# FUSIONMATTERS
## CANADA

On 4 October 2023 the Fusion Council of Canada (FECC) held its 3rd Annual General Meeting on 24 October 2023 the FECC and cohosted the Canadian Workshop on Fusion Energy Science and Technology (CWFEST-2023) with the Canadian Nuclear Society (CNS). This all-day virtual workshop attracted 12 speakers from Canada and globally to provide an update on the progress of commercializing fusion energy. In this issue we will look at what we learned.

## AGM 2023

2023 was a very successful year for the FECC. Although the FECC is still a small volunteer, not-for profit organization it has made significant progress since the 2022 AGM. Several initiatives and collaborations have strengthened FECC's position as a credible and objective advocate for Canadian fusion energy activities.

Progress was made on the development of a forward-looking report on potential fusion development in Canada and Canada's role globally. This work is proceeding under the leadership of Ian Castillo, Head of Directorate, Hydrogen and Tritium at Canadian National Laboratories (CNL), FECC contributed to the draft report.

A Strategic Action Group was formed under the leadership of Don Ryland at CNL to explore how Canada can leverage its expertise in the production, processing, handling, storage, and safety of Tritium.

FECC's strategic action focusing on neutron tolerant materials (one of five strategic actions identified in 2021) is still looking for members interested in establishing a committee to explore this further. If you have the expertise and interest in this topic, please contact me or our President, Axel Meisen (axel@meisen.ca.

Welcome to members of the 2023-24 FECC Board: Axel Meisen, Brian Kryska, Klaas Rodenburg, Glenn Stowkowy, Robert Fedosejevs, Amee Barber, Patrizio Ancini, Blair Bromley, Will Bridge, Amina Hussein, Chandra Tomaras. Current Members of the Board at Large are Perry Kinkaide, Allan Offenberger, Ying Tsui and the Advisory Council members are: Michael Campbell, Dennis Whyte, Allan Offenberger, Robert Fedosejevs. Information on the members is available on the FECC website at BOARD OF DIRECTORS – Fusion Energy Council of Canada (fusionenergycanada.ca) and ADVISORY COUNCIL – Fusion Energy Council of Canada (fusionenergycanada.ca).

Following the AGM, Dr. **Antoine Cerfon (**senior research scientist at **Type One Energy** https://typeoneenergy.com/) gave this year's keynote presentation on stellarators. Type One Energy, based in Madison, Wisconsin, has just opened a new office in Vancouver, BC. The latter will strengthen Canada's role in fusion energy development. It will also create new opportunities for employment, including employment of students and young researchers. Dr. Cerfon;s presentation will be posted on the FECC website shortly.

## CWFEST 2023

Fusion Energy Council of Canada

Conseil canadien de l'énergie de fusion

This mostly virtual event held on 24 October 2023 was a great success.

Cohosted by the FECC and CNS, the event focused on where we are at in commercializing fusion energy in Canada and around the world. It attracted 12 presenters including 9 leading private sector companies from around the world, each with a special approach to fusion energy production and addressing the commercialization of fusion energy challenge. The event had 129 paid attendees with a broad range of backgrounds.

Furthermore, the Students and Young Researchers initiative chaired by Amina Hussein at the University of Alberta hosted a Watch Party attended by 20 plus people as well as Professor **Robert Fedosejevs** and Professor **Amina Hussein.** Thank you to **Shubho Mohajan** for organizing the Watch Party. This initiative will serve as a template for future FECC events.

**Presenters:**

Twenty minutes is not a lot of time to explain a topic as complex as fusion and how a company or organization is pursuing a winning approach to making fusion energy a reality in the not-too-distant future. Each presenter did just that, but there is clearly much more to their stories. We encourage everyone to explore further by visiting the websites (shown after the presenters' names below) and continuing the conversation. The following lists the presenters and a brief synopsis of their presentations.

**Andrew Holland**, CEO, Fusion Industry Association (FIA)
https://www.fusionindustryassociation.org/ - *The Global Fusion Industry in 2023*

Based on the FIA's latest self-reported survey, investment continues to grow (reaching US$6.2 billion in total), there is increasing optimism on demonstration plant timescales and industry and government partnerships. However, many complex challenges / opportunities remain. The world needs fusion and fusion is ready. Industry's timeline envisions the design and construction of the first pilot plant by the late 2020's, operating pilot plant and first sales in early 2030's, and rapid deployment to global deployment by mid-2030's.

**Omar Hurricane**, Lawrence Livermore National Laboratory https://www.llnl.gov/ - *Lesson's from Fusion Ignition and the Implications for Fusion Energy Science and Engineering*

A detailed description of how the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory achieved ignition in December 2022 and June 2023.

**Nicholas Hawker**, First Light Fusion https://firstlightfusion.com/ - *Inertial Fusion with a One-sided Drive*

First light uses a one-sided inertial fusion driver with a projectile driver approach that is claimed to be simpler and hence less costly than other approaches. Their liquid first wall design sidesteps major engineering challenges. The current focus is on building the M4 DP5 ignition demonstrator. A modular 3 level, 72-meter machine.

**Marius Schollmeier**, MARVEL Fusion https://marvelfusion.com/ - *Laser-driven Inertial Fusion with Direct Drive Volume Ignition*

Marvel deploys a novel direct drive fusion approach based on mixed fuel types. Facilitated by the rapid innovation in solid state, diode-pumped, ultrashort-pulse laser technology that make commercialization feasible. Based in Munich Germany, Marvel is currently partnering with Colorado State University (CSU) to construct a US$150 million high intensity laser facility.

**Brian Berzin**, CEO, THEA Energy https://thea.energy/ (fka Princeton Stellarators) – *Fusion energy made faster and simpler*

THEA builds upon the stellarator legacy of Lyman Spitzer the founder of Princeton Plasma Physics Laboratory (PPPL) in 1951. The stellarator is an alternative to the Tokamak, relying on complex field coils to provide twisting magnetic fields, rather than by an internal current. THEA eliminates complicated modular coils by using Dynamic System Control capable of optimizing machine parameters and changing operating points in real time. Their vision is to design, construct and operate a large-scale neutron source stellarator currently in pre-conceptual design and expected to be completed in early 2030.

**Klaas Rodenburg and Axel Meisen**, Fusion Energy Council of Canada (FECC) https://fusionenergycanada.ca/ - Status of Fusion in Canada

FECC's mission is to "*mobilize human, financial, and other resources for the participation of Canadians and Canadian enterprises in first generation fusion energy systems and uses, with the objective of creating economic, environmental and social benefits*." Established in 2016 as an Alberta-based not-for-profit company, it was subsequently registered as a national organization in 2020. FECC collaborates with organizations interested in fusion, including the Canadian Nuclear Society, Canadian Nuclear Laboratory, General Fusion, University of Alberta, University of Saskatchewan, and the Tritium Conference 2025. FECC is also well positioned to work with international stakeholders in the United States, United Kingdom, European Union, Japan, and Korea on research, education, and commercialization.

**Alex Creely,** Head of Tokamak Operations, Commonwealth Fusion Systems https://cfs.energy/ - *High-field Path to Fusion Energy*

Commonwealth Fusion builds upon the physics demonstrated in Tokamaks around the world and has demonstrated its groundbreaking high temperature superconducting (HTS) magnets that allow for the reduction in size of fusion machines and aimed at making them commercially viable. They are currently working on SPARC, slated to be completed in 2025 and expected to achieve net fusion energy. This will be followed by ARC expected to be deployed in the early 2030's and be capable of sending carbon-free power to the grid.

**Michael Hua**, Director of Radiation Safety and Nuclear Science, Helion Energy https://www.helionenergy.com/ - *Nuclear Engineering Considerations for Pulsed, Magneto-inertial Fusion Using Field Reversed Configurations*

Helion is based in Everett, WA and fully funded to reach commercialization (US$ 600 million) It's Trenta: 6th generation prototype uses deuterium-helium-3 fuel and direct electricity capture. The next step will be to construct a 30,000 sq. ft. facility housing a 50MW Plant to be operational in 2028 with its first customer being Microsoft followed by Nucor Steel in 2030.

**Hiroshi Gota**, TAE Technologies https://tae.com/ - Overview of TAE Technologies' Fusion Program Towards Aneutronic Fusion

TAE is working towards aneutronic fusion via injection of high energy particles into a high beta field reversed configuration device named Copernicus. They also have two spin-off companies in the Life Sciences (medical) and Power industries. TAE's five experimental versions of their machine provide the foundation for the next machine named Norman that will provide proof of concept (2016-2024) followed by Copernicus in final design (2027) and DaVinci the first integrated DEMO plant to be constructed in Irvine, CA and be operational in late 2020's.

**Conner Galloway**, CEO Founder, Xcimer Energy Corporation https://www.xcimer.energy/ - *Bigger is Better: NLO-Boosted Excimer Lasers for Inertial Fusion Energy*

Founded in January 2022, Xcimer's is pursuing low cost KrF laser driver employing pulse compression using optical stimulated scattering in a mirror-less axial irradiation geometry of a more efficient target design that takes advantage of the Lawrence Livermore National Laboratory (LLNL) Hylife chamber design for wall protection. Initial laser system performance is scheduled for 2025 and a 50 MW demonstration plant in Phoenix, AZ to be complete mid 2030's. Allan Offenberger and Robert Fedosejevs, who serve on the FECC Advisory Council, also advise Xcimer.

**Robin Langtry**, Avalanche Energy https://www.avalanche.energy/ - *Electrostatic Orbitron Fusion Reactor*

Located in Seattle, WA, Avalanche is developing the Orbitron, the world's smallest fusion reactor for mobility and distributed applications using Inertial Electrostatic Fusion (IEF). Their 33-person team is working on overcoming the challenges of small scale fusion machines with several prototypes code named "Neon" (100 kV), "Marty" (300 kV), and "Janice" (material sciences).

**Megan Wilson**, Chief Strategy Officer, General Fusion https://generalfusion.com/ - *Transforming how we energize the world*.

Located in Vancouver, Canada General Fusion uses Magnetized Target Fusion (MTF), which they believe to be the fastest pathway to commercial fusion. It is a balanced approach between magnetic confinement and inertial compression. They are currently developing their LM26 Demonstration Program in Vancouver using recently awarded $30 million in funding from the Canadian and British Columbia governments.

**Major take aways from the workshop:**

- Interest in fusion is gaining momentum globally at all levels of academia, private sector companies, investors, and governments.
- There is a wide variety of approaches to making commercial fusion energy a reality. Each with its pros and cons. May the best one or a hybrid win!

- The private sector is bullish on its ability to generate electricity to the grid by early to mid-2030's. The procurement contract Microsoft has signed with Helion is noteworthy.
- Everyone is hiring, looking for the best talent available. This will provide opportunities for Canadian universities to partner with industry to develop highly qualified people and career opportunities for students and young researchers.
- There is a need for a harmonized fusion regulatory framework worldwide so that all development and permitting is consistent and predictable.

## Calendar

COSIRES 2024 -- Kingston, Ontario

**16- 21 June 2024 the 16th conference of Computer Simulation of IRradiation Effects in Solids**
Cohosted by Queen's University and Canadian Nuclear Laboratories in Kingston Ontario, this international conference attracts outstanding people in the fusion nuclear materials space. For more information visit their website https://sites.google.com/view/cosires2024/home Call for abstracts closes 15 December 2023.


**21-22 February 2024 FusionXInvest in Boston, MA**
Following on from the successful launch event in London in May 2023, FusionX Group—a partnership of Fusion Energy Insights, Realfin and New Energy Events—is bringing FusionXInvest to the US, a hive of fusion industry and investor activity. FusionXInvest is designed to bring capital and investment to the fusion energy industry—and to bring the considerable opportunity of fusion to investors. https://fusionenergyinsights.com/blog/post/fusionxinvest-in-boston-2024

***CANtrit 2025*** Canada has been chosen to host the next International Tritium conference in Ottawa in 2025. Watch this space for more information as it becomes available.

## Career Opportunities

There are currently many career opportunities for Highly Qualified People in the fusion technology ecosystem. Examples are:

- **Commonwealth Fusion Systems** has more than 60 open roles in their pursuit of fusion energy. See www.cfs.energy/careers or contact their Open Innovations team at oi@cfs.energy
- **Helion Energy** is looking for a Director of Materials along with a variety of other skillsets https://www.helionenergy.com/careers/
- **General Fusion** currently has several openings in Vancouver https://generalfusion.com/careers/
- **Type One Energy** currently has several openings in Vancouver https://typeoneenergy.com/careers/

If you like what you see, please let us know and forward **FusionMatters** Canada to your colleagues or anyone else who needs to know more about fusion; encourage them to subscribe **here** and please share your suggestions for changes.

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Fusion Energy Council of Canada | Conseil canadien de l'énergie de fusion


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