

Nuclear Energy Summit – Broadening the nuclear coalition

In our last two posts we looked at the pledge signed by more than 20 countries at COP28 in Dubai to triple the amount of nuclear globally by 2050 and the pledge made by more than 120 companies in the nuclear industry to meet this challenge. This month we comment on the first global Nuclear Energy Summit held in Brussels March 21, 2024.



The summit photo had Brussels' Atomium as its backdrop (Image: Klaus Iohannis/X)

This summit, organized by the IAEA together with Belgium, included senior government delegations from 32 countries, coming together for the sole purpose of discussing the future of nuclear energy and its role in supporting countries' climate and energy security goals.

The list of 32 countries includes 14 additions to those who signed the nuclear pledge at COP28 (not all COP28 signatories

participated in this event). This includes new countries with long histories of nuclear power like Argentina, India, Pakistan, and Slovakia, to those who are active nuclear newcomers (Bangladesh, Egypt, and Turkey) and those who are aspiring to bring nuclear power to their countries (Philippines, Saudi Arabia, and Serbia). The list also includes China, who has 55 operating nuclear plants and another 36 under construction, the world's most active nuclear program, and Kazakhstan, the world's largest supplier of uranium.

Just the fact that the summit was hosted by Belgium is important, given that it only recently abandoned its plan for a full nuclear phase out. And add Italy to the list of countries who have not been supportive of nuclear in the recent past.

The resulting declaration stated *"We, the leaders of countries operating nuclear power plants, or expanding or embarking on or exploring the option of nuclear power ... reaffirm our strong commitment to nuclear energy as a key component of our global strategy to reduce greenhouse gas emissions from both power and industrial sectors, ensure energy security, enhance energy resilience, and promote long-term sustainable development and clean energy transition."*

The declaration identified a range of topics where policies need to evolve (for a more complete description refer to the WNA release) including increased financing, workforce development, and support to nuclear newcomer countries. We will discuss each of these items in future posts. They are all critical to a healthy growing global nuclear sector. Why is this important? Because rather than continuously debate whether to pursue nuclear, the discussion has finally moved on to collaborating to create the necessary conditions for success.

In support of the government's declaration, global industry

associations released a joint statement noting their strong support to ensure governments can meet their nuclear ambitions. In addition, a group of 20 NGOs from around the globe issued a Declaration on the Future of Nuclear Energy jointly calling for the efficient and responsible expansion of nuclear energy.

This first nuclear summit shows the collation of countries, industry and NGOs supporting and actively promoting nuclear power is growing rapidly. It is unprecedented in the level of national leader support for nuclear since President Eisenhower's Atoms for Peace speech 70 years ago. The time has come for action, and the stage is set to put in place the necessary policies to enable the rapid scaling of nuclear in meeting all our climate and energy security needs. The future is bright. But the work ahead is hard. This is only the beginning.

[Complete list of those signing the declaration: Argentina, Armenia, Bangladesh, Belgium, Bulgaria, Canada, China, Croatia, the Czech Republic, Egypt, Finland, France, Hungary, India, Italy, Japan, Kazakhstan, Netherlands, Pakistan, Philippines, Poland, Romania, Saudi Arabia, Serbia, Slovakia, Slovenia, South Korea, Sweden, Turkey, United Arab Emirates, UK, and the USA]

How do we solve the world's big issues if we are not interested in truth?

Making good decisions on issues of importance like climate change requires access to evidenced-based, truthful

information. And yet we currently live in a world where there has never been greater effort to control people through misinformation. Unfortunately, more and more people simply don't seem to care.

Likely of no surprise to anyone, we have once again seen evidence of the current lack of public interest in truthful fact-based reporting, this time here in Canada. As a result of a new Canadian law requiring companies like Google and Meta (Facebook/Instagram) to compensate traditional media for posting or linking to their content, Meta has banned all Canadian news media from its platforms. Google is contemplating the same but has not yet implemented any change.



Source: [istockphoto.com](https://www.istockphoto.com)

Some background on how we got here. The Canadian news media

has long had a revenue model that included both advertising and subscription revenues. The issue is that big tech (Google, Apple, Facebook and Amazon) are now the main beneficiaries of online ad revenue estimated at \$9.7 Billion in 2020 (with 90% of this revenue going to just two companies), while the news industry has lost just over half its revenues over the past decade. The Canadian government has responded with Bill C-18, the Online News Act, in which big tech would pay news companies for their content. The result, big tech has said no – that they would just ban this content instead.

For us, the issue is not who is right and who is wrong (as this can be the content of a much larger discussion); but rather the fact that since Facebook has banned Canadian news sources, **its users, for the most part, don't seem to miss it or care.** After a month of blocking news, analysis has confirmed that “Daily active users of Facebook and time spent on the app in Canada have stayed roughly unchanged since parent company Meta started blocking news.”

This should be the headline. The lack of interest in genuine news to keep people informed should have people outraged. Yes, there were complaints by users who could not share important safety information when their local communities were impacted by wildfires. Access to credible, timely information was critical for those whose very homes were at risk. But in the end, even public safety was not enough to get Facebook users to fight back.

Of course, this comes as no surprise to anyone these days. The lack of interest in truth is an ongoing topic. There are different reasons why this is the case. For some younger people, they simply have no interest in news. From “it just makes me feel bad” and “it has nothing to do with me”, we have a demographic with little interest in what is going on in the world at large. Then, there are those that have made up their minds on the issues they think are important and only want to see input from those they agree with. Often, these are the

folks who do not trust the media and think they are heavily influenced by the other side (whoever that may be). After all, social media algorithms are structured to keep user's interest in staying on the apps by delivering information they want to see. The truth is not one of the criteria.

This is part of a larger issue where we no longer trust experts to provide us with useful information as input to our decision making. As we discussed 5 years ago, in his book **"The Death of Expertise: The Campaign Against Established Knowledge and Why it Matters"**, Tom Nichols, 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. Experts are no longer respected to the point where *"we actively resent them, with many people assuming that experts are wrong simply by virtue of being an expert."* He goes on *"The issue is not indifference to established knowledge; it's the emergence of a positive hostility to such knowledge."* In fact, those that disagree with these experts are often lauded for having the courage to stand up to corrupt elites.

The reality is that a free press is a necessary pillar of modern democracies and is essential to providing accurate impartial information on issues of importance. And experts, by the very definition of the word "expert", are needed to understand and progress complex issues like climate change.

While people are arguing about who pays to enable news organizations to survive and thrive, government should be more concerned about the public's access to verified credible sources as part of the response to any search for information.

In an interesting article from last week's New York climate week, Bill Gates mused, "Are we science people or are we idiots?" A bit harsh – maybe – but sadly, a good question.

Fukushima 10 years later – its time to focus on the social science

Ten years have passed since Japan suffered the great Tohoku earthquake and tsunami that killed 20,000 people, caused US\$300 billion of damage and initiated the accident at the Fukushima Daichi nuclear power plant.

Reviewing the media reporting last month, the nature of the stories has changed. There were of course many articles that continued to talk about the dangers of nuclear power but there were also numerous articles noting the real lesson to be learned from the accident is that nuclear power is safe. And when news outlets associated the deaths in Japan with the nuclear accident, complaints resulted in many of them accepting their articles were wrong and issuing corrections to state the deaths were all due to the earthquake and tsunami.

When it comes to the actual impact of the accident on human health, the science is absolutely clear. No one died from radiation from this event (the Japanese have associated one death of a nuclear worker with radiation, but the science does not support it). A recently (2020 edition) updated United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) report on the levels and effects of radiation exposure due to the accident said that future health effects, e.g. cancer directly related to atomic (nuclear plant) radiation exposure are unlikely to be discernible. But that doesn't mean there was not a large impact on people and Japanese society as a whole. People are suffering

consequences related to the fear of radiation and its potential impact to them and their families, rather than from the radiation itself. As stated in the earlier 2013 UNSCEAR report, *"The most important health effect is on mental and social well-being, related to the enormous impact of the earthquake, tsunami and nuclear accident, and the fear and stigma related to the perceived risk of exposure to ionizing radiation."* Addressing this impact is essential for both the Japanese people that continue to suffer and to minimize these kinds of impacts in the future.

How society feels about different technologies and their dangers vary dramatically resulting in a broad range of public views when accidents happen. Let's look at some of the tragic events that have happened around the world in recent years and how society reacted.

In 2018 and 2019 two Boeing 737 MAX aircraft crashed (in Indonesia and in Ethiopia) killing 300 people. After the second accident the world reacted (two accidents so close together for a new design has never been seen in the history of modern aviation), and these planes were grounded for over two years as serious safety culture issues were identified at Boeing. Changes have been implemented to correct the deficiencies with the planes now declared safe and returned to service. Why did it take so long for the industry to react and why did the public not become more concerned about flying? Flying is important to the world as we all want to travel. We accept flying as safe and are willing to overlook an accident as a rare event even though the consequences are tragic. (Since the pandemic we miss travelling more than ever.) Reporting was more related to how the issue can be resolved to get the planes flying again than in creating fear of flying.

Last summer, a large amount of ammonium nitrate stored at the port of the city of Beirut, the capital of Lebanon, exploded, causing at least 215 deaths, 7,500 injuries, and US\$15 billion

in property damage, and leaving an estimated 300,000 people homeless. This was a huge tragedy, with the blame focused on the corruption of the Lebanese government. There was no reporting talking about this dangerous substance and its risks. No one was asking how it should be safely stored and transported and whether there are shortcomings in the regulations on how to keep people safe. In fact, the industry that creates the chemical was nowhere to be seen in the discussion.

Finally, as we all continue to feel the impact of this global pandemic that to date has infected more than 145 million and killed more than 3 million, we still have many who are fighting against public health directives focused on keeping us safe and some who simply choose to not accept the danger posed by this disease. With the end of the pandemic now in sight because of the amazing success of vaccines developed in record time, the biggest risk remains vaccine hesitancy. Somehow there are many people who are more afraid of the vaccine than the disease.

Looking at these examples, we see that:

- It takes two crashes to convince authorities to look for problems with a new aircraft design. The public, although concerned, does not become afraid to fly as long as it is on a different aircraft model (easily compartmentalizing the risk to a specific model) and most are likely to feel comfortable flying on the 737 MAX now that it has been approved to fly again;
- A devastating explosion of a dangerous chemical raises no questions at all about the chemical itself. The public are comfortable allocating the blame to government incompetence without any thought to whether or not others are unsafe who are using this substance;
- A global pandemic that to date has killed more than 3 million people and completely disrupted all of our lives

for over a year is not enough for some to follow the science while erroneously worrying that the cure may be more dangerous than the disease risking a delay to the end of the pandemic; and

- An accident at a nuclear plant resulting from an extreme once in a hundred-year natural disaster disrupts the lives of many and kills no one. The conclusion for some is the technology is so dangerous that there are calls to completely shut down the industry, with some countries like Germany who have no plant models that are similar to Fukushima nor the conditions for a similar event deciding the risks are too great.

Our purpose here is not to go into detail but to contrast how we as a global population choose to see threats and risks and respond to them. Each one of these examples demonstrates a vastly different response as the public has varying degrees of concern when evaluating risk. Often many of us try and discuss why we think this is the case. However, truly understanding these differences in perception and reaction is a task for the social scientists. The issues are complex. Studies are needed to learn how to better address public concerns and develop strategies to ensure that risks are contextualized, and science better explained to ensure the best possible response when tragic events occur.

It is a good thing the nuclear industry learns lessons from its experience to make nuclear better, but we also seem to define ourselves by our accidents rather than by our successes. Perhaps its time for that to stop. It may have taken a decade, but the world is realizing the benefits of nuclear power far outweigh the risks (a phrase we hear every day about vaccines) and that climate change is the greater threat to humanity that needs to be addressed now, with nuclear power being an important part of the solution.

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 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.



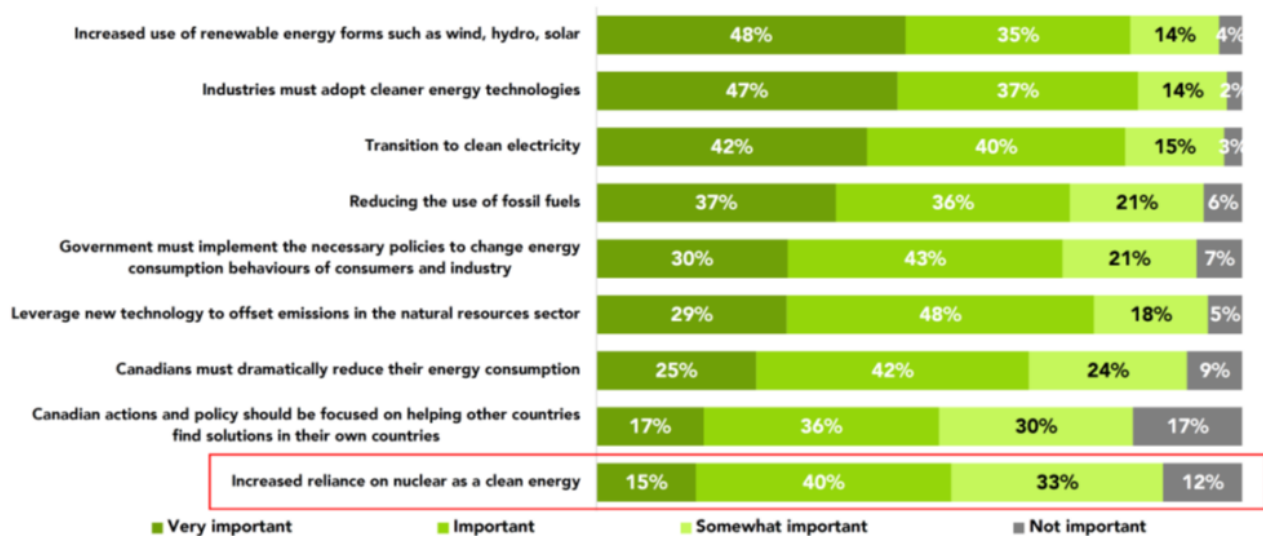
And we won't get there until we focus on the right things. After all, why should anyone even think about nuclear power, never mind come to love it? It is definitely not by explaining all the reasons they shouldn't worry about it; where it really starts is by having a clear understanding of the issues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

IMPORTANCE OF SOLUTIONS TO CLIMATE CHANGE



When it comes to climate change, how important are these possible solutions to addressing climate change?

ABACUS DATA

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.

With a new decade upon us, clean energy is as simple as following the science

It’s hard to believe, but a new decade is upon us. (We wrote the decade and nuclear power in our post earlier this year celebrating 10 years of blogging.) As the decade comes to a close, 2019 seems to be the year that climate change is finally being taken seriously, all led by a very unlikely champion. After all, who would have thought that a 16-year-old schoolgirl from Sweden would become not only a voice for a new generation, but a global leader in speaking truth to power on the importance of taking action to address climate change?

This is a young woman who has taken a stand. Starting her journey as a single protester sitting in front of the Swedish

parliament less than two years ago, she has now met with world leaders and inspired the largest climate strike in history. She acknowledges that as a 16-year-old girl, she does not have the answers, and as such, does not advocate for any one solution, nor claim to be smarter than anyone else. Her message is simple – this a climate crisis – and today's adults are not taking it seriously enough. Her recommendation to those older than her who do have the power, is to please do something and when choosing what to do, follow the science.

DOUBLE ISSUE

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PERSON *of the* YEAR

TIME

**GRETA
THUNBERG**

—
THE POWER
OF YOUTH



time.com

Time Person of the year

We have also been seeing one of the other less positive developments in the world over the last decade, trolling and personally attacking those we disagree with. In the case of

Greta Thunberg, the vitriol has been vicious and relentless. From world leaders such as Donald Trump who recently said she needed to work on her “anger management problem” to Brazilian president Jair Bolsonaro who called her a brat, to countless others whose attacks are so vicious that we wouldn’t repeat them. Her ability to respond with grace and humour when confronted with these attacks shows the strength of a new generation that cannot easily be bullied by those older than them.

When it comes to energy, criticism is nothing new for those of us in the nuclear industry. Recent polling has suggested that the younger generations are open to hearing more about nuclear power as it can be a part of the solution to the existential threat of their generation. But once again, there is conflict. On the one hand, there are those that believe nuclear is good. It is low carbon, nonpolluting, economic and provides an abundance of reliable energy to benefit all of us. Then there are those that believe that nuclear is dangerous. That it pollutes with dangerous waste products and is just the next accident away from destroying the world. These people believe that no benefits are worth taking such a risk. Our challenge in the new decade is to resolve this conflict with straight forward messaging. After all, the science is clear.

The reality is that nuclear power has been the largest contributor to carbon avoidance of any other technology in advanced countries and is a close second to hydro when considering the world as a whole. It has proven safe, having the best safety record of any form of energy generation. 2019 was the year this message started to resonate. From the important IEA report issued at the Clean Energy Ministerial meeting in Canada in June, to governments accepting nuclear as a clean energy source and undertaking the NICE (Nuclear Innovation: Clean Energy Future) initiative, to the recent MOU signed here in Canada between the Premiers of Saskatchewan,

Ontario and New Brunswick, to pursue and commercialize Small Modular Reactors (SMRs), the tide is turning.

It would be easy to leave this decade dismayed and worried about the future. It is a time when anything we disagree with is fake news and some say the very basic values of our liberal democracy are at risk. But we choose to enter the next decade full of hope. Yes, we have many challenges, one of them to protect the planet for future generations; while we want everyone—including the world's poorest—to have access to cheap, reliable energy. And yes, there are many who try to divide us; or we can listen to a new generation that are calling for us all to work together for the good of the planet with a compelling simple message – “follow the science”.

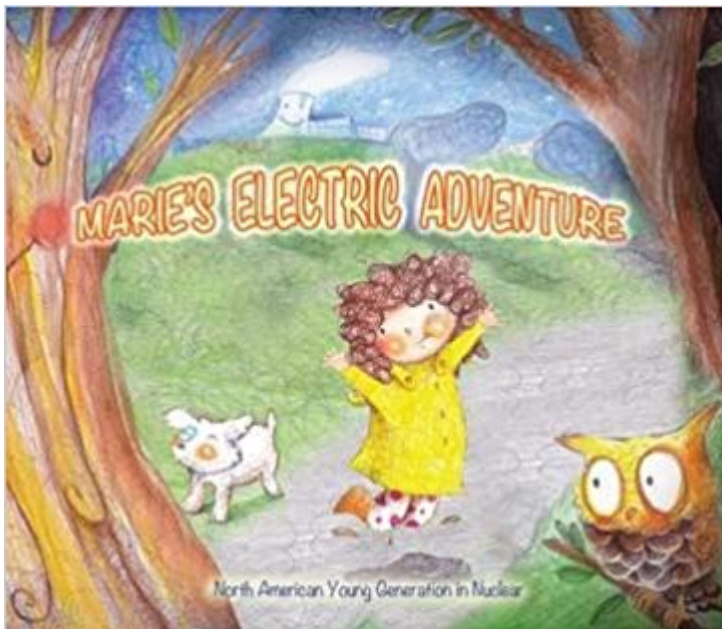
Once again, thank you for reading our blog. Wishing you all a very happy, healthy and prosperous 2020!

It's time to take back the narrative and rewrite the nuclear story

The facts are clear. Nuclear power is a critical part of our global low carbon electricity generation system. It provides abundant, reliable and economic low carbon electricity needed to power our energy hungry economies. Yet, as stated in the recent IEA report, **Nuclear Power in a Clean Energy System**, even though the use of nuclear power has reduced carbon dioxide (CO₂) emissions by over 60 gigatonnes over the past 50 years, (nearly two years' worth of global energy-related emissions), nuclear power has begun to fade in advanced economies, with plants closing and little new investment made,

just when the world requires more low-carbon electricity.

One issue that puzzles many in the nuclear industry is why we struggle to communicate our many merits to the public, unable to overcome the fear of nuclear that drives much of its opposition. The answer is simple. We talk in facts and figures, but people think in stories with emotion. As stated by Yuval Harari, in his newest book, **21 lessons for the 21st century** (make sure you also add his previous books, *Sapiens*, and *Homo Deus* to your to-read list), *"Humans think in stories rather than in facts, numbers or equations, and the simpler the story the better."* It is therefore time to ask – what is the nuclear power story?



Marie's Electric Adventure: A Children's Book About Nuclear Energy, a book by NAYGN

For an example of a positive story, we only need look as far as the renewables industry, with their compelling story that the world can be powered by nature using energy from the sun and the wind. These energy sources are limitless (after all, we will never use up all the sun and the wind) and have no negative environmental impact because they come from nature. Obviously, we need to increase their use until they meet 100% of our

energy needs.

This powerful story resonates with the public well beyond environmental groups to the point where many governments are fully supportive and are putting policies in place to realize this utopian dream. The fact that making this dream a reality is proving much more difficult than its supporters expected (as can clearly be seen in places like Germany and California), doesn't seem to phase any of the believers. They love their story and they know with absolute certainty that any technical impediments can be solved with time and effort and that wasting time on any other energy source is a foolish diversion from what is really important. This is in spite of the fact that you can't change the laws of physics or make the sun shine or the wind blow more than they do. But the faithful know they are on the right path and will not be dissuaded from their goal.

Why does this work? As discussed by Harari, facts often get in the way of a good story. A story not anchored in facts requires faith, and faith is a very powerful motivator.

On the other hand, the nuclear story has been dominated by those that oppose the technology. The story, based on extreme fear of radiation, is the technology is so dangerous that when it goes wrong (not if, but when) it may actually destroy all of mankind. Even many who support nuclear power believe the industry is made up of smart capable people who are safely managing doomsday machines. The fact that nuclear is by far the safest form of energy generation gets lost in the story that while the probability is low, the consequences of a big accident are unimaginable. Yet the reality is we have had big accidents and while the impact has been significant, they have proven that people can indeed be protected from harm – the most recent big accident at the Fukushima plant in Japan has resulted in zero deaths from radiation, but nobody believes it – it is inconsistent with this nuclear story.

The companion to this story is that even without accidents we have to fear nuclear waste. It is told that it's so dangerous that we need to bury it deep underground and protect society from it for thousands of years, the time it takes to decay away. This is a good example of how stories are made. All other toxic waste streams remain toxic forever. Therefore, the fact that nuclear waste eventually decays away should be a positive, or alternatively just assume it is bad forever like every other waste stream. But somehow, the fact that nuclear waste takes a long time to decay has been woven into a story of absolute fear of what we will do to the environment somehow making many believe that this waste is much worse than all other forms of waste. (This does not consider the fact that this waste is in solid form and in very low quantities – because who wants the facts anyway?)

After hearing these negative stories for so long, the industry is constantly on the defensive trying to fight the stories with factual arguments; in effect becoming part of the very stories we are trying to change. Well, the time has come to take back the narrative and re-write the nuclear story.

One position taken recently to try and shake things up is the story that wind and solar just aren't enough to meet all our energy needs reliably due to their low energy density and intermittency. We explain that storage at the levels required to make up the difference is very unlikely meaning that the 100% renewables goal only serves the fossil industry as gas and coal are needed to back up these unreliable energy sources. We then say that if we want to decarbonize and quickly, we need nuclear as it is the only large-scale low carbon dispatchable generating source. Or as said in this recent article, *"even if we don't love it, nuclear is the only carbon-free generating source that can provide backup power at the scale required."* The article then goes on to tackle all

the anti-nuclear stories talking about safety and waste. The problem with this approach is that we are telling a story that is not a happy one – it is the story that while we may all agree we don't like nuclear; we need it. It is always hard to get people to stand behind things they don't like by telling them they are good for you. And in our experience, being the option of last resort (we wish we had other options, but we don't) is never a good strategy. Because as shown in Germany who had 30% of their generation from nuclear and is now phasing it out as they try and decarbonize at the same time; eventually fear becomes fact and as long as there seems to be an alternative, it will be taken (sometimes even when it is not working).

We need to keep the opening part of this story, i.e. that we need to reduce carbon to address climate change, and that wind and solar are simply not up to the task – as this is the path to getting those concerned about climate and energy issues to consider other options. But once we get those opposed to nuclear to reconsider because they see the need, we must then tell them a positive story they can embrace, rather than ask them to reluctantly accept something they don't like. Some think that this is too late – that people can't change their thinking. But going back to Harari, he notes that individuals can *“knit revolutionary personal changes into a coherent and powerful life story: “I am that person who was once a socialist, but then became a capitalist; I was born in France, and now live in the United States; I was married, and then got divorced; I had cancer, and then got well again.””* So why not I was once against nuclear but now I support it?

Well then – what is our nuclear story? How about an optimistic story about an exciting prosperous future where we all benefit from abundant, reliable, economic energy; raising millions of people out of poverty, all while also protecting the environment? And the best part is that nuclear can actually deliver. Now that is a story I would want to tell my grandchildren. What do you think the nuclear story should be?

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

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

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

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

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



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

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

We are living in challenging times and increased tensions amongst nations does have an impact on the global nuclear industry. This is an industry that is heavily politicised with most decisions taking place at the highest levels of government. Yet we all know that this is an industry that needs global collaboration to succeed. We all understand that what happens in one country impacts us all, as did the accidents at Chernobyl and Fukushima. Global organizations like the International Atomic Energy Agency (IAEA) as a governmental organization, and the World Association of Nuclear Operators (WANO) as an industry association, work towards raising the bar so that we all benefit from continuous improvement. The results are obvious, the global nuclear fleet is operating at its best and we have one of the safest industries on the planet. And even though many of the world's nuclear plants are relatively old and near their end of life, it is through global cooperation that we are now striving to extend the lives of the global fleet, with great success.

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

the other 38 countries; and most of all, with new friends from around the world that will last them the rest of their careers.

I have been seeing this happen for years now, but somehow this year it made a big impression on me.

Getting to know each other a little bit better is an important step that

will make us all better off while building a stronger more vibrant global

nuclear industry.

Nuclear Power provides the performance we need

We often speak about the incredible energy density of nuclear fuel; a pellet the size of the end of your finger can deliver as much

energy as a ton of coal. In addition to

producing a large amount of energy from a very small amount of resource, the

plants themselves offer another important benefit, their exemplary operating performance. They operate at very high capacity factors

(the amount of energy produced / the total energy that would be produced if the

unit ran nonstop) meaning they provide us with a reliable 24/7 energy source to

support our energy hungry economies.

In fact, even as the global fleet ages, it just keeps on getting better. In 2018, the US fleet

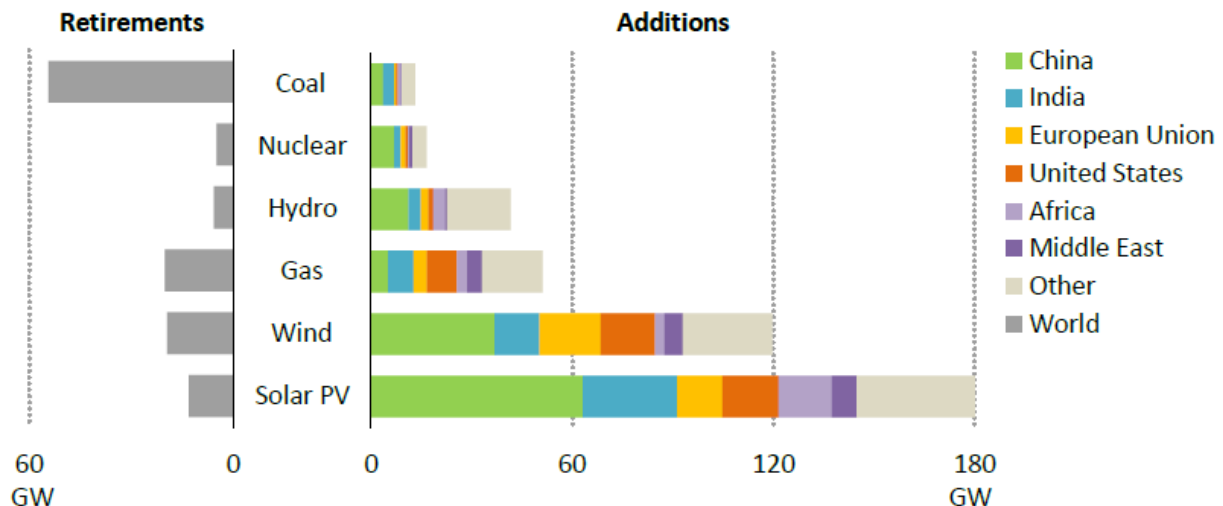
produced the most energy ever, exceeding the previous peak from 2010 even though 7 units have been retired and only two new ones have come on stream. The annual capacity factor in the US for 2018 was 92.3%. This should come as no surprise since the US fleet has operated around 90% CF for the past 20 years. This is a testament to the technology and its robustness. Not only does nuclear operate extremely well, it does so at all times during its very long life. It has no early life breaking in period and no end of life deterioration in its performance. It just continues to provide the energy we need day after day, year after year.

Let's contrast this with the world's most talked about generation sources, wind and solar. Not only are they intermittent, because the wind doesn't always blow and the sun doesn't always shine, but on average they produce relatively small amounts of energy from a given plant, i.e. a low capacity factor. Wind farms usually operate about 35% of the time and solar only about 15% of the time. Not only does each generator produce a relatively small amount of energy, it can't be called upon to produce it when it is needed.

This is why it is frustrating and frankly, deceptive, when supporters tout how much capacity of new renewables is being added to the grid, without mentioning the inconvenient truth of how little energy they are really contributing. The following figure shows how much capacity is expected to be

added to the global grid in the World Energy Outlook (WEO) 2018 Sustainable Development Scenario.

Figure 9.24 ► **Global capacity additions and retirements by technology and region in the Sustainable Development Scenario, 2018-2040**
(average annual)



Solar PV and wind provide the lion's share of new capacity, while coal sees the most retirements

Source: IEA World Energy Outlook 2018

At first look, it seems like wind and solar are leading the charge to decarbonize the world energy system – 180 GW of new solar, 120 GW of new wind and only 17 GW of new nuclear. But now let's transform these capacities into energy. The WEO assumes that nuclear runs about 80% of the time, wind 30% and solar 15%. So, what does this mean? Building 10 times the amount of solar and about 7 times the amount of wind as nuclear results in only about TWICE as much energy being produced from these sources as from new nuclear. Yes, you heard that right. Building 180 GW of solar running 15% of the time produces only about double the energy in a year as building 17 GW of

nuclear plant that runs 80% of the time.

And to top it off, the nuclear energy is also reliable and predictable. Of more importance, it also means that there is a need for much more land to place all these wind and solar plants, a huge increase in the materials mined to manufacture them, a much larger and more complex transmission system, and a storage system that is not yet technologically feasible to accommodate their intermittency (or more likely gas generation to back them up); all leading to higher costs of energy, less system reliability and more carbon emissions.

A successful narrative has been created that renewables are a good way to meet all our energy needs, but it is based on how they make us feel, not on science. Who doesn't like the sound of harnessing nature and getting our energy from the wind and the sun? In reality, we simply cannot make the wind blow or the sun shine. We cannot imagine our way to a clean energy future with solutions that sound good but are incapable of giving us the result we so desperately need. In fact, the WEO bases its low carbon scenario on implementing large efficiency gains to reduce demand as a massive renewables new build program alone cannot meet the carbon reduction targets.

Looking at these numbers, should we be investing in these enormous quantities of renewables (and the back up / storage needed to accommodate their intermittency) or is there a better path to a lower cost decarbonized energy

system. Nuclear power delivers what we need when we need it – large quantities of economic, reliable and low emission energy.

It's fear, not facts, that influence our attitudes and beliefs

"We are the healthiest, wealthiest, and longest-lived people in history. And we are increasingly afraid. This is one of the great paradoxes of our time." As said by Daniel Gardner in his book "The Science of Fear: How the Culture of Fear Manipulates Your Brain" more than a decade ago; fear can be all consuming and it is often hard to understand how we choose what to be afraid of and why.

8 years ago this month, Japan suffered the great Tohoku earthquake and tsunami that killed more than 20,000 people and caused US\$300 billion of damage. Entire towns were wiped out when the wave hit on March 11, 2011. Farms, factories, roads, railways and electricity lines were destroyed, while almost half a million people were made homeless. Yet when you research this tragic event, the focus is more than likely to be on the resulting accident at the Fukushima Daichi nuclear power plant than on the natural disaster. The reality is that **no one died from the nuclear accident**, although some died indirectly as a result of the evacuation. No one was exposed to enough radiation to cause future concern for their health, but there are health impacts, all as a direct result of a tremendous fear of radiation and what people believe may be

its potential impact on the population and their families. It is this same fear that is delaying the recovery of the nearby towns even though radiation levels are as low as other safe cities in the world like Hong Kong and London while the area's fruits and vegetables are fine to eat and so is the catch from the Fukushima fishing boats. When this tragedy is discussed, it is not fear of earthquakes and tsunamis that are talked about, it is an overwhelming fear of radiation.



Japan plans to lift the evacuation order for part of Okuma town on April 10

But it is not just radiation that we fear. For years, there has been a portion of the population that has feared vaccinations and as a result, have refused to immunize their children against preventable childhood diseases. Currently, we have an outbreak of measles in North America, a disease that should no longer exist given there is a very effective vaccine to prevent it. But over the past decades there has been a huge fear campaign by so called anti-vaxxers, causing many people to be wary of vaccinating their children and allowing the disease to flourish once again. The science clearly shows the risk is essentially zero for those getting

the vaccine while the risk of complications from the disease are indeed real. Prior to the availability of a measles vaccine, 2.6 million children annually died of the childhood disease. Today, that number is 109,000 but it should be zero. The WHO (World Health Organization) has now declared “vaccine hesitancy” as one of the top ten health threats to the world in 2019. So why is it, when the science is clear, so many are so afraid of vaccines to the point that they are willing to put their children’s health at risk (although they believe they are protecting them)?

This month we had a second tragic accident with the new Boeing 737 MAX as an Ethiopian Airlines plane crashed soon after take-off causing 157 deaths. This is the second crash of this new version of the popular airplane in 6 months; the first being a crash of a Lion Air flight in Indonesia last October, killing 189. Never before in the modern air travel age have we seen a new version of a plane come out and have two fatal crashes within 6 months of each other – and so soon after the plane first entered commercial operations. Yet it took days until the US and Canada grounded the plane for safety reasons as it became apparent there were similarities in the accidents. With more than 300 dead, all within the first few minutes of their flights, we just don’t seem very worried about flying. Don’t get me wrong, air travel is very safe – but this particular situation is troubling and there is a need to ensure the root cause of this failure is identified and addressed. Early reports state that a new system that may be implicated in the accidents was not properly rolled out to pilots in order to save airlines money. I travel a lot and I am very concerned about flying on this type of aircraft until a solution is identified that ensures this particular issue will never happen again. But somehow, when fears can in fact be justified, we find a way to manage them. In this case it is essential for Boeing and the industry to act decisively to not squander this very important public trust.

So, what is the point of this discussion? We know that fear can be a powerful driver in our behaviours. What is not always clear is why we choose to fear things to the point of trauma when they are proven safe, yet don't get too worried about things that should actually be of concern. As a result, it is not enough to fight fear with facts. Fear is a strong emotion. The facts may be clear but all you need is just a bit of doubt and the fear remains. And it is easy for those opposed to something to cause doubt.

As asked in this interesting article on the measles issue, should we hijack the fear monger's method and use fear to push back on untrue claims? Clearly what is driving the strong push to finally silence anti-vaxxers is the resurgence of this disease and the potential impact to children and young adults who may get it. In other words, once we see the disease touching those close to us, a mostly forgotten childhood disease becomes real again and the option of vaccinating becomes less scary than the fear of getting sick. We see young adults getting vaccinated because they are worried about getting measles overcoming their parents' earlier concerns that caused them to withhold vaccination when they were children. Is it time to use frightening imagery to push the factual side of the argument? As stated in this article, *"A baby in the midst of a whooping cough (pertussis) fit will appear to cry without making a sound. Her mouth will be open as she tries to cough to clear the mucus from her narrowed airway, but if she's really struggling, nothing will happen. Her lips and tongue might turn blue. She could seize. When the fit is finally over, she'll vomit. It's absolutely terrifying to watch (and no doubt, to experience), and precisely the type of picture public health organizations need to paint to counter anti-vaccination propaganda."*

Getting back to the nuclear industry, it is time to accept that taking the high ground and fighting fear with facts alone is just not enough. We are in an industry where fear abounds. An article this week, on the 40th anniversary of the Three Mile Island accident looks at just how frightened we were at the time. While this may be historically interesting, the real question is why we think about this 40 years on when the accident turned out to have **no impact on public health**. 40 years is a long time to focus on a non event. A new poll in the US shows the public evenly split on the issue of support for nuclear power (49% in favour, 49% opposed), but of more interest, is the fact that 49% are also concerned with nuclear safety, or in other words, it is fear that continues to drive opposition to the technology.

Even more so, the people in Germany today are investing hundreds of billions of dollars in decarbonizing the German economy through its Energiewende; yet they seem to be comfortable replacing low carbon nuclear plants with new coal plants greatly impacting their ability to achieve their climate goals. So, what does this say? Clearly Germans believe nuclear power is far more frightening than climate change. Again, this is not consistent with the facts, but the public remains supportive.

The reality is, if we are afraid of something, we need a strong reason to change our views. Just telling someone there is no need to be afraid by explaining the facts is going to fall on deaf ears. What is needed to revisit one's fear is understanding that there is a greater issue at hand, a bigger problem to solve. Only then may we be willing to reconsider our long-held beliefs. Not

because we suddenly believe the facts,
but rather because we finally feel a need to actually listen
to them to solve a
greater concern. It is easy to worry
about vaccines when you've never heard of anyone getting
measles, and for sure
never dying of it. But when you see your
neighbour's child seriously ill, it may be time to
reconsider.

<https://www.youtube.com/watch?v=Z-MZjeBWilQ&feature=youtu.be>
The wind blows and the lights come on
Over the last 40 years the nuclear industry has been worn
down and tends to respond to criticism defensively. Well,
maybe it is time to do something different
and go on the offensive. Of course, as
opposed to those on the other side, we should always tell the
truth (although
those against scientifically supported truths always have an
easier time as
they see no need to tell the truth, only to frighten). For
example, it is not enough to say nuclear
can help in the fight against climate change because the
public already
believes a viable solution is available with renewables. We
also need to show that 100% renewables is
simply not feasible. Only then can we get
the attention required to consider alternatives. Here is a
recent ad by citi bank about its
support for clean energy – look at the last part where the
lights all go on as
a result of this new off shore wind farm.
Should we be making ads that show the lights going out when
the wind
stops blowing as it does two thirds of the time, showing the
need for reliable
24/7 clean energy?

How do we decide what we are afraid of and what we are not? The time has come to divert some of the research money going into the continued improvement in nuclear safety to better understand the psychology of fear and how it impacts views on this clean safe energy source. Then we need to better address these concerns by showing how this technology can reduce societal fears making all our lives better. One thing is for sure, the facts are on our side, but we need to understand that this is simply not enough. Only then can we really try and change attitudes.

Addendum (added April 7): See this video by BP that shows that gas is there to meet the need in the *“off chance the wind ever stops blowing here”* making it seem that wind is the primary source of energy. Of course we know that it is actually in the **absolute certainty** the wind doesn't blow more than half the time, gas will fill in the gaps.

<https://youtu.be/C5Jj2wD3GjE>

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.