CIFAR

CIFAR Symposium on AI for Energy and the Environment

Summary Report

Authors: Johnny Kung, PhD and Kira Lussier, PhD

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Executive Summary

In November 2021, the Global Partnership on AI (GPAI), in collaboration with Climate Change AI and the Centre for AI & Climate, published the report Climate Change and AI: Recommendations for Government Action. The report set out a suite of actionable recommendations for how governments can support the responsible use of AI in the context of climate change.

Building on this report, on March 21, 2023, CIFAR brought together Canadian stakeholders from across academia, government and the private sector (see **Appendix I** for a list of participants) to explore opportunities to advance research and innovation on AI applications in areas related to sustainable energy and the environment (AI4E&E). The objectives of this symposium were to:

- Showcase great case studies of AI4E&E application from across sectors that are having a significant impact and to understand the breadth of activity across Canada and across sectors;
- Identify gaps that researchers, innovators, and policymakers are facing in their work to advance AI applications in energy and the environment;
- Identify and prioritize opportunities for collaboration and investment to address gaps by developing and implementing AI4E&E applications.

The symposium is part of the broader effort of the Pan-Canadian Artificial Intelligence Strategy, which was renewed for its second phase by the Canadian federal government in June 2022, to leverage the potential of AI to grow the Canadian economy and improve standards of living. As one of the four key strategic priorities of the Strategy's second phase, CIFAR's activities in the area of AI4E&E will accelerate solutions that mitigate the effects of climate change, protect the environment, and deliver innovation in the energy sector. A working group on AI for Energy & the Environment, consisting of 12 Canada CIFAR AI Chairs across the three National AI Institutes whose work and expertise are relevant to this sector, is serving as key advisors to CIFAR's efforts in this area (see **Appendix II** for the membership of this AI Chairs working group).

This report summarizes the key insights shared at the symposium, along with recommendations for action and priorities for next steps that were generated by the symposium's speakers and participants. Highlights include:

Recommendations to Canadian policymakers

- Support a diverse ecosystem of cleantech startups, strengthening the pipeline of translating from academic research into private sector applications
- Establish pathways between AI education/training and relevant opportunities in the public sector and a variety of industries
- Develop "Grand Challenges" for applying AI to a variety of application areas
- Include a sustainability lens in evaluating, prioritizing, and funding all AI work
- Recognize the perils of "greenwashing," and avoid letting AI applications detract from other sustainability actions

Key existing gaps in AI4E&E

- Lack of talent
- Gap between machine learning expertise and domain expertise in E&E
- Lack of incentives for long-term, applied AI work
- Challenges in scaled-up adoption of AI by industry and government
- Commercialization and intellectual property challenges
- Specific challenges for small- and medium-sized enterprises
- Prioritization of funding
- Evaluation metrics
- A need for inclusion by design
- Lack of innovative collaboration models
- A need for high quality, accessible data at scale with proper governance

Collaboration opportunities to address some of these gaps

- Develop matchmaking mechanisms to connect expertise across disciplines
- Establish Master's-level programs in "AI + X" to cultivate the talent pipeline
- Provide teaching credits, through the three National AI Institutes, for faculty engaged in external capacity-building activities
- Partner with organizations for upskilling and immigration support to draw on untapped and diverse talent resources
- Leverage federal funding for clean energy to establish training programs for reskilling and upskilling that bridge specialities
- Engage colleges and professional bodies and recognize the role of non-PhD talent
- Establish grants or social impact funds for experiments in creating communities of practice
- Create data broker / repository organizations, as well as organizations that can partner with startups to help with patenting and licensing
- Mobilize angel or philanthropic funding to support early stage, high-risk / high-reward projects
- Establish co-creation models that bring together startups and seed funders, with scientific support from organizations such as CIFAR and the National AI Institutes
- Set up government task force or agency that can develop regulations and standards around data sharing and open source data, create sector-specific recommendations, and link with existing initiatives in other countries or industries
- Develop funding programs oriented towards data creation and sharing

Next steps

- Engage with groups that were missing from the table or had limited representation at this meeting, including civil society / non-government organizations, Indigenous environmental leaders, and the agriculture sector
- Ensure that future efforts in AI4E&E address questions of governance and regulation of AI and of green technology
- Pick a few priority areas not addressed by existing frameworks to develop more robust cross-sector case studies
- Develop funding competitions to encourage cross-sector collaboration

Background: Mapping the Canadian Landscape of AI for Energy and the Environment

In advance of the symposium, CIFAR undertook an analysis of the AI4E&E landscape in Canada, across sectors and geography, to better understand the current state of the field and opportunities for collaboration. Three key conclusions emerged from this analysis:

Figure 1: Number of case studies — By Yassine Yaakoubi, PhD

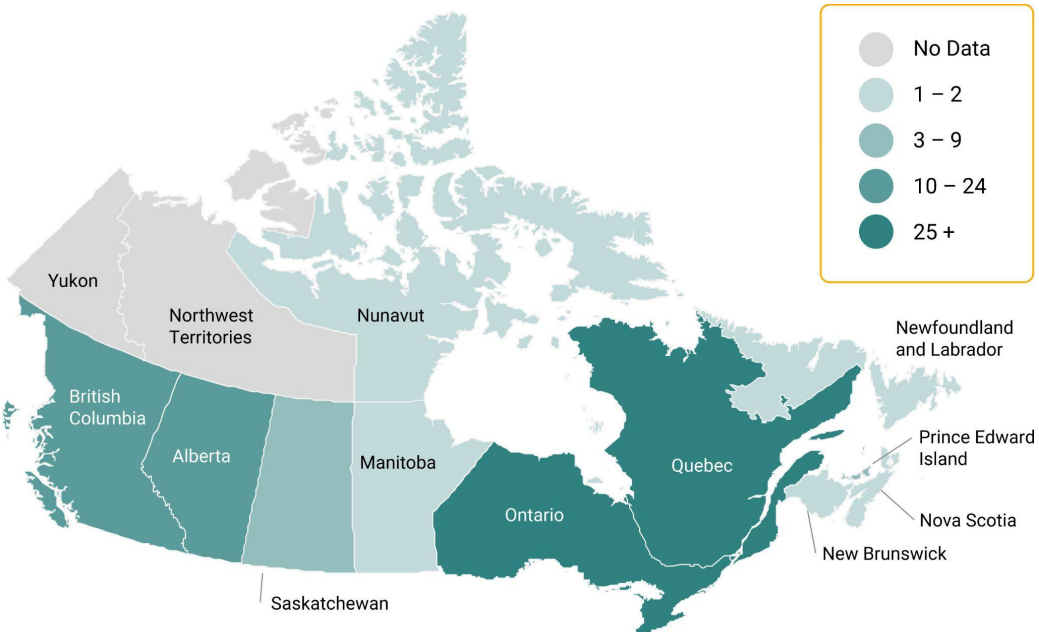
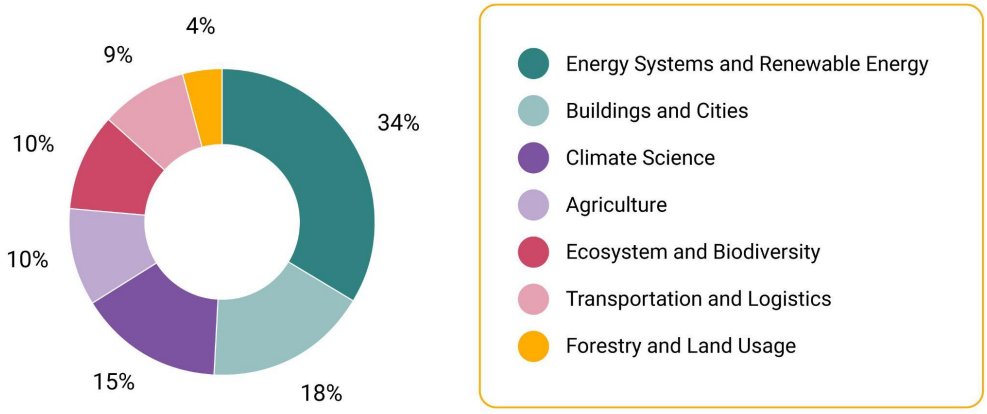


Figure 2: Proportion of projects per theme — By Yassine Yaakoubi, PhD



- Over 100 projects in AI4E&E, involving more than 200 organizations and supported by both public and private investment, were identified across Canada (**Figure 1**), indicating a clear interest in AI-driven innovation for challenges facing energy and the environment. However, many of these are led by single research groups or companies, with limited multi-stakeholder collaborations.
- A plurality of identified projects in AI4E&E in Canada involve energy management and renewable energy (**Figure 2**), demonstrating a strong focus on using AI to help improve energy efficiency and mitigate emissions. Specific applications can be found throughout the electricity sector, from generation, transmission, to distribution (including integrating renewable sources into the energy system), and in optimization and forecasting for the electric grid.
- A broad range of public, private and academic stakeholders are currently involved in AI4E&E in Canada. These include the three National AI Institutes (Amii, Vector, Mila), Mitacs, the National Research Council, several of Canada's Global Innovation Clusters (including Digital Technology, Protein Industries, Scale AI, and Ocean), and Natural Resources Canada.

Case study 1:

BIOSCAN — MACHINE LEARNING FOR BIODIVERSITY

Graham Taylor (Canada CIFAR AI Chair, Vector)

How can machine learning help measure and monitor global biodiversity? BIOSCAN, a global project with a node at the University of Guelph, uses novel machine learning (ML) techniques to create a planetary inventory of life on earth. The goal is to create and assign a barcode to each species, in the process building novel foundation models to assess the probability that a DNA sequence belongs to a particular species.

The challenges of species identification and the highly multimodal nature of data — including soil samples, animal images, and DNA sequences — pose technical challenges for ML, while also allowing exciting opportunities for deep learning (DL) algorithms. As one example, researchers sought to identify species in images containing multiple kinds of insects, which is a challenging computer vision problem, given the huge variability within and across species. Novel DL techniques were able to analyze bulk images of multiple insects, to discern the insect species — or "soup of barcodes" — likely represented in the image.

As a global undertaking with nodes in Canada, the project offers an interesting model for collaboration, both cross-nationally and across domain expertise, incorporating entomologists alongside ML experts. Ultimately, the project's rationale is to aid in preserving biodiversity against myriad threats posed by climate change, pollution, and invasive species.

Case Study 2:

REINFORCEMENT LEARNING FOR WATER TREATMENT

Martha White (Canada CIFAR AI Chair, Amii) and
Adam White (Canada CIFAR AI Chair, Amii)

How can reinforcement learning help improve municipal water treatment?

In the rural community of Drayton, Alberta, Amii researchers piloted a project to improve water treatment through reinforcement learning (RL). Rather than rely on simulations, the team built a miniature treatment plant to model all stages of the water treatment process, valuable as a data-gathering exercise, as a laboratory for algorithmic innovation and as an eventual path to commercialization. Their collaborative model incorporated a diverse set of expertise — academic researchers, students, interns, programmers, industry, municipal operators, engineering firms — in order to ensure the performance and safety of the system.

The short-term impacts of the project included an improved software monitoring and control layer and a prediction visualization dashboard that allowed workers in the plant to see sensors in real time. Ultimately, their major goal is to deliver fresh water for rural communities in a more efficient and cost-effective way. Beyond water treatment, the long-term goal is to create a broader black box RL system for industrial control applications beyond water, such as sewage and HVAC systems.

Opportunities for Canada and Recommendations to Governments

In a keynote address, **David Rolnick** and **Priya Donti**, two of the co-lead writers of the report on Climate Change and AI, recapped the challenges identified in the report and made specific recommendations relevant to the Canadian context.

AI could enable a number of opportunities to support climate action, including helping with gathering information (by distilling useful information from unstructured datasets, such as estimating carbon stock from satellite monitoring of forests), improving operational efficiency (with complex automated systems such as smart grids and heating/cooling systems), improving forecasting (such as predicting agricultural yield or electricity demand), speeding up simulations (by approximating parts of complex physics-based models, e.g., for climate, to help them run more quickly), and accelerating scientific discovery (e.g., by suggesting candidate materials for cleantech, such as catalysts, batteries and clean fuels).

However, the speakers pointed out that it is important to remember AI is not a silver bullet — AI alone will not solve climate change or any other environmental problems, except with close collaboration across disciplines and sectors. Importantly, impactful applications of AI are not only, or even usually, the "flashy" ones like autonomous vehicles (AVs) and large language models (which may in fact exacerbate other societal issues). Instead, because AI is a general application technology, it will have a variety of implications depending on the specific application areas, some of which may be negative. For example, the process of AI computation itself generates emissions, and AI hardware also embodies significant emissions in terms of its production and end-of-life impacts. AI-enabled applications may also increase emissions, for example by making the extraction and use of fossil fuels more efficient. AI can also have system-level impacts that put sustainability efforts at risk, including:

- The rebound effect (reducing energy consumption of some applications might lead to increased use);
- Lock-in and path dependency (e.g., better AVs may lock-in automobile usage and outcompete cleaner options such as public transportation);
- Changing consumer behaviours through targeted advertisements;
- Reducing societal support for climate action through the spread of misinformation; and
- (Further) concentrating societal power and resources in the hands of the few.

Rolnick and Donti then discussed a range of challenges and recommendations for the application of AI4E&E, as detailed in the published report. These include the need to establish and implement standards or best practices to guide responsible AI practice and participatory design (e.g., in ensuring equitable and just choices in the problems to which AI is applied); establish data task forces or platforms for data collection in critical sectors while making compute infrastructure available for civil society; support impact-driven (rather than method-driven) funding for AI research that consider deployment pathways and capacity for expert evaluation; facilitate deployment and systems integration by developing cross-sector innovation centres to incubate projects, facilitate collaborations and hone scaling models for deployment; reduce AI's negative impact on climate by setting reporting requirements (where appropriate) for lifecycle emissions for AI deployment and use; and build capacity for AI4E&E deployment by implementing AI literacy and upskilling programs for government, industries and civil society.

Finally, the speakers outlined the following recommendations to Canadian policymakers:

- Support a diverse ecosystem of cleantech startups, particularly in strengthening the pipeline of translating from academic research into private sector applications. Measures could include guidance for entrepreneurs and support for investors. Focus should be placed on a diversity of options for applications and not just the flashy or low-risk ones.
- Establish pathways between AI education/training and relevant opportunities in the public sector and a variety of industries, so that students don't just have to choose between either pursuing academic research or going into industry/startups in AI or computer science.

- Develop “Grand Challenges” for applying AI to a variety of application areas that are important for Canada, such as forest management, agriculture, materials research, freight transportation, and the cryosphere.
- Include a sustainability lens in evaluating, prioritizing, and funding all AI work.
- Recognize the perils of “greenwashing”, and follow through on climate and environmental commitments, while at the same time avoid letting AI applications detract from other sustainability actions. In other words, do not insist on the incorporation of AI tools as a blanket requirement for all funding.

Challenges and Opportunities for Canadian Startups

A panel of experts from the AI4E&E ecosystem, including **Priya Donti**, **Stuart Lombard**, **Humera Malik** and **Deval Pandya**, discussed some of the key challenges and opportunities for startups in this space. Key insights from their intervention include:

- Some applications in oil and gas and other high-emitting sectors may present moral dilemmas to AI startups. While this sector has the advantage of being rich in data (and, rich in funding), which is helpful for the development of AI tools, working to make the sector more "green" may also risk further entrenching the status quo rather than pushing towards a transition away from fossil fuels. At the same time, one consideration is that a green economy requires making everything more sustainable, not necessarily just creating more "green" technology such as solar panels; sectors such as energy, as well as steelmaking, are some the biggest polluters currently, but that also means these sectors are in the greatest need to be decarbonized. To identify and avoid "greenwashing", startups may want to look at potential partner companies' financial statements to see if their actual investments and expenditures into truly green / decarbonization-focused technologies match their rhetoric. Another key metric could be whether there is an alignment between the executive-level push for working on green applications, and interest at the level of the firm's engineers.
- Canada has a few potential areas of advantage when it comes to developing AI4E&E. Canada has a well-developed AI research ecosystem which can be leveraged for energy and environmental applications; to do so, however, will require significantly more investment into scaling and deployment, more regulatory support, and for researchers to move beyond a focus on application-independent methods in areas such as language processing or computer vision. Canada also has some of the world's largest pension funds and other institutional investors, which can both be a source of alternative, nontraditional (i.e., non-venture capital) funding to build new markets for AI4E&E applications, and provide a collaboration opportunity for AI researchers to help balance their portfolio in terms of climate risk and impact.

Key Gaps

Based on the input from all symposium attendees, 11 key gaps facing the application of AI for energy and the environment were identified:

- **Lack of talent:** This includes challenges with recruitment and retention of talent, as well as competition for talent with industry (specifically, with big tech companies not primarily focused on energy or environment-specific applications).
- **Gap in expertise:** AI and machine learning (ML) experts often don't have domain expertise in energy and the environment, and vice versa. There is a need for individuals or teams who can bridge this expertise gap.
- **Lack of incentives:** The culture for innovation in academic AI/ML research tends to be focused on making fundamental advances in interesting new methods, and researchers (particularly students) need projects with relatively short time horizons that allow for the publications on which they are evaluated. There is a lack of incentives for long-term, applied work.
- **Scaled-up adoption of AI by industry and government:** How to collaborate with stakeholders in public and private sectors to make sure they have the literacy, will and capacity to adopt AI at-scale for impactful applications?
- **Commercialization and intellectual property (IP) challenges:** This includes finding support for applications that may have significant impact but low potential for commercial profit, mitigating the risk of monopolization by single companies, and avoiding hollowing out of IP from countries (including Canada) that are conducting the basic research.
- **Specific challenges for small- and medium-sized enterprises (SMEs):** SMEs face certain challenges more acutely when adopting AI4E&E, including a lack of knowledge, resources, capacity, or visibility (as compared to big tech companies).

- **Prioritization of funding:** Funders and investors, both public and private, may have a lack of information or expertise in identifying areas of potential impact to fund or invest.
- **Evaluation metrics:** What are the right metrics, and at what timescales, to evaluate both whether a project is successful and what projects to fund? These are often application-dependent and very different from the metrics by which AI research is traditionally evaluated.
- **Inclusion by design:** How to bridge the technical community with those impacted by potential AI solutions, particularly rural and Indigenous communities?
- **Lack of innovative collaboration models:** How to build flexible, effective and mutually beneficial models of collaboration across disciplines (e.g., AI/ML, ecology, earth sciences, chemistry, health, social sciences), sectors (academia, government, industry, nonprofit) and geographies (domestically and internationally)?
- **A need for high quality, accessible data at scale with proper governance:** Considerations include the geographically unequal distribution of available data, data sovereignty (particularly for data involving Indigenous communities), and the importance of metadata. Beyond data, a related gap is access to computational resources.

Collaboration Opportunities to Address Identified Gaps

After voting to select four of the top gaps facing AI4E&E, the symposium participants worked in small groups to further define the challenges and brainstorm possible collaboration opportunities to address these gaps.

1. **Bridging gaps in domain expertise**
    - Challenges that contribute to, or exacerbate the gap in expertise include:
        - The time required to hire and train the appropriate staff;
        - The lack of pathways to quickly obtain subject matter expertise;
        - The AI field's emphasis on "clean" benchmarks that may preclude researchers from exploring other subject areas; and
        - The lack of clarity around the role of academia (vs that of industry and government) in this issue, including administrative barriers to cross-appointments for faculty members.
    - Possible solutions may include:
        - Creating more incentives for "knowledge translators" who can bridge these disciplinary gaps;
        - Developing matchmaking mechanisms such as mailing lists or apps to connect expertise across disciplines;
        - Establishing Master's-level programs in "AI + X" to cultivate the talent pipeline;
        - Providing teaching credits, through the three National AI Institutes, for faculty engaged in external capacity-building activities; and
        - Building industry-academia cross-functional teams.

2. **Addressing talent shortage**
    - A range of barriers currently impede the recruitment and retention of talent for AI4E&E in Canada, ranging from general to field-specific. These include:
        - Difficulties associated with the immigration process (including issues with transferring credentials from their home countries and a lack of familial support in Canada);
        - The rising cost of living, especially in big cities where tech talent is concentrated, which eats away at the existing cost advantage of Canada compared to the US; and
        - The lack of access to time and funding, for individuals in energy and environmental sectors, to train, upskill or reskill for AI-related applications.
    - Possible solutions that address this talent shortage include:
        - Drawing on untapped and diverse talent resources (e.g., skilled immigrants, or youth motivated by climate change) by partnering with organizations for upskilling and immigration support (such as Mitacs, or government agencies for settlement and employment);
        - Implementing progressive immigration approaches or pathways that play to our strengths (such as allowing for flexibility in terms of staying in Canada and returning to their places of origin), combined with social support for workers (e.g., in terms of family needs or affordability);
        - Leveraging recent federal funding for clean energy to provide more competitive funding rates to attract and retain talent, and to establish training programs that bridge specialities for reskilling and upskilling (and providing funding and time for such training); and
        - Recognizing that talent looks different across sectors, and that PhDs aren't always required (acknowledging the roles that can be played by colleges and professional bodies).

3. **Establishing innovative collaboration models**
    - Factors that are currently discouraging more collaboration across sectors include:
        - Inherent tensions between the goals of different sectors (e.g., academic publishing vs short profit timelines vs a focus on return-on-investment and IP retention);
        - Existing grants or funding models don't always incentivize risk-taking;
        - AI-focused consulting services may be all that is needed by some companies in the energy and environment space, but this is not aligned with the interests of venture capital because of the difficulty in scaling; and
        - A lack of potential models for collaboration.
    - Potential new models of funding or partnerships that may encourage more cross-sector collaborations include:
        - Grants or social impact funds (SIFs) for experiments in creating communities of practice, with tangible objectives that are motivated not by immediate revenue but by societal impact;
        - Broker-type organizations that can facilitate data access;
        - Organizations that can partner with startups to help with patenting and licensing, such as an umbrella company that conducts the contracting and then executes licensing agreements for different products;
        - Specialized entities to provide consulting services;
        - Funding from angel investors or the philanthropic community to support early stage, high-risk / high-reward projects; and
        - Co-creation models (e.g., similar to the Creative Destruction Lab) that bring together startups and seed funders, with scientific support provided through partnership with organizations such as CIFAR and the National AI Institutes.

4. **Acquiring accessible and properly governed data**
    - Specific issues that are exacerbating data access concerns include:
        - The lack of incentives or downstream benefits for data sharing by data owners, such as recognition, academic credit, or access for communities to the benefits of applications developed with their data;
        - Proprietary concerns about sharing data by data owners who may be in competition with each other, and potential conflicts with existing business models; and
        - The inability for companies or organizations to access high-powered computing to work with data.
    - To encourage and incentivize data sharing in order to provide better access, measures that could be taken may include:
        - Establishing data repository organizations that can identify sources of existing data and engage with the range of public and private sector data owners including academics, government organizations and agencies (such as statistics bodies, national labs, health authorities), civil society organizations (such as standards bodies) and companies (both major industrial players such as steel and concrete companies or electricity system operators, as well as “data firms” such as the providers of remote sensing or Internet of Things devices);
        - Setting up a government task force or agency that can develop regulatory/legal requirements and standards around data sharing and open source data, create sector-specific recommendations, and link with existing initiatives in other countries or industries;
        - Establishing review boards to assess data quality and to ensure the development of metadata/data ontology; and
        - Developing funding programs oriented towards data creation and sharing

Next Steps

Based on a survey of symposium attendees following the meeting, CIFAR has identified a range of potential follow-up actions and priorities:

- Extend and deepen networks forged at this event, with CIFAR continuing to play the role of convener, matchmaker, and funder
- Engage with groups that were missing from the table or had limited representation at this meeting, including civil society / non-government organizations, other government ministries, Indigenous environmental leaders, the agriculture sector, and more domain experts (e.g., Earth scientists)
- Ensure that future efforts in AI4E&E address questions of governance and regulation of AI and of green technology
- Pick a few priority areas in the broader field of energy and the environment — areas that perhaps aren't being addressed by existing frameworks — and develop more robust cross-sector case studies around these priority areas
- Develop funding competitions to encourage cross-sector collaboration

CIFAR will continue to work with the three National AI Institutes, Canada CIFAR AI Chairs, and other stakeholders across the country to put these priorities into action.

Appendix I: Symposium Attendees

The indicated affiliations are accurate at the time of the symposium (March 21, 2023). While individuals representing many organizations participated in the symposium, the report should not be read as representing the views of any specific organization. Contributions from individuals do not necessarily reflect the views of their employers.

Camilo Alejo, Postdoctoral Fellow, Future Earth Canada Hub, Concordia University

Chibueze Amanchukwu, Assistant Professor, University of Chicago / Azrieli Global Scholar, Bio-inspired Solar Energy program, CIFAR

Alán Aspuru-Guzik, Professor and Director of the Acceleration Consortium, University of Toronto / Co-director, Bio-inspired Solar Energy program, CIFAR

Maryam Bafandkar, AI Project Specialist, Protein Industries Canada

Kelly Barker, Policy Analyst, Innovation, Science and Economic Development Canada

Laurence Beaulieu, Vice-President, Academic Affairs, Mila

Yoshua Bengio, Professor, Université de Montréal / Scientific Director and Canada CIFAR AI Chair, Mila / Scientific Director, IVADO / Co-director, Learning in Machines & Brains program, CIFAR

Junaid Bhatti, Senior Data Scientist, Manulife

Boyan Brodaric, Research Scientist, Geological Survey of Canada, Natural Resources Canada

Sean Caffrey, Executive Director, Acceleration Consortium, University of Toronto

Luz Angelica Caudillo Mata, Computational & Applied ML Scientist, MDA

Peter Dauvergne, Professor, University of British Columbia

Priya Donti, Executive Director, Climate Change AI / Incoming Assistant Professor, MIT

Guillaume Durand, Team Lead, Data Science for Complex Systems, National Research Council Canada

Sophie Fallaha, Executive Director, CEIMIA, Global Partnership on AI

Mostafa Farrokhabadi, Assistant Professor, University of Calgary

Padraic Foley, Director, Strategy and Partnerships, Acceleration Consortium, University of Toronto

Sajjad Ghaemi, Research Officer, NRC-Fields Mathematical Sciences Collaboration Centre, National Research Council Canada

Tyler Hamilton, Senior Director of Cleantech, MaRS

Andrew Johnston, Program Director, Materials for Clean Fuels Challenge program, National Research Council Canada

Mark Kozdras, Emeritus Scientist, Natural Resources Canada

Cam Linke, CEO, Amii

Stuart Lombard, CEO, ecobee

Stéphanie Lord-Fontaine, Vice-President, Scientific Affairs, Génome Québec

Ali Malek, Research Officer, Energy, Mining and Environment Research Centre, National Research Council Canada

Humera Malik, CEO, Canvass AI

Mathieu Marcotte, Head of AI Ecosystem Mobilization, CEIMIA, Global Partnership on AI

Lissa Matyas, former Vice President, Global Government Affairs, CIFAR

Anne McLellan, Senior Advisor, Bennett Jones / Vice-Chair of the Board of Directors, CIFAR

Annie-Shan Morin, Senior Advisor, Partnerships, Mila

Mo Movassat, Senior Manager — Data Analytics, Ontario Power Generation

Daniel Mulet, Principal, Radical Ventures

Wesley Oakes, Director, Equity and Indigenous Engagement, Genome Canada

Christopher Pal, Professor, Polytechnique Montréal / Canada CIFAR AI Chair, Mila

Deval Pandya, Director, AI Engineering, Vector Institute

Nicholas Parker, Chairman, Parker Venture Management

Dominique Payette, Senior Privacy Counsel, Financial Crimes and Data Protection, Royal Bank of Canada

David Rolnick, Chair, Climate Change AI / Assistant Professor, McGill University / Canada CIFAR AI Chair, Mila

Ann Rooney, Member of the Board of Directors, CIFAR

Barbara Sherwood Lollar, Professor, University of Toronto / Co-director, Earth 4D: Subsurface Science & Exploration program, CIFAR

Christopher Srinivasa, Senior Machine Learning Research Team Lead, Borealis AI

Pierre-Luc St-Charles, Senior Applied Research Scientist, Mila

Ian Stones, Senior Policy Advisor, Innovation, Science and Economic Development Canada

Elissa Strome, Executive Director, Pan-Canadian Artificial Intelligence Strategy, CIFAR

Graham Taylor, Professor, University of Guelph / Research Director and Canada CIFAR AI Chair, Vector Institute

Rhode Thomas, Executive Director, The Centre for Indigenous Innovation & Technology

Brendal Townsend, Director, AI Program, Ocean Supercluster

Éliane Ubalijoro, Director, Future Earth Canada Hub and Executive Director, Sustainability for a Digital Age, Concordia University

Anatole Von Lilienfeld, Professor and Scientific Leadership Team Member of the Acceleration Consortium, University of Toronto / Clark Chair in Advanced Materials and Canada CIFAR AI Chair, Vector Institute

Adam White, Assistant Professor, University of Alberta / Fellow and Canada CIFAR AI Chair, Amii

Martha White, Associate Professor, University of Alberta / Fellow and Canada CIFAR AI Chair, Amii

Yassine Yaakoubi, Postdoctoral Researcher, COSMO Laboratory, McGill University

Josef Zankowicz, Vice-President, Corporate Development, Canvass AI

Appendix II: Canada CIFAR AI Chairs Working Group on AI for Energy and the Environment

Alán Aspuru-Guzik
Vector Institute

Yoshua Bengio
Mila

Jeff Clune
Vector Institute

Samira Ebrahimi Kahou
Mila

Christian Gagné
Mila

Marlos C. Machado
Amii

Christopher Pal
Mila

David Rolnick (Co-Chair)
Mila

Csaba Szepesvari
Amii

Graham Taylor
Vector Institute

Adam White
Amii

Martha White (Co-Chair)
Amii

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