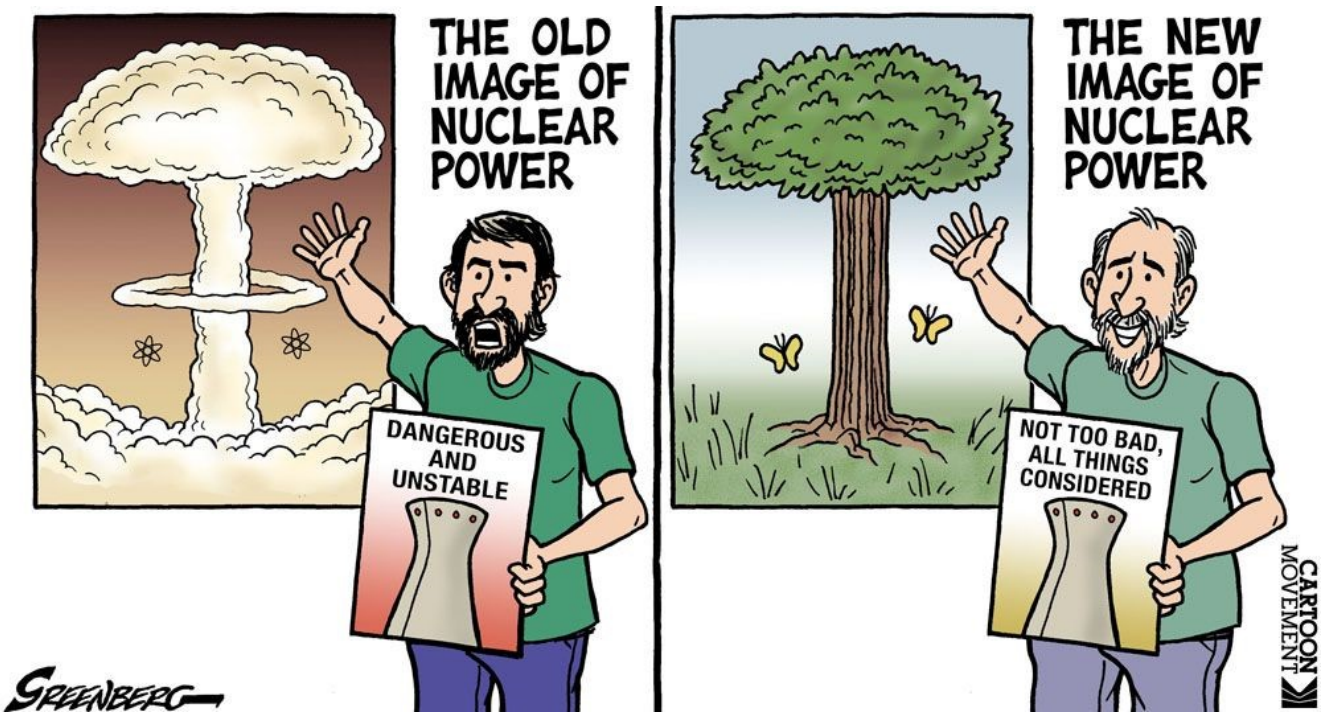
Let’s stop focusing on beliefs and really start communicating

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."

Everybody knows how energy will be generated in the future, or do they?

At an event a few weeks ago, a number of speakers prefaced their comments with statements like "**everybody knows** the future will be based on distributed generation – primarily with small scale renewables and storage to provide reliability". While there is currently a trend towards increased use of wind and solar and batteries are increasing their footprint as viable short-term storage (current batteries mostly provide 4 hours of energy and some provide 8 hours), pronouncing this as the definitive path for the future is premature.

It is hard to understand why so many people seem to believe that securing energy from a traditional large electricity grid is the way of the past and that generating your own electricity, perhaps together with your neighbours in a microgrid, is by far the better way.

After all, in most aspects of our modern lives, we are

becoming more and more networked and interdependent with others. We have no problem securing our internet from large telecoms and we love using large social media sites such as Facebook and Instagram to share our most private thoughts with our global network. We are comfortable being totally dependent upon large companies for so many aspects of our daily lives. We read books and listen to music on our various devices where we depend upon the company being in business as we no longer take physical delivery of content. I spent thousands of dollars on Sonos speakers that provide fantastic sound, but if Sonos disappears tomorrow they will no longer function since they need the Sonos app and its business associations with a range of music providers to keep working. Our NEST thermostats require the app to function at their best and as we move to the "smart" home, all of these devices are operated with apps that require the company supporting them to be in existence for the long-term while we naively assume that because they are so large that Amazon, Facebook and Google will always be there and can never go bankrupt.

Yet somehow, when we have accepted being so dependent upon companies that are larger than some nations for most of what we consider important in our lives, for a basic commodity like electricity, which is essential to enable all of these other services we both need and desire, we conclude that generating it ourselves on our roofs is the best way forward. We have this romantic fantasy that we can live off-grid with a combination of solar power and battery backup. Of course, with a bit of thought we realize that it would be a crisis if it rains for a week and we can't charge our iPhones, so we accept that we cannot go it completely alone. The conclusion being that maybe we need to collaborate with our neighbours and build a small system (or microgrid) to achieve the reliability that we need to power our lives. The question then becomes how big a system do we need?

Electricity generation and distribution is a complex system.

It is already distributed in a sense because a traditional grid requires a number of generating stations in different locations connected by a system of wires to provide customers with cost effective and reliable electricity. How big a system do we need to maintain reliability? Well, after the big black out in North America in 2003, it was decided by US regulators that increased inter-connectivity would be required and all utilities would have to adhere to stringent reliability standards to maintain this interconnection so that one bad actor cannot bring everybody down. So, in a sense we are all connected. The same in Europe where most countries' grids are interconnected to provide a robust reliable system.

Since it is likely that distributed generators will have to be connected to a microgrid and that microgrids will have to be interconnected to maintain robustness and reliability, then aren't we just building a new type of large system similar to what we have now? I guess it is the larger centralized generating stations that people dislike as they believe that smaller renewable generation with each of us being generators is the way forward.

But is it? It may be nice for middle class and wealthy environmentalists to dream about a simple life in which they generate their own electricity on their roof, grow much of what they eat in their own garden and buy organic and GMO-free products to meet the rest of their dietary needs; but does this really reflect the reality of society as it is developing today? The world is urbanizing quickly with most people not living in single family homes in the suburbs, but in high density buildings in cities. Is it realistic to generate our own electricity on the roof of a 200 unit apartment building where our own unit may be only 600 square feet? Should we grow our own food on our concrete balconies? Should we drive our electric car to work and clog the roads because we can charge it overnight when demand is low and avoid the subway because it uses on peak electricity when demand is high?

As the world moves to higher density living, it seems unlikely that we can meet our energy needs with lower density sources of supply. As stated by Michael Shellenberger, "Humankind has *never* transitioned to energy sources that are *more* costly, *less* reliable, and have a *larger* environmental footprint than the incumbent – and yet that's precisely what adding large amounts of solar and wind to the grid requires. " …. "In other words, going from energy-dense fuels to solar and wind requires the *rematerialization of energy* in the form of more land, materials, mining, storage, and waste."

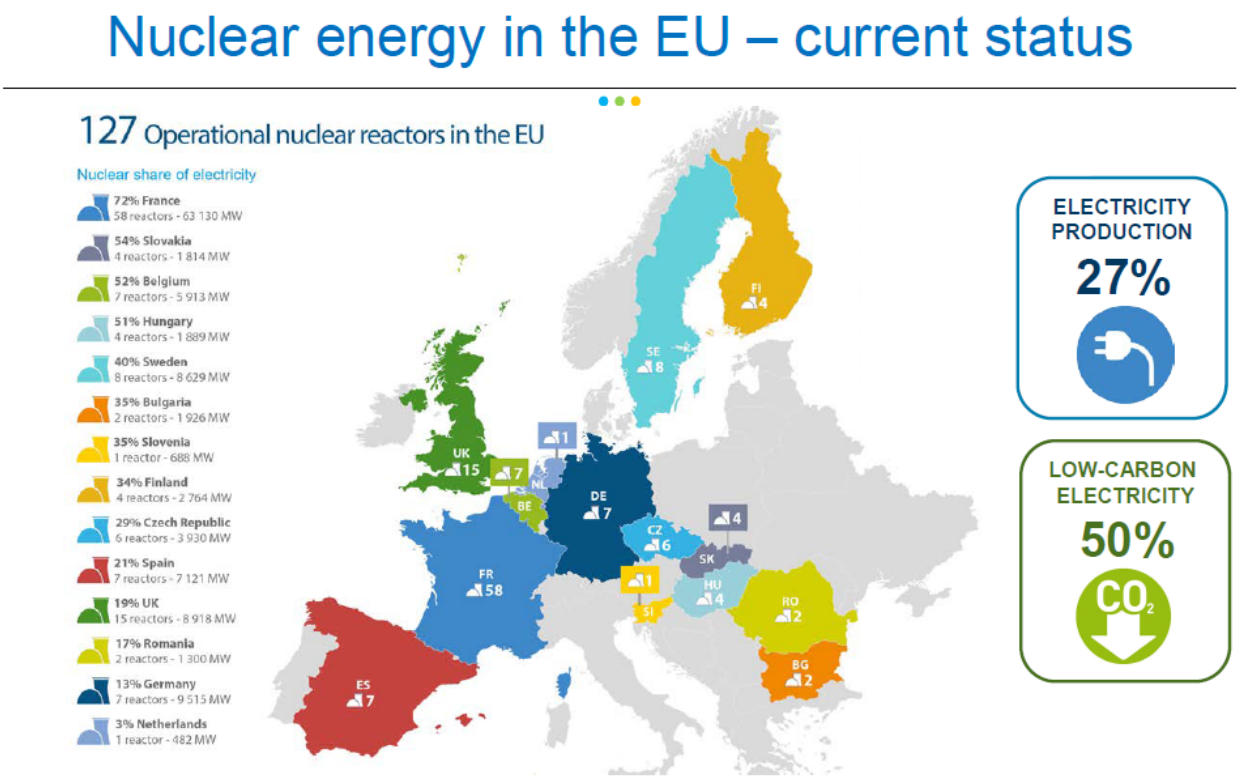
While idealistic environmentalists can live in their big homes in the suburbs and pretend they are living in an isolated cabin in the woods, the rest of us need to power our lives with reliable economic and low carbon electricity. This means high density generation for high density living, and there is no better high-density fuel source than uranium.

One thing we know for sure is that predicting the future is perilous at best. We can be certain that we are more likely wrong than right when gazing into our crystal balls. The next time someone tells you that "**everybody knows…**" remember that this a way to avoid actually providing supporting evidence for their view of the future. What we do know is that the future is ours to shape; that reliable and abundant low carbon energy is required to power it, and that nuclear power has the density to meet these needs economically.

The road to a low carbon Europe is nuclear power

There are more nuclear plants in the European (EU) than

anywhere else. Yet a broad range of nuclear policies across the European nations is having a large impact on its future. Currently there are 127 nuclear plants in operation in the EU (plus another 5 in Switzerland). Of the 14 EU countries with nuclear power, a quarter generate more than 50% of their electricity with nuclear power and more than half generate more than 30%. In total, nuclear in the EU, generates 27% of its electricity and accounts for fully half of the EU's low-carbon electricity.



Source: Foratom presentation "Keeping Europe lights on – a role for nuclear", WNFC, Madrid April 2018

Nuclear power has provided decades of low carbon, reliable and very economic energy to the people of Europe playing an important role in fueling the European economy. It provides over 800,000 jobs at over 3,000 companies and provides security of supply needed by a region that mostly imports its fossil fuels (although some countries are coal rich). Most gas and oil come from Russia and Norway. It is not by accident that the lowest carbon emitters are the largest users of nuclear power.

You would think that there is nowhere on earth where nuclear has a brighter future. But you would be wrong. There has always been a strong anti-nuclear presence in Europe, more in some countries than others. Countries like Austria and Italy are anti-nuclear to their core, while other nuclear power houses such as Sweden, Belgium, Spain and of course, Germany, have continuously had to address strong anti-nuclear sentiment. These anti-nuclear forces are primarily based on ideology. They are the greens that have since the 1970s simply believed that nuclear energy is dangerous and needs to be stopped. But there are also countries like the UK, Finland and Hungary that have relatively high support for nuclear and are either building new plants or are planning to.

Greens have been successful in convincing the public that if you support the environment, then you must be against nuclear power. This belief was re-enforced by the Chernobyl accident in the Ukraine 30 years ago, and then again following the Fukushima nuclear accident in Japan in 2011. Couple this with a strong belief that renewables, primarily in the form of solar and wind energy can simply replace nuclear, then the solution seems simple – who would say they don't like sun and wind?

Some European nuclear countries, where greens have had influence in government, have been fighting to sustain their programs for decades. Anti-nuclear supporters have succeeded in getting government to impose special taxes on nuclear to make it costlier while at the same time subsidizing renewables. Under pressure from the Greens, some governments have agreed to long term nuclear phase outs. These deals were made (Sweden, Germany, Belgium) at the time as a compromise to enable continued operations in the short term, with nuclear supporters maintaining hope that in the long term it would become obvious that the phase out would not be practical. Unfortunately, as the time for these phase outs is now approaching, the opposite rings true. These policies have

been in place for a long time and the public have simply accepted that new renewable technology will be there to replace the aging nuclear fleet when its time comes.

With nuclear closures on the horizon, governments have had to take action with mixed results. Sweden has made progress to maintain their fleet having allowed plants to run longer and eliminating its nuclear tax, while Belgium has confirmed its phase out for 2025, and Spain is still working on its plan going forward.

Even France, Europe's largest nuclear country, has not been immune to anti-nuclear thinking. Its previous government mandated a maximum nuclear capacity to ensure the share of nuclear doe not increase and then a planned reduction of the nuclear share from about 75% down to 50% within 15 years. In the short term this means that for the soon to be completed new plant at Flamanville to come into service, an existing plant has to be shutdown; the country's oldest at Fessenheim. The new government has taken a more pragmatic stance and has deferred the target date while undertaking a review of its nuclear reduction plan. Let's face it, it is literally crazy to shut down an excellent operating asset at Fessenhiem for no reason other than it is politically mandated. The French regulator has said that these plants are safe to operate for another decade. This is an expensive political give –and needs to be seen for what it is, a plan by those opposed to nuclear to exert pressure to close plants, demonstrate there are viable alternatives, and over time push for a complete phase out.

Of course, the biggest change has been in Germany, Europe's technology powerhouse. After finally starting to reconsider the timing of its planned nuclear phase out, the Fukushima accident happened, and the Greens pushed for immediate closure, even sooner than was originally planned. And they succeeded. As part of its Energiewende, nuclear plants have started to close, and the share of nuclear energy has dropped

significantly with a total shutdown only a few years away. In December of last year, one of Germany's top economists, Prof. Dr. Hans-Werner Sinn, made news when he published a paper stating it is unrealistic to believe that Germany can power itself with only wind and sun due to their immense supply volatility. He concludes that 30% renewable is a viable target although this can increase through cooperation with neighbouring countries.

To those of us outside of Germany, their strong commitment to quickly removing nuclear from the mix is a complete mystery. Fear of nuclear in Germany has put the shutdown of nuclear ahead of reducing carbon emissions. No German has ever been hurt by a nuclear plant and German industry has benefited from abundant economic nuclear energy for a generation. With the highest energy carbon intensity in Europe, Germany recently accepted that it cannot meet its 2020 commitments as carbon emissions reductions have ground to a halt in the few years since nuclear started shutting down. Shutting coal plants instead of nuclear would have shown Germany as a carbon reduction leader, but for some reason they chose to continue to damage the environment by opening new coal mines and building new coal plants, as they prioritize nuclear shutdowns over carbon reductions. The German Energiewende is a good albeit expensive experiment, and the results to date should make others think twice about going down this path.

The fight for nuclear power in Europe has been long and hard. In some countries nuclear supporters have been worn down and sometimes wonder if they are fighting a losing battle. But they must always remember that European anti-nuclear sentiment is rooted in an ideology that is out of step with the current need to combat climate change. In reality, nuclear power has made Europe better in every way by delivering economic reliable electricity, while providing energy security of supply and preserving the environment by reducing the use of fossil fuels.

Even with the new build plans currently in place, Europe will need another 80 GW of nuclear by 2050 just to maintain the status quo. And that is not good enough. Rather than accept the political views of those that oppose; bold new plans should be made to increase the nuclear footprint in Europe including the very challenging task of changing views in anti-nuclear countries. If decarbonization is a goal, then there must be a realization that nuclear has been a great success in Europe and represents the best path forward to secure a low carbon economic energy future for all Europeans. A strong Europe needs nuclear power.

Going for gold, nuclear plants contribute to a resilient electricity system

Over the years, when talking about the pros and cons of various generating assets, we have talked about economics, environment and reliability – but more recently a new word has entered the energy lexicon – **Resilience**. As defined by Oxford, "***resilience*** *is the capacity to recover quickly from difficulties; toughness, the ability of a substance or object to spring back into shape*"

Well, if you are anything like us, you have been glued to your TVs watching the winter Olympics in PyeongChang Korea over the last two weeks. Watching these athletes whose hard work knows no bounds do their best to represent their countries and try to secure a medal is truly inspirational and their **resilience** is what keeps them going above all odds. With close to 3,000 athletes competing and only 307 medals earned, most were

disappointed in their quest for gold, yet they are all proud to have represented their countries and performed at their best. They never quit. They work for years to make it to a global competition where most do not win medals and then go back home, work even harder, and then hope to have the chance to do it all over again in another four years. I find that every time the Olympics are on, I feel inspired to work harder and do more to achieve my own goals.

The following Olympic ad by Toyota shows how shear determination and hard work can overcome the one billion to one odds of winning Olympic gold. It still brings tears to my eyes every time I watch it.

https://www.youtube.com/watch?v=sefscV3GvWM

Now that we have all been inspired, what do we mean when we talk about **resilience** of generating assets like nuclear plants? We mean being able to continue to operate through difficult and extreme external events, usually weather related. We first took notice a few years ago in 2014 when North America experienced the polar vortex and it was clear that gas couldn't meet generating requirements in the extreme cold, but that America's nuclear plants continued to run and keep Americans' lights on.

Last year, the US Department of Energy completed a study that emphasized the importance of **resilience** to our energy infrastructure. The cover letter from the Secretary of Energy started *"A reliable and **resilient** electric grid is critical not only to our national and economic security, but also to the everyday lives of American families."* It also introduced the idea that **resilience** has value to energy customers stating, *"We also need to recognize the relationship between **resiliency** and the price of energy. Customers should know that a **resilient** electric grid does come with a price."* Ultimately the Energy Secretary recommended to FERC that they compensate nuclear and coal generators for their **resilience** based on fuel

availability on site. Unfortunately, this approach failed but did start an important conversation.

This past fall during hurricane season, we used this word again when there were extreme storms in Houston, Florida and Puerto Rico. At the time it was noted that even though communities suffered greatly, the South Texas Project nuclear plant continued to run during the hurricane in Houston and that most nuclear plants were able to ride out the storm in Florida. On the other hand, even today, about 5 months after hurricane Maria devastated Puerto Rico, approximately one third of the island's residents are still waiting for power to return. Much of the reason for lack of power is the collapse of the transmission and distribution system, but this clearly demonstrates the importance of the electricity system as critical infrastructure in being able to successfully recover from natural disasters.

Then as we entered the new year, it was once again extreme cold that impacted the supply of electricity in the North East. Wind and solar don't do well in these extreme conditions and gas is directed to homes first for home heating. The result – New England was saved by oil, yes it was oil that provided a third or more of New England's electricity needs. And even that was at risk if the cold spell would have lasted much longer as reserves started to dwindle. Yet there is still a discussion of closing nuclear plants that just keep on generating during these events. So let's remember what Secretary Perry said, "*Customers should know that a **resilient** electric grid does come with a price.*" What should really be said is that not having the **resilience** needed comes at a significant cost for us all should the electricity we need not be there when we need it.

So why talk about this now? We were thinking of writing about the importance of **resilience** to the electric grid for some time since the DOE study came out last year. We know that nothing continues to operate in extreme conditions better than

our nuclear plants. But having been inspired by our Olympians, we realize it is not only the **resilience** of the nuclear plants we build that are so important to all our lives; rather, it is the **resilience** of those that work in the nuclear industry that will ensure our success. Just like those Olympic athletes, the people that work in the nuclear industry have unlimited passion for what they do – because they know they are working to make the world a better place, providing abundant economic, reliable, low carbon – and yes – **resilient** – energy to power our dreams for a better future.

In 2017, the myth of powering the world with 100% renewables has started to crack

When thinking about 2017, it is easy to see the bankruptcy of Westinghouse and the subsequent cancellation of its Summer project in South Carolina as this year's big issue. But as the year has drawn to a close, the continuation of its AP1000 project at Plant Vogtle in Georgia has been approved by the regulator and there is every expectation that Westinghouse will emerge from bankruptcy in 2018.

So while important, to us there is a much more important defining issue for 2017. It is the very real start of a movement that recognizes that powering the world with 100% renewables is a myth – and that chasing a myth will not get us to our global goal of meeting the world's increasing energy needs while reducing carbon emissions and successfully

combating climate change.

There were a number of defining moments in 2017 that highlight this change in attitude.

First there was the 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. In a nutshell, the paper found many poor assumptions in the Marc Jacobson paper and ultimately finds that its conclusion that 100% renewables in the United States by 2050 is false. And how does Marc Jacobson respond to this criticism? Does he review his work, make changes and then show that his conclusion remains valid? No, he does what some would do when their beliefs are under attack, he sues. This is one of the most shameful episodes of the year. A scientist suing when others disagree with him is just not the way things are done. Science is about skepticism and continuous questioning. A peer reviewed paper that is critical of another one is to be applauded and responded to, to continue the discussion. Suing those who disagree is simply not one of the options.

Second, we saw Germany called out for its lack of progress on decarbonization in recent years while holding COP23 in Bonn late this year. While massively investing in new renewables, these are unable to take the place of its closing nuclear plants, thereby making coal king in Europe’s most polluting nation. This story shows how a 12-thousand-year-old forest that has been almost completely consumed by the country’s ravenous addiction to coal power.

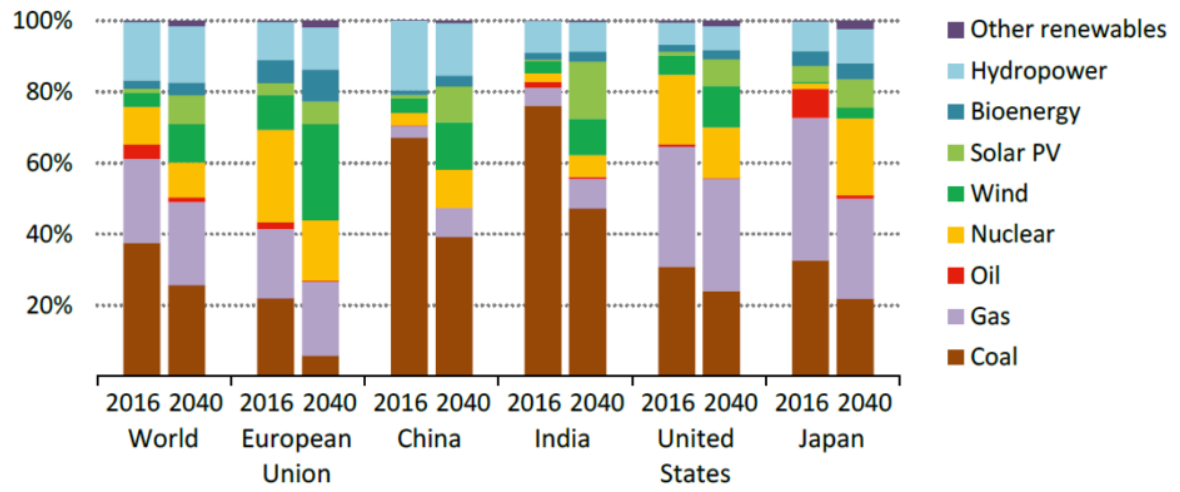
Other countries have seen the light as well. The UK is strongly committed to new build nuclear and Sweden and France have realized that removing nuclear from the mix will do nothing to achieve their climate goals. In Korea, the public

decided to continue with a new build going against its new government's policy.

And finally, we saw something this past year, we have not seen before – the rise of the pro-nuclear environmental NGO – as those who care about the environment and climate change are starting to realize that renewables alone is a path to nowhere. This includes such organizations as Environmental Progress, Energy for Humanity and Mothers for Nuclear.

A look at the 2017 edition of the World Energy Outlook tells an interesting story.

Figure 6.14 ▷ Share of total generation by type worldwide and in selected regions in the New Policies Scenario



Current and proposed policies strongly reshape the power mix in the New Policies Scenario, nearly doubling the share of renewables and driving down coal's contribution

Source: World Energy Outlook 2017

Even with massive investment in renewable technology, fossil fuels remain king in electricity generation by 2040 still producing about half of all global electricity. Wind and solar increase to anywhere from 20% in the New Policy scenario to about a third of electricity generation in the Sustainable Development Scenario (the scenario that shows what can be done to meet Paris objectives). This is even though wind and solar make up about 45% of the total investment in new capacity and

global subsidy for renewables grows from about $140 billion per year to $200 billion.

Looking deeper at the numbers, it can be seen that this investment results in a huge increase in wind and solar capacity of 5000 GW in the Sustainable Development Scenario. All other things being equal, this same amount of energy would only have required about 1500 GW of nuclear to be built since a nuclear plant produces about 3 times more energy than an equivalent size of solar plant and more than 4.5 times as much energy as wind capacity. And this is before any consideration of the intermittency of wind and solar and the needed improvements to systems to accommodate that – and of course the predominantly fossil backup needed for when the wind doesn't blow, and the sun doesn't shine.

What this shows is that wind and solar are good ways to reduce fossil use, probably by about 30% or so. But they are not good ways to REPLACE fossil fuels in their entirety. This must be done by more robust alternatives such as hydro and nuclear. These are the only large-scale base load options that are both reliable and low carbon available today.

And what about storage? Often, we hear that once storage technology improves, this will be what is needed for renewables to break free of their intermittency. Of course, this sounds better than it actually is. In reality, storage would be ideal for base load plants like nuclear where it can help store energy generated during times of low demand reducing the need to build new peaking generating plant. On the other hand, storing enough energy from wind and solar would require massive overbuilding of capacity to collect extra energy during the 20% of the time the sun is shining and the 30%, the wind is blowing.

Changing beliefs is hard. We live in a time when all opinions are considered valid, whether from experts or lay people. And most of all, people are challenging expert views

as never before. Yes, it is a romantic view of the future to believe that all of our energy will come from energy sources such as the wind and the sun. But beliefs don't change physics and if we really want to change the world, we need more nuclear power to replace a large portion of today's fossil generation. Only then will we be on our way to a truly low carbon economy. We are under no illusion that this change is coming quickly, but 2017 saw the start. There are now cracks in the 100% renewable myth. It will take hard work and ongoing support from the new generation of pro-nuclear NGOs to keep broadening the crack in 2018 – and who knows? Maybe the tide will shift, and we will be on our way to a truly sustainable future.

Wishing you all a very happy and healthy new year!

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?

Planning for nuclear project success – the false security of a fixed price contract

Nuclear plants can be the workhorse for many utilities, offering reliable and economic electricity into their grids. Operations across the globe have been excellent with the entire US fleet, representing a quarter of the world's operating plants, consistently operating at 90% capacity factors or better. However, building new nuclear plants is more challenging especially in Europe and the US where there has been a long pause in new plant construction. This has meant the infrastructure and supply chain has had to be re-

established for new plants to be built.

As a result, when it came time to restart nuclear construction, utilities who had not built plants for decades saw a path forward by passing on as much of the construction risk as possible to the plant vendors. The strategy is straight forward; get a fixed price EPC contract so that the vendor takes on all the project risk and responsibility. The belief is that these companies have developed the technology so they are obviously best suited to take this on. The only problem with this logic, is that it is wrong.

Just talk to Southern Company or SCANA in the US, or TVO in Finland. They negotiated hard and got their technology vendors to take on large fixed price contracts. The result, Olkiluoto 3 is 9 years late and counting; and Areva has been forced to restructure. And with Westinghouse in Chapter 11 bankruptcy, Southern has had to take over the main contractor role at Vogtle and the Summer project has been cancelled. Not quite the outcomes these owners were planning on. While there are a number of reasons these projects have struggled, it is not because of the technologies themselves. We have little doubt that once operating, these advanced designs will generate reliably for many years to come. And while some believe nuclear plants just can’t be built to cost and schedule, we know this is not the case as can be seen in countries like China and Korea where they have been successfully implementing large ongoing new build programs consisting of standardized designs for many years. Therefore, in this post we want to focus on some principles that owners should consider when structuring a project to effectively manage nuclear project risk and achieve project success.

Let’s start with some basic facts about nuclear projects. They are large, capital-intensive projects with relatively long project schedules. Once they are operating they have low and stable operating costs primarily due to the low cost of nuclear fuel. Therefore, to maintain the economics of a nuclear project – plants must be built to cost and schedule. And we all know, this often does not happen. Large projects (of all kinds) are renown for going over budget and over time.

Nuclear projects take an incredible amount of planning and effort to complete successfully. **Success;** this is the most important word not used nearly often enough in planning and executing a large nuclear project. It is easy to get so consumed when talking about risk with figuring out which party will pay when things go wrong, we forget the most important objective is to absolutely ensure that things go right.

One of the most important lessons learned from these recent difficult projects is that the project owners took too much comfort from placing a huge amount of risk on the contractor – and the contractors’ willingness to take on this risk was accepted as a proxy for both capability and confidence that

the overall level of risk was manageable. The reality is that if you are an owner building a plant, there is one absolute truth – if it is your plant, then it is your risk. There is no way out of it. I can assure you that if the contractor fails, the owner fails. Always.

It is essential to recognize that managing this risk is the owner's responsibility. And while this can be accomplished by transferring some risks to contractors and others to insurance – most of all, the owner needs to manage and mitigate this risk through its own strong project management.

How do you, the owner do this? First of all, build a strong internal project management team to control the project. If you don't have enough experience, get it. Once you have a team in place here are a few key tips.

- Choose a design that has been built before. A standard deign will be lower in risk. First of a Kind (FOAK) risk is real. If it is not possible to avoid a new design, then plan to get the engineering completed before a final decision is made to proceed with the rest of the project and have a cost and schedule that take this higher level of uncertainty into account;
- Invest in your supply chain. Don't select your major contractors based on reputation alone. Projects are built by people, not reputations. Make sure the best people are assigned to your project. Assume the contractors are not as good as you think they are and be prepared;
- Choose contract structures that transfer risk to your contractors sufficient to incentivize them to perform. Pushing too much risk and then driving your main contractors into bankruptcy serves no one; and
- Most of all, no matter the contract structure, there must be transparency through the contract because it is always your job as the owner to manage your project. It is in no one's interest to allow the contractor to

manage on his own and then watch him fail. It is only with a strong set of project metrics and efficient reporting that problems can be identified early and acted upon – by all parties – with an unwavering focus on project success.

Nuclear plants are extremely reliable, efficient, low carbon and cost-effective producers of electricity. As they are capital intensive, their economics depend upon successful project implementation. Therefore, once you take a decision to implement such a project always remember that success is your responsibility and this responsibility cannot be passed on to others. Keep that in mind when structuring your project and in all decisions you make – and you will be well on the road to achieving your goal – a successful nuclear project built to cost and schedule.

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!