A/CFTA
Newsletter 1-2019
March 26, 2019

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Alberta/Canada Fusion Technology Alliance

ACFTA.ca

VISION

"Fusion energy is society's fundamental source of primary energy".

Message from the President:

*What is the level of energy literacy in Canada? I was recently asked the question by a federal government Minister on why nuclear was not included in the June 2018 Government of Canada Report by the Generation Energy Council entitled "**Canada's Energy Transition Getting to Our Energy Future, Together**". I could not give an answer.*

*Canada is aware of the lack of discussion about the role of nuclear energy. Jointly with the United States and Japan, in June 2018 Canada initiated the **Nuclear Innovation: Clean Energy (NICE) Future** initiative under the **Clean Energy Ministerial (CEM)**. The goal is to initiate a broad-based dialogue on the future role of nuclear power.*

What I do know is that the public level of understanding of fusion energy is minimal, and often thought to be the same as nuclear fission. In our meetings with government, industry and the general public, one of the most commonly asked questions is whether fusion is the same as fission. It is not.

Energy literacy needs to improve. Hence, we are undertaking a survey on energy literacy to help determine the level of pubic understanding and energy systems and fusion. The results will be public in the upcoming months.

Glenn Stowkowy P. Eng.
President
Alberta Canada Fusion Technology Alliance

SYNOPSIS OF RECENT ACTIVITY

A report was released in December 2018 by the US National Academies of Sciences, Engineering and Medicine calling for a **"*Strategic Plan for Burning Plasma Research*"**. It recommends that the US DOE start a national program that continues its work with the International Thermo-nuclear Experimental Reactor (ITER) but focuses on building a compact magnetic fusion energy (MFE) pilot plant that would have the US take leadership in fusion energy.

Scientists from China's Institute of Plasma Physics announced in November 2018 that plasma in their Experimental Advanced Superconducting Tokamak (EAST) reached 100 million degrees Celsius, the temperature required to maintain a fusions reaction that produces more power than it takes to run. This is an important milestone in developing fusion power.

Upcoming Activities:

ACFTA Planning Session – more information forthcoming (all members will be invited)

Upcoming newsletters will include

- *Ongoing fusion development updates*
- *Questions and answers about fusion energy*
- *The results of a national survey on energy literacy being sponsored by ACFTA*
- *People behind the Alliance*

Information sessions are ongoing. Public sessions will be announced on the website ACFTA.ca or in future newsletters. Speakers are available if your organization would like a presentation on fusion.

Canada's Nuclear Policy Framework

The Government of Canada has a policy framework that supports the development of nuclear energy. At an operational level, there is a *Nuclear Energy Division* under *Natural Resources Canada (NRCan*), which has the responsibility for overall policy (fission and fusion), and administering related initiatives.

Currently, the overall energy policy direction within NRCan reflects the direction provided under the *Clean Energy Ministerial (CEM)*. Established in 2010, it is a high-level global forum where members work together to share best practices and promote polices and programs that encourage and facilitate the transition to a global clean energy economy. Membership currently exists of 25 countries and the European Union (EU). Annual meetings are held with attendance comprising of member country energy ministers and other high-level public and private sector delegates. Goals reflect the *2015 Paris Agreement on Climate Change*. At these annual meetings, strategic direction is provided for the work undertaken during the next year.

The current CEM strategic focus directions are (1) energy supply and system integration, (2) energy demand, and (3) crosscutting issues. Within these three, there are 14 initiatives and 8 campaigns, of which only one has a direct reference to nuclear energy – *Nuclear Innovation: Clean Energy (NICE) Future*. While there are other initiatives and campaigns, the focus is predominantly on renewables, to what appears to be the exclusion of nuclear energy and industrial (large scale) energy supply and demand considerations.

Another Ministerial initiative is *Mission Innovation (MI).* It was established in Paris in 2015 just before the climate change meeting in Paris, in response to the concern that clean energy innovation was not going as quickly as needed. High-level leadership is provided by member governments' Ministers with responsibility for clean energy innovation. In Canada , the Minister is from *Innovation, Science and Economic Development Canada (ISEDC)*. There are currently 24 members (including the EU). Membership is comparable to CEM. Its goal is to accelerate the pace of clean energy innovation through performance breakthroughs and cost reductions throughout the world over the next two decades and beyond.

The MI is organized around four sub-groups: (1) information sharing; (2) analysis and joint research; (3) business and investor engagement; and (4) a Ministerial planning team. It has eight innovation challenges covering smart grids, off-grid electricity development, carbon capture, sustainable biofuels, solar conversion, clean energy materials, building heating and cooling, and renewable hydrogen. There is no direct reference to industrial energy use (carbon capture and storage has an indirect link), and no mention of nuclear energy. Canada is a member of both CEM and MI, and is sponsoring the joint session for 2019 in Vancouver (the *10th Clean Energy Ministerial and 4th Mission Innovation Ministerial* (CEM10/MI-4), May 26-29).

The NICE Future initiative was launched in May 2018, at the ninth annual CEM conference (CEM9). Its goal is to initiate a broad-based dialogue on the role that nuclear power can play in economic growth, energy access, energy security, and environmental stewardship (Paris climate goals). Until it was introduced, there was no discussion of the possible role of nuclear energy in CEM and MI. The lead members are Canada, Japan and the United States. Participating countries include Argentina, Poland, Romania, Russia, United Arab Emirates and the United Kingdom. In total, 13 of the 25 CEM members have expressed interest.

Nice Future has four focus areas: (1) technology evaluations of innovative energy systems and uses; (2) engagement of policy makers and stakeholders in future energy choices; (3) valuation, market structure, and ability to finance; and (4) communicating nuclear energy's role in clean, integrated energy systems. The overall objective is to bring nuclear energy discussions to ministerial and working levels, including a discussion among all energy policy makers of the future role of nuclear energy covering areas such as technological feasibility, economics, financing and stakeholder perspectives.

The Nuclear Energy Division of NRCan is the entity in Canada managing NICE Future. Proposals are now being accepted, with significant weight being given to activities that include stakeholders outside the nuclear sector and expand the scope of energy conversations. NRCan has indicated that NICE is predominantly focused on nuclear technology deployments within the next five to 10 years. Examples would include modular fission reactors that could be used in Alberta's in-situ oil sands industry.

In terms of support for MI projects, Innovation, Science and Economic Development Canada is the lead ministry. Financial support is possible under the *Strategic Innovation Fund (SIF),* which was announced in July 2017. General Fusion from Burnaby received $49.3 million of funding in October 2018 from the SIF.

How does fusion differ from fission (answer by Dr. Allan Offenberger)

Fission results when a heavy nucleus (such as Uranium 235) captures a neutron, becomes unstable and splits into 2 lighter daughter nuclei, producing additional neutrons and releasing energy in the process. The neutrons created can induce more fission events. Runaway is prevented by moderating the number of daughter neutrons to maintain a desired reaction rate. The long-life daughter nuclei are highly radioactive and must be stored for thousands of years before they decay sufficiently to no longer be a hazard. Importantly, in the event of a reactor accident, continuous cooling of the waste is required due to "afterheat" produced by the decay of the radioactive daughter nuclei.

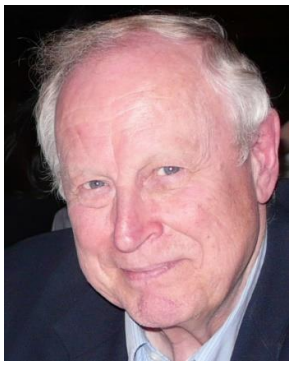
Fusion is very different. In the first place, the daughter products of a fusion reaction are not radioactive. Secondly, there cannot be a runaway reaction as in fission. Thirdly, the amount of fusion fuel in the reaction chamber is very small with no "afterheat" problems requiring cooling as for fission.

How safe is fusion?

Fusion energy systems are completely controllable and safe. The operation is more concerned with keeping the reaction going (a temperature decrease will quench fusion reactions). There is no chance of a runaway. Moreover, the amount of fuel in a reaction chamber is small, the direct fusion products are safe and a reaction shutdown does not require continuous cooling (no "afterheat"). Fusion plants could be safely sited in the middle of cities for convenience and reduced transmission line requirements.

Meet the People Behind the Alliance - Dr. Allan Offenberger

Allan Offenberger is Professor Emeritus of Electrical & Computer Engineering at the University of Alberta. He received his B.A.Sc. and M.A.Sc. degrees (1962, 1963) from the University of British Columbia and Ph.D. degree (1968) from the Massachusetts Institute of Technology. His research is focused on the development of high-power lasers and their application to inertial fusion energy research. He has published extensively and given many invited talks at international conferences, universities, government and industrial laboratories throughout Asia, Europe and North America.



He is a Past President of the Canadian Association of Physicists and has served on many scientific advisory & research grant committees and boards, as a consultant to university, government & industrial institutions and, as a reviewer for research proposals, publications, university appointments & promotions. Allan has been a guest professor and consultant at, among others: UK Atomic Energy Agency-Culham Laboratory; University of California-Los Alamos National Laboratory; Oxford University-Rutherford Appleton Laboratory; University of California-Lawrence Livermore National Laboratory and; Osaka. University-Institute of Laser Engineering (major labs for laser development and fusion energy R&D).

Allan is the Founding President of the Alberta/Canada Fusion Technology Alliance