future and the cost too high today politically to ask people to pay to resolve it. Well, if this report is correct, the future is now, and we must act. Yet at COP 24 in Poland this month, the best that could be achieved was to agree on the rules for measurement so that each country can report its Paris commitments in the same way.

One thing is for sure – the world needs energy, and lots of it. Yet getting the political support for meeting these needs while setting even more aggressive carbon targets seems impossible.

One of the reasons we don't see the progress we need is that the solutions are hard. The answer on the left is 100% renewables – which excludes a number of low carbon technologies; all while this option is being proven more and more to be an unfeasible solution. Looking at Germany we can see that huge investments in renewables have resulted in Germany still being the largest emitter in Europe as they remain a huge coal user. But the believers have no doubt that renewables are the solution and reject all other options.

The answer on the right is to downplay or in some cases ignore the problem and continue to push fossil fuels to maintain important jobs that are critical to local economies. They abhor the idea of carbon pricing seeing it as a job-killing government tax grab. Of more importance as we have seen in France with the massive yellow jacket protests, the answer cannot be to place the burden of paying for change at the feet of the most vulnerable in society who don't have ready options to use non-carbon solutions when the price goes up for their

core energy needs.

The reality is that both sides make good points, and in both cases, there is some progress. Renewables are starting to contribute to lowering carbon. Replacing coal with lower emitting natural gas has had a big impact. The rising cost of energy due to increased renewables penetration and carbon pricing in some jurisdictions may also be impacting the outcome by reducing demand, but the stress of higher prices on those that live pay cheque to pay cheque cannot be ignored.

These are the low hanging fruits and it is clearly not enough. In 2017 emissions increased and will do so again in 2018. So, what are we to do?

The reality is we have a solution available today that can work for everyone – nuclear power – recognized as necessary in the IPCC report, but there is hesitancy across the political spectrum.

Nuclear power solves the main concern of the left – it is a very low carbon emitter – but long entrenched anti-nuclear sentiment of many environmental groups is hard to overcome. It solves the concerns of the right – providing large quantities of reliable energy while creating lots of high-quality jobs that boost local economies, but there are valid concerns about large project costs getting out of control negatively impacting its economics. And both sides remain concerned about the one overriding issue when it comes to nuclear generation – fear of radiation.

The real strength of nuclear power lies in its energy density. It can be built at very large scale. After all, currently it powers 11 % of the world with only 450 plants as opposed to literally thousands of what we otherwise use. For example, in the US, 98 nuclear plants generate about 20% of its electricity while about 3,000 coal and gas plants generate just over 60%. Or, in other words, it takes 30 times as many

plants to generate only 3 times as much energy as the nuclear fleet.

Nuclear power can be the solution we are all looking for. It is reliable, economic, low carbon and creates many high-quality high paying jobs while contributing to the tax base of its host community. Its massive energy density provides a lot of energy from a small amount of fuel – and a new generation of smaller more versatile plants (SMRs) are being developed to expand the market potential and address new energy needs in addition to traditional on-grid electricity such as high-quality process steam.

We don't see many governments championing nuclear as the solution. Korea and Germany, both with strong nuclear programs, have seen their leadership move away from the technology. France, as the world's most prolific nuclear country seems to think reducing reliance on nuclear is the way to go. Yet there are bright spots. In Canada, a decision was taken to life extend Ontario's nuclear fleet at a cost of $25 billion for 10 nuclear units (producing more than 60% of Ontario's electricity), and this is now the largest clean energy project in North America.

Change is in the air. More and more environmental groups are realizing that their environmental goals cannot be met without nuclear and are opening their minds to this solution. On the other side, there is an acknowledgement that nuclear projects are good for communities, good for the environment and good for producing large amounts of reliable electricity. And even though much of the press has talked about nuclear plants closing in the US in 2018, it was a year of great progress globally. 15 GW of new nuclear were added to the global grid in 2018 and both the first EPR and AP1000 reactors have entered into service after substantial delays.

The public are moving forward as well. Sweden has stopped its nuclear phase out with support from its population.

Switzerland voted to not accelerate the closure of its plants. In Korea, a citizen's jury, established by the current government to take a decision on whether or not to continue with two units under construction, strongly supported the project's continuation and polls show that in excess of 70% of the Korean public are supportive of continuing with its nuclear power program. To the government of Taiwan's surprise, a referendum on whether or not to continue with an early shutdown of its nuclear plants supported continued operation by a large margin.

And governments are starting to move in the right direction too. The NICE future (Nuclear Innovation: Clean Energy Future) which began as part of the Clean Energy Ministerial (CEM) recognizes that nuclear power has an important global role to play in meeting international climate objectives. The three founding members of NICE are Canada, the United States and Japan. Other participating members include the UAE, UK and Russia. Three non CEM countries are also participating (Argentina, Poland and Romania).

But as we enter 2019, we in the industry have much work to do. The challenges are many, but they must be overcome.

The sky is falling, and the world is in crisis. However, the public recognize the increased magnitude and frequency of extreme weather events such as storms and flooding. What they don't know is what we know – that nuclear power is an excellent solution to many of the energy issues we face as a planet. We know that we can build and operate them successfully. We must all work together and engage with our communities to show people there is a viable solution out there that can be embraced by all.

Wishing you all a Happy Holiday Season and Healthy and Prosperous 2019. And thank you for reading our blog. We plan to keep on writing in 2019 and hope you keep on reading.

South Korea has a strong vibrant nuclear industry – except it is not supported by its President

It is with great sadness that we see the Wolsong Unit 1 reactor start to defuel after being shut down prematurely as part of the South Korean government's plan to reduce reliance on nuclear energy.

This is part of the South Korean government's commitment to replace nuclear and coal with renewables supported by gas, hopefully one day coming by pipeline from Russia through North Korea. (Today all gas in South Korea comes as LNG and even an optimist would see energy security issues with this pipeline plan.)

We have a long history in South Korea. We were very active in the development of the contracts for Wolsong Units 2, 3 and 4 back in the early 1990s and worked to secure collaboration between South Korea and Canada for most of the next decade. This first big project success in Korea holds a special place in our hearts. And of even more importance, the lessons learned in South Korea are the backbone of our approach to nuclear power projects today and going forward.

In 2017, South Korea elected Moon Jae-in its President. As part of his platform he committed to reducing the share of nuclear over time. "*So far, our country's energy policy has been focused on low price and efficiency only, thus neglecting the safety of the people or the sustainability of the natural environment*," he said last year when Kori 1, Korea's oldest

reactor, was retired. *"The new government shall consider the nuclear safety issue as a national security agenda,"* he said based on a fear of nuclear power following the accident at Fukushima in 2011 in neighbouring Japan.

Wolsong Nuclear Power Station, South Korea

Wolsong 1 is South Korea's second oldest reactor, so what's the big deal with retiring it? It is a CANDU and Korea has developed its own domesticated PWR as its main reactor type. Why should anyone care? First, its on-time construction as it went into operation in 1983 was a precursor of what was to come from this burgeoning technical and industrial powerhouse in the making. In the 1970s, four CANDU 6 type units were committed around the world. Two in Canada (in Quebec and in New Brunswick) and two abroad (Argentina and South Korea). Even though it was the last of the four committed, Wolsong 1 was the second to go into operation following a short 60-month construction schedule. This showed how Korea was developing its strong construction industry that focused on success. They also fully domesticated fuel production with only one CANDU unit in operation, another success story. It operated

for 25 years at top capacity factors until it was shut down for refurbishment and life extension in 2009 returning to service in 2011.

Once again, it was the most successful CANDU refurbishment project anywhere to date. And that is the rub. Although reported that it is South Korea's oldest operating reactor and only had a license until 2022, in reality, it was the newest of the units on the Wolsong site. A CANDU refurbishment is a complete overhaul of the reactor changing out the entire core so that the unit can operate another 30 years or more. This means that the Wolsong 1 reactor had the newest components when compared to Wolsong 2, 3 and 4 that came into service in 1997, 1998 and 1999 and should be operated into the 2040s.

In his recent article "Nuclear Energy Needs Truth, Not Truthiness" (truthiness is a term coined by comedian Stephen Colbert to describe the phenomenon – that basically one's desires, intuitions and fantasies are as true as reality and can substitute for them with no consequence), Jim Conca talks about the importance of the media being "*energetic advocates for, and defenders of, the actual, factual truth*" rather than succumbing to providing a "*false balance*" in their ongoing effort to report both sides of the story. Trying to match experts on one side with others who have no actual knowledge or expertise to support the other is foolish at best, and dangerous at worst. We need to listen to experts to know the actual truth.

Here is the truth about South Korea.

In 1960, a few years after the end of the Korean War, it was one of the poorest countries on earth. With a small population and little to no natural resources; even though a peninsula, it was more like an island with its unfriendly neighbour to the north. Based on sheer determination of its people, South Korea achieved an economic miracle, becoming an industrial giant, a software leader and an exporter of goods

and services to the world. This was in part due to its ability to secure reliable and economic energy to fuel this development. Today, South Korea produces 70 percent of its electricity from 24 nuclear reactors (27 percent) and thermal coal plants (42 percent). Liquefied natural gas (LNG) accounts for about 20 percent. Renewables are less than 10%. All its coal and gas are imported.

As for the nuclear sector, since it built Wolsong 1 on time and on budget three decades ago, Korea went on to develop a nuclear industry second to none. It fully domesticated its standard 1,000 MW design, the OPR1000 and then developed its larger standard APR1400 design on its own. In 2009, it became a full member of the tier one nuclear club with its first nuclear export to the UAE, a four-unit APR1400 project. Today the first of these units is complete and ready for operation with the remaining units on a path to completion on schedule. The UAE project is considered one of the major successes of the global nuclear industry in recent times, when other projects by more traditional vendors have not proved to be nearly as successful.

And what about the public? Last year, when President Moon proposed to stop construction of the in-progress Shin Kori units 5&6, he decided to make the decision with the help of a jury of the public to secure support for his energy plan. The Citizens' Jury announced on 20 October 2017 that it recommended construction of the two units should be resumed. The panel – comprising 471 randomly-selected citizens – voted 59.5% in favour of construction proceeding. More recently in August of this year, in a poll conducted by the Korean Nuclear Society, 71.6 percent of respondents supported the use of nuclear power in the country, far more than the 26 percent that said the country will be fine without it.

South Korea is a small country and so far, efforts to increase the renewable footprint has also had issues. Solar power plants installed on mountains are causing landslides. Korean

Experts say that the government should slow down its transition to renewable energies due to both environmental concerns (such as the land slides) and energy inefficiencies. Nuclear remains the key low carbon energy source and with an electricity carbon intensity of about 540g/KWh due to its significant fossil generation, South Korea will not succeed in decarbonizing by trying to replace its nuclear fleet with renewables. Replacing coal with even more nuclear would be a far better approach.

Even though the nuclear phase out is intended to be long and slow, it is having an immediate effect on the industry. As one of the world's most successful nuclear industries, the South Korean nuclear community is demoralized. It is a sad thing to see. New graduates are already avoiding an industry that doesn't appear to have a long-term future, and I would expect that some of Korea's best and brightest will be getting job offers from the global industry which will be Korea's loss. Of course, it is also difficult to export a technology when the strategy at home is to phase it out. While the term of a South Korean president is 5 years, this is long enough for a lot of damage to be done.

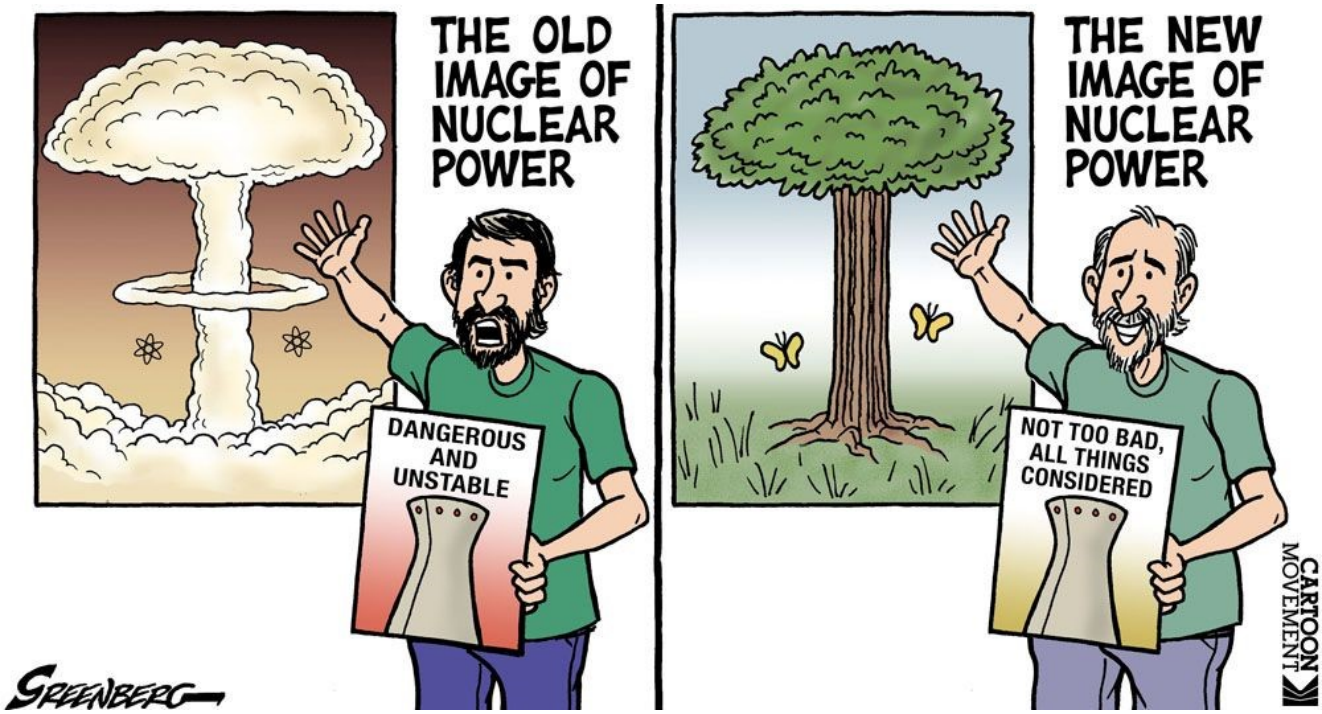
South Korea is truly an economic miracle and has developed one of the world's most successful nuclear industries. They have created a fleet of standardized plants that are built at low cost and to schedule. Their operating performance is excellent, and their people are among the world's best. This should be a point of great pride. It is hard to find any other country that has benefited from nuclear power more than South Korea. It is a shining example of what to do when building an industry. Even the Korean people see this to be true. Unfortunately, truthiness prevails as fear shapes the beliefs of its President. All we can say is ***President Moon, please listen to your nuclear experts. They are the very best there is***.

Let’s stop focusing on beliefs and really start communicating

How many discussions have you had today where either you or the other person thought carefully, and then said “here is what I believe….”? Believe is a strong word. It evokes personal values; and when something makes it to the level of a belief, it is often unshakeable.

There was a time when we didn’t talk like this. We gave our opinion, or our view on a topic. This was developed through learning, by listening to (hopefully) an expert or reading relevant information. An opinion meant this is what we think at the moment, and that should we learn more, we may change or evolve our position. Now our views on almost every topic need to be elevated to the level of “belief”. And as we know, we don’t change our beliefs easily.

In our world of nuclear power, we know that many have strong views on whether this technology is worthy of being a path to a better world with clean economic abundant energy, or as others believe, is a path to our eventual demise. We have written before about the need to ramp up our communications and work hard to increase support for nuclear power. The facts are on our side, but negative beliefs stand in our way. We are happy to see even more young people come out with supportive communications, from Jarret Adams, to Eric Meyer at Generation Atomic and Bret Kugelmass with his podcast series, Titans of Nuclear; each using their own unique method to promote a nuclear future.



As it is the middle of summer, this is when we love to be a bit more philosophical. It is a time to do some deep thinking while enjoying the sunshine and sharing some more esoteric views based on our reading list so far this year. I have read a few books that I think are useful to both better understand the current environment for communications and provide some useful insights on how to better communicate going forward.

You may think these three books have nothing in common, but I see a common thread that should contribute to our thinking as we move forward. They are "**The Death of Expertise**: **The Campaign Against Established Knowledge and Why it Matters**" by Tom Nichols, "**Is Gwyneth Paltrow wrong about everything**: **When Celebrity Culture and Science Clash**" by Timothy Caulfield and finally, "**If I understood you, would I have this look on my face?: My Adventures in the Art and Science of Relating and Communicating**" by Alan Alda.

The first two books provide us with two different but complementary views of the environment we live in. Tom Nichols, in his excellent book, makes the case that America has taken freedom and liberty to an unrealistic extreme – that there is a common belief that everyone is equal and thus, so

are their opinions. In fact, he goes so far as to suggest that it is cool to be ignorant. Experts are no longer respected and in fact, he states that "*we actively resent them, with many people assuming that experts are wrong simply by virtue of being an expert*."

He talks about the changes to higher education, where young people think they are customers buying a service rather than students given an opportunity to learn. He talks about the changing news media, from provider of unbiased news to "infotainment" and notes that too many people approach the news not to seek information but rather confirmation of what they already know, avoiding sources they disagree with because they believe they are mistaken or even lying ("fake news").

This book is a must read, with more good quotes than I can use in a short blog post. But if I can summarize in one quote, it would be as follows. "*The death of expertise, however, is a different problem than the historical fact of low levels of information among laypeople. The issue is not indifference to established knowledge; it's the emergence of a positive hostility to such knowledge. This is the new American culture, and it represents the aggressive replacement of expert views or established knowledge with the insistence that every opinion on any matter is as good as every other.* " For everyone in the nuclear industry – sound familiar?

If we don't listen to experts, then who do we listen to? That is answered in the next book. In his fascinating book on celebrity culture and how it influences us, Timothy Caulfield explores the massive power that celebrities have over our decisions and beliefs. This ranges from using beauty products endorsed by your favourite celebrity (costly but not likely harmful), to using their favourite health care products (costly and may be harmful), to taking bad decisions that can negatively impact the health of our children like avoiding vaccines (definitely harmful).

In summary, we have replaced “experts” who we no longer believe in, with celebrities, who are the ones we look up to. We long for fame rather than accomplishment and dream of achieving it without necessarily working to get there. Anything to be like our idols. Unfortunately, the outcome is often nothing more than an empty wallet and little in terms of being able to take decisions that positively impact our lives.

This takes me to the third book of the bunch, Alan Alda’s book on how to better communicate science. Of course, if we shouldn’t listen to celebrities, then why listen to Alan Alda? It tuns out that he has been involved in communicating science to laypeople for over 20 years, having hosted a show by Scientific American and then starting the Alan Alda Center for communicating science at Stony Brook University. So, what does this book have to say that you may not have heard before? It makes a strong case for communicating, which means having a conversation noting that “*real conversation can’t happen if listening is just my waiting for you to finish talking*.” It talks about the importance of having empathy for your audience, consistent with many who talk about better communications; but he goes further, saying empathy is not enough; we need to be able to “relate” to our audience. Only then are you really communicating. The book then makes the case for using theatrical improvisation techniques as a means to break down barriers to learn to relate to others.

What can we learn from these books that we can apply to the nuclear industry? Our objective is to change the paradigm on nuclear power and raise awareness of the many benefits it brings to society. To do that let’s first work to improve our approach to communicating. We need to avoid trying to change others’ deeply held beliefs nor try to impose our own beliefs on others. This is a path to nowhere.

Rather, we need to focus on communicating, i.e. having an open and productive conversation with others while working hard to keep open minds. It is a willingness to consider new

information that is important for life long learning. Go beyond empathy and truly try to relate. Developing a relationship is hard work but hopefully the outcome will be that we both understand each other better and learn something new.

Moving the needle on public opinion on nuclear power is important and also very challenging. Hopefully some of these perspectives will help us think of new and better ways to have the conversation.

Afterword

For those of you that are interested, the following are a few more quotes from The Death of Expertise. Powerful stuff.

"There is a cult of ignorance in the United States, and there always has been. The strain of anti-intellectualism has been a constant thread winding its way throughout political and cultural life, nurtured by the false notion that democracy means that "my ignorance is just as good as your knowledge.""

"These are dangerous times. Never have so many people had so much access to so much knowledge and yet have been so resistant to learning anything. In the United States and other developed nations, otherwise intelligent people denigrate intellectual achievement and reject the advice of experts. Not only do increasing numbers of laypeople lack basic knowledge, they reject fundamental rules of evidence and refuse to learn how to make a logical argument. In doing so, they risk throwing away centuries of accumulated knowledge and undermining the practices and habits that allow us to develop new knowledge."

"Rather, Americans now think of democracy as a state of actual equality, in which every opinion is as good as any other on almost any subject under the sun. Feelings are more important than facts: if people think vaccines are harmful, or if they believe that half of the US budget is going to foreign aid,

then it is "undemocratic" and "elitist" to contradict them."

If we want to breathe clean air – shutting nuclear plants early is insanity

People are dying – lots of people, each and every day. As stated in a study published by Lancet on October 19," Pollution *is the largest environmental cause of disease and premature death in the world today. Diseases caused by pollution were responsible for an estimated 9 million premature deaths in 2015—16% of all deaths worldwide—three times more deaths than from AIDS, tuberculosis, and malaria combined and 15 times more than from all wars and other forms of violence."* And to make matters even worse, it continues, "*In the most severely affected countries, pollution-related disease is responsible for more than one death in four.*" (Note: James Conca wrote an excellent article following the release of the lancet paper).

Earlier this month authorities in New Delhi took a decision to spray water over the capital to fight toxic dust in the air. It's hard to imagine having to take such extreme action just so people can breathe.

And yet, we seem to want to make it worse, not better, by supporting the early shut down of safe, reliable, and of most importance, CLEAN, nuclear power plants. Nothing can be more foolish than removing low carbon, non-polluting generating plants from the generation mix when the replacements are almost always dirtier fossil fueled generation. These nuclear plants still have years of useful life left and are operating

safely as clearly evidenced by the regulators who are giving them licenses to operate in their respective countries.

This is sometimes based on local economics such as in the United States, where low cost gas is making nuclear uneconomic in some de-regulated states. But of more importance, it is more often a result of made-in-the-past anti-nuclear sentiment. In Germany, shutting nuclear early is accepted as more important than reducing carbon emissions even as new dirty lignite mines are opened to replace them. In Japan the slow return to service of nuclear plants following the 2011 accident at Fukushima is not only causing an increase in fossil usage but there are now plans to build more than 20 new coal plants. The previous French government decided to close its oldest two nuclear units early, even though they are licensed for another 10 years, and set a target to reduce the share of nuclear going forward when there is no clear option to replace them. In Korea, even though a large public review approved the completion of two partially built plants, the Korean government has cancelled further new build plans, and of more importance, is against extending the lives of existing operating units wanting to replace them with a combination of renewables and gas. They are also on the verge of closing Wolsong 1, their oldest operating plant even though its recent complete refurbishment has made it operable for another 30 years and frankly, makes its components the newest of the four operating CANDU type units on that site. In the United States, California has decided not to extend the life of Diablo Canyon, claiming it can replace these units with renewables and demand management. In Belgium, there are plans to retire their units without life extension, etc, etc, and the list goes on.

As for the argument on economics, let’s remember that nuclear plants have very low operating costs due to the low cost of fuel. However, in some jurisdictions, mostly in the US, low gas prices and subsidized renewables make these plants less

economic for now. Since in all cases, they would be replaced by fossil generation (with some renewable component), the replacements will increase both pollution and carbon emissions and if we include the cost to build new plants, then even with low fossil fuel prices, this new fossil generation will not be more economic than existing nuclear.

Many governments have started to see the reality of the situation. That is why the fight is on and in many countries efforts are underway to save these reliable non-emitting plants. In the US, a number of states including New York, Illinois and Connecticut are working to keep plants open and there is a federal initiative to support nuclear plants as a result of their "resilience" (a topic for another day). In Sweden there is support for extending the lives of existing units and recently the French government has decided to slow its plans to reduce its share of nuclear.

This is why I am proud to live in Canada where the commitment to our existing nuclear fleet is strong. The new 2017 Long Term Energy Plan in Ontario supports the decision made in 2015 to refurbish 10 more reactors and to maintain nuclear as the back bone of the system for the foreseeable future. A just released review by the Ontario Financial Accountability Office concluded "*Two of the primary benefits of nuclear generation are that it is both relatively low-cost and emits very low amounts of greenhouse gases. There are alternative generation portfolios which the Province could use to replace nuclear generation. However, currently none of the alternative generation portfolios could provide the same supply of low emissions baseload electricity generation at a comparable price to the Base Case Plan*".

So, it appears that we Canadians are indeed sensible people. We understand that our existing fleet of nuclear plants are reliable, low cost and low emitting. And it is this good sense that will keep our air clean. This needs to be an

example to others so they can also see that removing existing well operating plants from service early to appease a big green lobby is a crazy risky proposition. After all, what can be more important than being able to breathe?

An Inconvenient Reality – Nuclear Power is needed to achieve climate goals

On a quiet Wednesday afternoon, I decided to go and see Al Gore's update on climate change, "**An Inconvenient Sequel: Truth to Power**". While certainly a powerful update on the importance of climate change and on the need to do something about it, I was disappointed. Why? Because, once again, after repeating the phrase "climate crisis" many many many times over its 140 minutes (would really like to know how many times this phrase is repeated), the solutions presented exclude the one with the largest potential, nuclear power.

While showing us melting glaciers and extreme weather, a case is then made that renewables are finally taking hold and the future is now within reach. The film claims there are jurisdictions that are indeed close to 100% renewables and talks about some already achieving 100% for limited periods of time.

We have talked about this before in our discussion of the recently published study that criticized the popular Marc Jacobson paper claiming a 100% renewable United States is achievable by 2050. It simply cannot be achieved; and it's time to focus on a larger basket of solutions that can actually solve the climate crisis.

The large Banning Pass 615 MW wind farm in California provides as much energy as one fifth of a standard 1,000 MW nuclear plant – is this what we consider environmental progress?

After watching the movie, I went to the web site and signed up for emails from the Climate Reality Project. On the first email, there was a box asking for donations labelled “Science Matters”. And yes, it does. Science tells us that nuclear power provides large amounts of low carbon electricity economically and reliably. In fact, during the recent Hurricane Harvey that flooded Houston Texas, it was the South Texas Project nuclear plants that kept running ensuring ongoing electricity supply. If you want to advocate to resolve the climate crisis, then all science matters, not just the science that supports a certain point of view.

However, there are also important lessons to be learned for the nuclear industry from this movie. First of all, the environmental movement has succeeded in making the word “renewable” completely synonymous with both “low carbon” and

“clean”. There is little argument from the public when stating renewables are the solution to climate change. Whereas in reality it is “low carbon” energy that is needed. Look at any country’s projections for the future and they will talk about their target for renewables, not for low carbon energy. If we really have a “climate crisis”, then limiting the solution to a subset of what is available when it comes to low carbon options will not lead to the outome that we all need.

There is no doubt that Al Gore is a very credible champion in the fight against climate change. The nuclear industry does not have the same although change is in the air. As we discussed last month, there are now pro-nuclear NGOs with credible leadership. In the movie, Al Gore offers training to support those who want to become climate advocates. This includes lectures and the provision of useful presentation materials. I suggest that this is what is required for the nuclear industry. Provide training in nuclear advocacy and offer up materials to be used. While there is excellent information available on industry websites such as the Canadian Nuclear Association, the Nuclear Energy Institute and of course the vast resources on the World Nuclear Association site, I would suggest there is still more work to be done. We now live in a visual world so let’s make sure we offer a large photo gallery and useful charts and diagrams that can readily be dropped into any presentation. This includes factual information on other forms of energy as well such as wind and solar – and information on countries such as Germany who have taken decisions on their energy future that clearly show their progress, or lack thereof.

So, if the movie is right and the world is in crisis, it makes absolutely no sense to not use all the options available to humanity to solve this crisis. Limiting the fight to options that are clearly insufficient is akin to madness. At the end of “An Inconvenient Sequel: Truth To Power,” the audience is

asked to take the pledge to be inconvenient – to keep demanding schools, businesses and towns invest in clean, renewable energy. We agree, be inconvenient and also demand that nuclear power play the significant role that it can to really make a difference because the inconvenient reality is that renewables are just not going to get us there.

Sometimes we need to ask if, for many in the environmental movement, decarbonization is really the goal? Imagine a world where all the electricity was suddenly generated by nuclear power eliminating carbon emissions completely so that the climate crisis was solved. Would Al Gore consider this a win? I just don't know.

Advocating for nuclear power – the time is right

We live in strange times. Globally, populism is growing in response to a deep-seated anger with so-called liberal elites. Experts are no longer respected over louder voices that support peoples' strongly held views. There are no facts, only beliefs.

While most of the world continues to support the Paris agreement on climate, there is a reluctance by some to include nuclear power in the tool-kit to help meet this global challenge. There is wide spread belief that Germany is going down the right path as it eliminates nuclear from its mix and drastically increases its use of renewables. The only problem is that fossil fuel use is also increasing and emissions are not going down. This has not stopped other countries like France, which has one of the lowest emissions in Europe due to

their nuclear fleet, setting out a policy to reduce reliance on nuclear. And now Korea seems to be going down the same path even though it would probably be hard to find another country that has benefited more through successfully implementing its nuclear program.

Does this mean that nuclear power is getting ready to move over and cede the future of energy supply to a fully renewable world? Not even close. With 58 units under construction there are now more new nuclear units coming into service each year than in the last 20 years. The UAE is nearing completion of its first units, a four-unit station as it becomes the newest entry into the nuclear club.

On the other hand, in the USA units are struggling to stay in service in de-regulated states and one of two new build projects has been stopped in the face of Westinghouse bankruptcy.

In the midst of all of this apparent chaos, there is a bright light. People are standing up saying – don't close my nuclear plants. People are recognizing that removing large low carbon emitting stations from the energy mix is no way to improve the climate. And most of all these people are ready and willing to fight. In the more than 35 years we have been in the nuclear industry I don't remember a time when there were strong vocal pro-nuclear NGOs. Yes, that's right – there are those who are not directly in the nuclear industry who have taken up the fight for nuclear. Not because they have any great passion for the technology, but because (as we discussed in May), they see nuclear plants as the ultimate solution to important issues. They want to save the environment. They want plentiful economic energy and they know that nuclear is an important part of the solution.

More vocal pro-nuclear NGOs today than we have had in 35 years

These organizations include a growing list of environmentalists such as Environmental Progress, Energy for Humanity, Bright New World and Mothers for Nuclear – to name a few (this list is not meant to be exhaustive so if your organization is advocating for nuclear power, please comment with your name and a link). What they have in common is an understanding that nuclear power is not the evil that some think it is and that in fact it can help to make the world a better place. And of more importance they are willing to advocate for it.

The way I look at it, there are two types of advocacy. First there is the broader objective of securing public support; and then there is the more targeted advocacy that fights in the trenches to get political support for specific projects and actions. It is this second approach that I want to focus on here. These pro-nuclear groups consist of many who have spent

their lives advocating for what they believe in; and therefore, bring a knowledge of how to influence decision makers and raise the profile of their cause. I have talked before about Meredith Angwin's wonderful book on how to be a nuclear advocate. It's a "how to" on getting out there and taking action. Or take the case of the nuclear bus – old fashion grass roots activism.

As was once explained to me, it is always easier to be against something than to be a supporter. It is anger about things that people believe is wrong in the world that ignites passion and brings them to the streets; supporters often stay at home and discuss these projects with their friends over a glass of wine. That is in part why there is so much passion about stopping the closure of existing nuclear plants. It is easier to be against closing them with the impacts to emissions and our communities than to argue in support of building something new. This is the beginning.

Because after all, it is a numbers game. 200 anti-project protesters can get a lot of press even though there may be 2000 who support the project but who stayed home. It's about getting people out – politicians want to do the will of the people and they need to see this will. Supporting continued operations of a plant or even a new build is much easier if the preponderance of the people speaking at public hearings are in favour of the project.

The word we use today is "social license". But what does this really mean? If it means securing significant local support for something then it is a laudable goal. However, most anti-nuclear (or anti-anything) groups take it to the extreme and mean that they have to agree with proceeding; which is something they will never do. As stated so eloquently by Rex Murphy in his piece on the efforts of the new NDP government desire to develop oil in Alberta – "*Notley [the Premier] missed the central point of social licence: its preconditions can never be met, and are not meant to be. It is an*

obstructionist tactic, designed to forestall and delay."

So why are countries ignoring the potential benefits of nuclear power as they strive to feed their energy hungry citizens with low carbon economic energy? There are many reasons as we and others have discussed before. We certainly believe that the overriding issue is fear. But we can also see that when people become supporters based on nuclear power being a solution to issues of importance to them, they do their homework and are able to resolve their fear. So we need to ask ourselves are people really that afraid, or is this also a remnant of the past where environmentally conscious groups were synonymous with being anti-nuclear? Are we seeing the last vestiges of a generation that fears nuclear power at all costs? Do we now have the opportunity to start to change the minds of a new generation that is willing to stand up and advocate for nuclear power? It may well be.

One thing is for sure, we all need to get out there and advocate for what we believe in. The time for talk is over – it is time to act. We need to organize and be sure to be out there every opportunity we can to support the decisions that we believe are necessary to achieve our goals.

So,

- if you believe that climate change is a threat and that fossil fuel use is the main culprit; or
- if you believe that access to economic reliable energy is essential for progress and is critical to lift people out of poverty; or
- if you believe that high quality jobs and technological innovation is good for our communities and our economies; or
- if you want a future for your children and grandchildren with abundant plentiful reliable economic and low carbon energy to support them as they create their own future;

Then the answer is clear – and that answer is nuclear power.

This is a call to action. We all need to work together to advocate for what we know is right. We have been involved in this industry for close to 40 years and still are passionate supporters – because we truly believe we can leave the world a better place than when we started.

Energy policy cannot be based on fantasy – the truth may yet prevail

Over the last week or so, the internet has been abuzz with articles on the recent paper published in the Proceedings of the National Academy of Sciences, "***Evaluation of a proposal for reliable low-cost grid power with 100% wind, water, and solar***", by 21 prominent scientists taking issue with Mark Jacobson's earlier study claiming that 100% renewables is feasible in the USA by 2050. Given the strong desire to believe in this utopian future; and how many prominent people have referenced this Jacobson paper to support their energy views, it is somewhat surprising how much press the opposing view elicited. That being said, most of the articles had titles like, "*A bitter scientific debate just erupted over the future of America's power grid*" or "*Fisticuffs Over the Route to a Clean-Energy Future*" making it seem like this is about scientific debate, when it is actually about a paper that has been proven to be false.

As stated by this paper's authors, *"In this paper, we evaluate that study [the Jacobson study] and find significant shortcomings in the analysis. In particular, we point out that this work used invalid modeling tools, contained modeling errors, and made implausible and inadequately supported assumptions. Policy makers should treat with caution any visions of a rapid, reliable, and low-cost transition to entire energy systems that relies almost exclusively on wind, solar, and hydroelectric power."* These are pretty strong statements for an academic paper.

Of course, for most of us in the industry this study is telling us what we already knew, that 100% reliance on intermittent low-density energy sources is not going to meet the needs of an energy hungry world. We suggest you read a few of the articles and of most importance, the actual paper. We would also recommend you read the article by James Conca "*Debunking The Unscientific Fantasy Of 100% Renewables*" which takes aim at the issue of bad science.

But the world is passionately in love with renewables. What can be better or more natural than wind and solar? It makes you feel good – there are no problems that can't be overcome

with these wondrous technologies. They definitely don't cost too much [but they need subsidies], or have environmental or waste issues [solar waste is increasing] and of course their intermittency is a modest problem to be resolved by smart people [by building more gas to back them up]. On the other hand, fossil fuels emit carbon and while nuclear plants are low carbon, they are dangerous – everybody knows that. And in this era of fake news and alternate facts, why would anyone want to change this glorious view of the future?

Of course, the option that does tick all the boxes for a low carbon energy revolution is nuclear power. And we are starting to see this position being more widely accepted. As the dream of a renewables only future fades, the merits of nuclear are once again coming to the forefront. That is why the US government is taking action to save its operating nuclear plants that are struggling in de-regulated markets, the UK is strongly supporting new build, Canada is refurbishing its aging nuclear fleet and China is rapidly expanding its share of nuclear production.

Countries like Germany that are committed to phasing out nuclear for a 100% renewable future are further proof that this approach to decarbonization is flawed as they add coal production to make up for their nuclear shortfall. Now Korea seems to be following this approach as their new president is committed to getting rid of both coal and nuclear (70% of their current system) for a renewable future. We only hope this analysis of Jacobson's paper is a wake-up call that is heeded in these markets that now seem to be following an unrealistic romantic world view rather than a realistic one.

Once again, I have to quote Michael Shellenberger. In his proposal for Atomic Humanism his first principle is – "*nuclear is special. Only nuclear can lift all humans out of poverty while saving the natural environment. Nothing else – not coal, not solar, not geo-engineering – can do that. How does the special child, who is bullied for her specialness, survive? By*

pretending she's ordinary. As good as – but no better than! – coal, natural gas or renewables."

And it is this pretending that needs to stop. There is no longer a need to be defensive when supporting the nuclear option. Or as stated by the Department of Energy in the USA. *"… we're particularly proud of the contributions being made by the nation's nuclear power plants. Nuclear is, in short, a clean, constant, and downright cool energy resource. Unfortunately, many people may not understand how remarkable this unique energy source truly is, or the role that it plays in our energy portfolio and Americans' daily lives."*

We are at a crossroad. The time has come to strongly support the best technology that can reliably meet the energy hunger of the world and we need to make it known to policy makers everywhere. Making energy policy on a hope and a dream is no way to plan our energy future. Nuclear power is the only true path to a low carbon future with the vast amount of energy needed to fuel the world that is both economic and reliable – and yes safe. If we work hard to support the facts, the truth may yet prevail. Or as stated by Michael Shellenberger – Nuclear is special – let's say it loud and let's say it proud!

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.

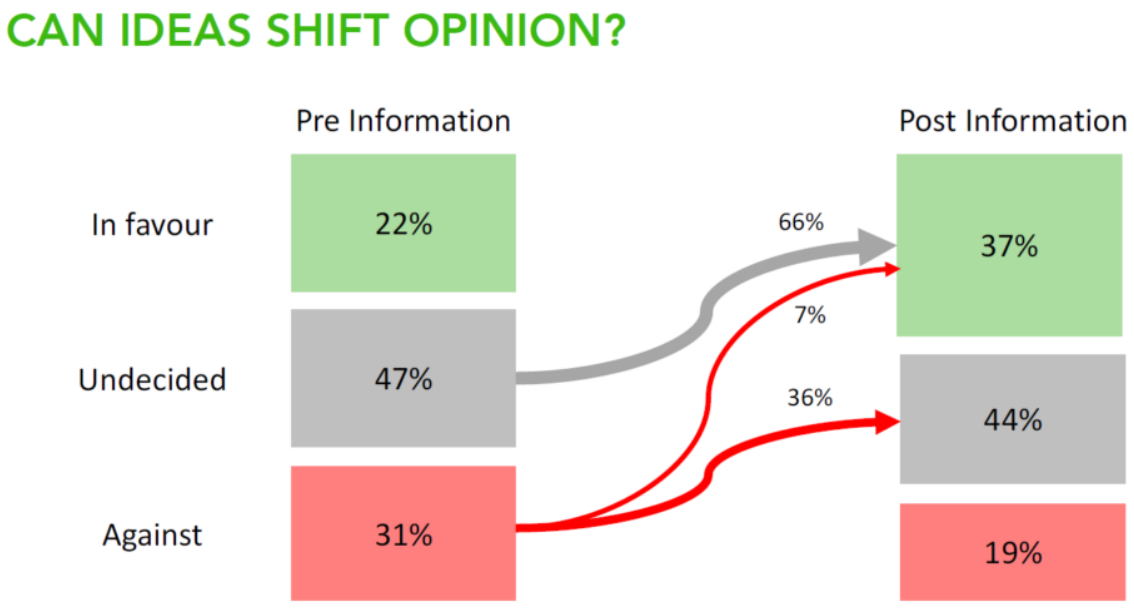
Beliefs about nuclear power are well entrenched in society. Most of the concerns come from its weapons origin and a significant fear of radiation that will not just go away with a simple explanation or better education.

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.



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 20th – century dinosaur; but rather is a technological wonder able to produce the huge amounts of clean reliable energy required for the 21st 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.