



# Financing clean technologies within Canada's Indigenous communities: Perspectives on sustainable energy transition from practitioners and academics

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## ABSTRACT

Indigenous communities across Canada continue to maintain significant influence on the long-term trajectory of that nation's clean energy transition. Whether it is merchant transmission lines in Ontario or new large-scale hydroelectric generation in British Columbia, communities are adopting their own financing approaches to support Indigenous financial inclusion. Some of these strategies are long-running, while others demonstrate novelty. All approaches aim to develop financial and energy sovereignty. In this co-produced paper (jointly prepared by Indigenous and non-Indigenous practitioners and academics), we synthesise select locally-rooted structures already in use – including many leveraged through extended experiences in both the energy transition generally and the national or community-based Indigenous economic development & energy and infrastructure units specifically. We then spotlight national clean technology financing-supportive organisations that can help with maintaining momentum and reaching scale. To conclude, we offer distinct areas where Indigenous communities and non-Indigenous partners can continue to creatively collaborate at every stage of the energy finance lifecycle – from very early-stage innovation all the way through to later stage refinancing of maturing assets. The Canada-centric case study presented here may present implications and insights for other countries or territories seeking to empower Indigenous voices in their own energy transition.

## 1. Introduction

As the energy transition continues to evolve, a growing body of academic work has recognized not only the critical role that Indigenous communities will play in any ultimate energy system configuration, but also the enabling nature of Indigenous epistemologies and knowledge sets for anchoring an equitable energy future (see, for instance, Mazzone et al. [1] and Sovacool et al. [2]). Although there has been extensive academic attention to supportive policy frameworks (such as the

Indigenous reconciliation aspect of an aspirational Pact for a Green New Deal, per MacArthur et al. [3]), social justice aspects (or alleged lack thereof-Hoicka et al. [4]), and other important elements of this movement, there has been relatively little focus on financing mechanisms necessary to reach the desired levels of Indigenous-owned renewable energy<sup>1</sup> generation (and the requisite associated enabling infrastructure like transmission and storage). The importance of remedying this gap comes into view when one reviews a simplified Levelized Cost of Energy (LCOE) equation<sup>2</sup> (with the cost of capital in the denominator defining

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<sup>1</sup> Despite obvious nuances between renewable energy, renewable electricity, clean energy, and clean technology, we use these terms interchangeably throughout this piece owing to the relatively “big picture” ideas contained herein that apply across all of these groupings.

<sup>2</sup> Although it is a fundamental energy calculation, readers interested in reviewing examples of an LCOE can consult Krupa & Harvey [54] & Ueckerdt et al. [44], while contextualization of how an LCOE might be modified to better reflect interest rates, Operations and Maintenance (O&M) costs, and output reductions is provided in Harvey [45].

the ultimate marginal cost of each added physical unit of clean technology infrastructure) in the overall context of financing the global renewable energy transition (e.g. [5]).

Ownership can be essential to many Indigenous communities' social and economic trajectories,<sup>3</sup> as we have shown elsewhere (e.g. Krupa et al. [6]), and there are several important reasons for pursuing Indigenous financial stakes in clean energy projects. The first and foremost reason is philosophical. This is because Indigenous community ownership of clean technology assets goes beyond the transactional financial realities of many general economic development initiatives. Specifically, Indigenous communities maintain a tighter and more complex connection to their traditional territory than is perhaps commonly understood – one that not only involves a range of historical and cultural connections to land, but also a deep sense of belonging and stewardship for future generations of their specific traditional territory.<sup>4</sup> From the perspective of many Indigenous cultures, land is personified and considered to be alive and animate. Many believe that the land does not belong to them; it is they who belong to the land.

The second rationale pertains to legal and policy requirements. Going forward (in both Canada and other major energy-producing nations), proponents of all sizes and scales are legally required to initiate a process called 'consultation' that, at least in many cases, will entail a requirement to facilitate equity ownership for the impacted community (or 'communities'). In Canada, this requirement applies to entities ranging from large government-run vertically integrated utilities to small Independent Power Producers, and serves to make Indigenous financial inclusion in clean energy development a seeming inevitability. Securing the social licence for any Independent Power Producer or government-run utility necessarily involves Indigenous communities, and that reality makes better understanding the financing of Indigenous financial inclusion an urgent priority.

The third reason is particularly compelling. Unlike many energy decisions that involve difficult trade-offs with clear "winners" and "losers," our on-the-ground experience has shown that Indigenous-owned clean energy projects present a rare opportunity for economic, social, and environmental (colloquially known as the "triple bottom line") win-win-wins in the energy sector (Krupa [7]; Krupa [8]). Broader experience shows such mutually beneficial "win-win-wins" are often challenging, for combining multiple policy goals into a cohesive framework makes success difficult to sustain.<sup>5</sup> Indigenous clean energy projects, as shown in subsequent sections, provide a contradistinction to this systemic energy system issue, and does not necessarily need to be

<sup>3</sup> We acknowledge the diverse Indigenous groups in Canada, including First Nations, Métis, and Inuit peoples. For the purposes of this paper, we use the term "Indigenous communities" more broadly to encompass these groups. Throughout the text, we will highlight specific examples to illustrate their unique contexts and contributions.

<sup>4</sup> In a discussion on co-creating climate adaptation knowledge between scientific and Indigenous communities (a thematic model we follow here), Hill et al. [46] use the helpful, somewhat self-explanatory term 'place-attached'.

<sup>5</sup> Large-scale energy transition initiatives like the Green New Deal or the Paris Agreement (two of the best examples of tackling multiple policy goals in one package) are complex, costly, and often require contradictions. They may involve politically sensitive topics, such as the need for genuine personal sacrifice, or may be coordinated in nation-states where fossil fuel extraction is fundamental to the country's budget and identity (such as Dubai in the United Arab Emirates and Baku in Azerbaijan), thereby introducing the potential for conflict of interest. Although the language associated with these movements can inspire audiences, there is a genuine risk that some or all of the overall desired outcome will either be diluted in the messiness of negotiation and subsequent implementation-or, at least in some cases, not even be met. Smil [47], in the appropriately titled piece entitled *Beyond magical thinking: Time to get real on climate change*, outlines that even under the highly improbable scenario that all voluntary Paris Agreement pledges were honoured, the world would still see a 50% increase in emissions since the United Nations' first climate conference in Rio de Janeiro in 1992.

dilutive to economic-social-environmental pursuits.

More specifically, consider the following examples-perhaps an Indigenous-owned run-of-river hydroelectric facility, or a joint venture in a transmission infrastructure project. Through the financing and commissioning of such an initiative, one Nation can support own-source revenues (i.e., economic), promote a recycling of revenues for community human capital and physical assets of various sorts (i.e., social), and reduce transboundary harms from greenhouse gas emissions (i.e., environmental). Energy decisions, such as compromising local air quality to provide lower cost coal-fired electricity generation or exploiting Congolese miners to fuel batteries for electric cars, often entail compromises within the economic-social-environmental trifecta. In contrast, Indigenous-owned clean energy projects come as close to achieving a balanced triple bottom line structure as one is likely to find in energy markets. This makes it an ideal focus area for governments at all levels, as they are often quite understandably-eager to achieve multiple policy objectives at once. These projects can indeed succeed, and it is this potential for driving forward plausible success that we now focus on exploring.

## 2. From extraction to co-creation: Contextualising joint Indigenous/non-Indigenous contributions to sustainable energy transition

In this Perspective, we leverage our collective and myriad experiences operating in climate and finance academia, the public sector, Indigenous-focused organisations, and the Indigenous communities themselves to provide a short overview of the Indigenous energy financing landscape thus far. This academic-practitioner coupling leads to a discussion on possible viable avenues for future exploration and consideration, as the piece is profoundly rooted in a range of community-based experiences. Of special relevance to the academic literature, this Perspective is co-written by both Indigenous and non-Indigenous contributors fusing academic and practitioner frames of reference. We believe this represents the next wave of Indigenous-focused academia – focusing less on institutionalising Indigenous knowledge or using funding to perpetuate extractive forms of research, and instead on working together to co-produce works that can advance important shared reconciliation and sustainability goals. Such work has been undertaken in other areas related to energy policy, including in our home Province of British Columbia (sometimes shortened to B.C. - see an example in [9]). To the best of our knowledge, this research provides first-of-a-kind insights into the intersection of non-extractive Indigenous scholarship and the financing of Canadian clean technology deployment.

In one of our community-rooted examples, the first author (Joel Krupa) was invited to live and work for several years in the semi-remote community of the Ojibways of the Pic River First Nation (now Biigtigong Nishnaabeg). This experience led to the creation of several community-supported academic works through a role as an Energy Analyst for the First Nation-Krupa [7]; Krupa [8]; Krupa et al. [6]. This unique opportunity also included publications like Krupa [10], which advocated for a specific policy transformation desired by the Band's energy leadership. The second author (Frank Busch) is a member of the *Nisichawayasihk* (Nee-chise-away-a-see) Cree Nation and grew up in Northern Manitoba, Canada. He has a wide range of experiences working with Indigenous community development, having visited approximately 300 communities in the last two decades-the culmination of a varied career path that involves both writing and on-the-ground, often community-linked economic development work. The third and fourth authors, Derek Gladwin and Naoko Ellis, are professors at the University of British Columbia, through which they collaboratively work on energy transition projects linked to engineering, education, and communication. As settler

**Table 1**  
Summary of select financing options, along with example activities from the field.

Type of financing options	Example(s) in the field
Government funding options	Capacity building, technical work
Project finance	Large-scale, technologically mature renewable energy facilities
Internal equity	A community developing a 100% community-owned renewable energy project
Partner organization financing	Supporting Indigenous inclusion via favourable financing terms

scholars, they apply decolonizing approaches to research, emphasising ethical, accountable work with diverse epistemologies on energy that take into account the continued need for community-led energy sovereignty projects.

### 3. Financial support mechanisms in the marketplace

We begin with a brief review of extant examples in areas like corporate finance and asset finance, as well as a review of established national organisations (specifically, the First Nations Finance Authority and the Canada Infrastructure Bank) that have provided valuable additional support. We then proceed with some examples of relatively “low hanging fruit” in the apocryphal policymaker fruit tree. Of course, this somewhat simple summary represents only a small fraction of all possible opportunities, but is a meaningful starting point for those seeking to advance Indigenous financial support and equity participation in Canadian clean energy markets. Several promising future alternatives lie beyond the scope of this paper, but would be valuable areas for further exploration. These include private equity participation from Canada’s well-capitalized pension funds (e.g. for early-stage risk capital and/or later-stage growth capital), the potential creation of a reconciliation-focused Indigenous sovereign wealth fund (similar to a proposed reparations fund in the U.S. for descendants of enslaved individuals – see a sample framework in [11]), and theoretical roles for domestic and international philanthropic or impact-oriented support for innovation. Additionally, supranational approaches, national de-risking mechanisms, and grants present exciting avenues for future review and assessment, building on the foundation we aim to provide here.

Other long-used tools are not discussed extensively in this piece. Examples include the guaranteed power offtake advantage, premium price benefits, and capacity set-asides associated with feed-in tariffs (FITs). Feed-in tariffs, we note, are a model widely used in earlier days of the clean energy transition, but which have fallen out of widespread usage (such as in the Province of Ontario, which struggled with some of the political implications of implementation [12] and cost containment issues partially arising out of technology price digressions [13]). We also do not go into detail on Province-specific loan guarantees, such as Ontario’s Aboriginal Loan Guarantee Program [14], nor do we discuss carveouts (e.g. those in place in the Province of Saskatchewan, where incumbent vertically integrated utility SaskPower facilitates more financier-friendly power purchase agreements for Indigenous proponents, among others – [15]).

There are some well-established tools worth outlining at this stage.<sup>6</sup> These are summarized in Table 1, and further outlined below.

First, government funding programs remain the foundation of new Indigenous-linked clean energy infrastructure builds in Canada [16]. Grants can help provide very early-stage risk capital for the support of critical measures such as clean technology feasibility and technical

<sup>6</sup> One notable omission in our list would be the self-explanatory wealthy private investor. In this common but highly idiosyncratic scenario, this individual-often local to a given project-would provide funding for everything from working capital to earlier-stage (and consequently higher risk) expenditures.

assessments. Grants can also support new in-house community capacity building or the retention of knowledgeable external consultants, depending on the situation. Leonhardt et al. [17], in a study on 18 government instruments to support community clean energy in remote and northern communities, identify the centrality of grants in community renewable energy processes by observing that respondents to their survey identified it the most often (relative to other government policy measures, such as feed-in tariffs). Of course, the zero-sum nature of aggregate government funding means that this still-critical foundation to Indigenous financial participation is inherently limited in terms of the total support that it can offer – a finding mirrored in studies like the above-mentioned example of Leonhardt et al. [17].

Second, project finance (or asset finance, as it is sometimes called) is one of the simplest and most well-trodden options for supporting Indigenous financial participation in Canadian clean technologies like solar, wind, and hydroelectric power. Researchers have long recognized that the effectiveness of project finance – significantly influenced by supportive policy design [18] – is crucial for the rate of renewable energy deployment. Steffen [19], in his aptly titled paper *The importance of project finance for renewable energy projects*, highlights how project finance can bolster renewable energy initiatives in various ways beyond just managing funding. For instance, it can protect against cash flow issues in other areas of an organisation that could jeopardise the financial viability of a standalone project – particularly if all community-owned assets are grouped under a single entity.

A project finance approach could involve working with a traditional financial institution for financing or refinancing. More specifically, this would anchor around: a) an existing clean technology asset; b) a largely de-risked clean technology asset, such as one at the construction finance stage; or c) another later-stage “under development” clean technology asset. A typical scenario would involve a commissioned asset on a community’s traditional territory that a community is looking to acquire or pursue a stake in – perhaps in partnership with a public sector or private sector counterpart. The option pursued here (and in similar acquisition or very late-stage renewables investment opportunities) is described in an Alberta-based case study from the Royal Bank of Canada (RBC), where \$32 million was provided to support a 25% Indigenous stake in three solar farms southeast of Calgary (a major city in the Province of Alberta – see overview in [20]).

Yet another option would involve the community leveraging internal sources of equity,<sup>7</sup> such as proceeds from an impact benefit agreement with a local mining company, in order to fund the various stages of renewable energy generation and transmission development. This would require access to an existing balance sheet, and could lead to pursuing a community’s own greenfield (meaning “from scratch”) developments or a brownfield (meaning “already operational”) acquisition. Commercial lenders are usually only interested in supporting debt for projects at a construction finance (or later) stage, so using community funds can allow for the retention of a significant ownership stake and the ability to define a community’s own economic direction. The downside, of course, is that community funds are often zero sum –

<sup>7</sup> This could also include “land equity”, where a community project’s equity is as a result of their provision of the land to the community base.

meaning that any funding expended on pursuing (possibly high risk) clean energy ventures will need to be taken from other community priorities, such as on-reserve social infrastructure, education, and other important priorities.

It was approaches like these (along with others) that were pursued during one of the authors' (Krupa) time living on the reserve of the Ojibways of the Pic River First Nation. The Ontario Waterpower Association [21], in a case study entitled *Footprints to Follow: Ontario Aboriginal Waterpower Case Studies*, observes that two wholly Indigenous-owned facilities (Manitou Falls and High Falls) would lead to a sizable commissioning of 6 megawatts (MW) of power capacity, and represent the culmination of a journey that began when Pic River worked with an IPP to produce what was then one of the first First Nation partnerships with an IPP in Canadian history. Fisher River Cree Nation in Manitoba adopted a somewhat similar approach in their more recent 1 MW solar facility project, injecting \$2.4 million of their own money (alongside a \$1 million grant from Western Economic Diversification Canada, according to Fisher River [22]). Fisher River [22] also notes that such an approach brings not only equity ownership in the project itself, but also ancillary benefits such as using a largely Indigenous workforce for the substantial capital investment.

And finally, there is always the option of receiving financing support from the partner organisation(s). A good example of this approach is the East-West Tie single transmission line in the Province of Ontario, which allowed for-inter alia-the unlocking of stranded renewables capacity along the north shore of Lake Superior. Over nearly a decade, the Ontario Energy Board (OEB) led efforts to encourage new transmitter partners in the Ontario electricity grid, ultimately allocating over \$5 million for Indigenous involvement under the "regulated return" for the transmission line. A more detailed overview can be found in a 2021 OEB Decision and Order [23].

#### 4. Seeking scale: Notable existing Canada-wide organisations

All of the options presented thus far represent some of the community-specific approaches that have been adopted. These financing approaches have often been supplemented by two notable pan-Canadian entities – the First Nations Finance Authority (FNFA) and, more recently, the Canada Infrastructure Bank (CIB). The former has been long-running and examples of its efficacy are already publicly available, while the latter is relatively nascent, with an impact that has yet to fully materialise. A summary table (Table 2) is presented below, and subsequent sections further expand on the contents.

##### 4.1. First Nations Finance Authority

One of the greatest hindrances for access to capital in Indigenous communities is the antiquated Indian Act of 1876. This Act, which is still in force today, gives creditors no recourse from borrowers on reserve lands. The key excerpt from this Act, still found on the Government of Canada Justice Laws website [24], is outlined below:

“89 (1) Subject to this Act, the real and personal property of an Indian or a band situated on a reserve is not subject to charge, pledge, mortgage, attachment, levy, seizure, distress or execution in favour or at the instance of any person other than an Indian or a band.”

**Table 2**  
Summary of organisations active nation-wide, along with example activities that have been pursued.

Organization	Example activities
First Nations Finance Authority (FNFA)	Debt issuance
Canada Infrastructure Bank (CIB)	Indigenous Community Infrastructure Initiative (ICII), Indigenous Equity Initiative (IEI)

This simple clause has excluded First Nations people from being active participants in the modern economy. The FNFA provides a work around, by intercepting revenue streams bound for reserve lands before they get there. This is done by having the First Nations government sign an “Assignment of Receivables Agreement” directing the funds owed to the First Nation into a “Secured Revenue Trust Account” (a bank account with specific rules for this purpose). The FNFA utilises the funds received to cover principal and interest to service the debt, with the excess funds returned to the First Nation (usually within 24 hours).

The FNFA’s program operates under the “First Nations Fiscal Management Act, 2005”, which was passed through Canada’s Parliament with all-party support. This program provides First Nations with the ability to better manage their finances with assistance from the First Nations Financial Management Board (FNFMB), creating a real property tax regime with support from the First Nations Tax Commission (FNTC) that can borrow at government rates by issuing investment grade debentures through the FNFA that is then overseen by the governance apparatus of the FNFA.<sup>8</sup> FNFA is not an agent of His Majesty or a Crown corporation, and maintains a governance structure wherein direction and oversight comes solely from the First Nation communities that join as Borrowing Members. The members in assembly elect the board of directors from amongst themselves at FNFA’s Annual General Meeting – an event always held by policy on reserve lands.

Although there are limits to the publicly available materials that could be accessed by the research team, a recent Investor presentation by FNFA is instructive [25]. Specifically, they make note that approximately 15% of their portfolio relates to clean energy projects. Of note, the scale of the debt issuances in the two spotlighted projects with quantitative data (\$41 million for a run-of-river hydroelectric project with Mashteuiatsh First Nation and \$11 million for a wind project with Wahgoshig First Nation, respectively) show that these are meaningful investments. Excitingly, while minimal data is provided, other renewable electricity technologies (including solar at Ocean Man First Nation) and clean technologies linked to other sustainable development needs (such as food security and sustainable food systems, with Taykwa Tagamou Nation in Northern Ontario securing \$16 million) are also present in their portfolio.

##### 4.2. Canada Infrastructure Bank

The roles of government-backed infrastructure banks are well-documented in the literature, with special long-standing emphasis on the benefits as they relate to the green economy (see, for instance, Geddes et al. [26]). The Canada Infrastructure Bank (CIB), while not exclusively dedicated to Indigenous support or clean technologies, has similar programs and initiatives aimed at supporting Indigenous people and Indigenous communities seeking clean energy infrastructure equity investment opportunities in Canada. These programs are designed to facilitate the development and financing of infrastructure projects that can drive economic growth, improve quality of life, and create sustainable opportunities for Indigenous peoples. The two main programs are: the Indigenous Community Infrastructure Initiative<sup>9</sup> (ICII) and the Indigenous Equity Initiative (IEI). We expand upon both below.

###### 4.2.1. The Indigenous Community Infrastructure Initiative

The ICII’s objectives, as laid out in the Applicant Guide [27] and elsewhere, are to: a) reduce the infrastructure gap in Indigenous communities; b) provide bespoke solutions for smaller-scale Indigenous projects; and c) to support Indigenous (communal) ownership of

<sup>8</sup> The FNFA’s President and CEO, Ernie Daniels, is a financial leader who, among many accomplishments, currently sits on the Board of Directors of the Bank of Canada [48].

<sup>9</sup> A detailed overview, including sample deal structures and partnership examples, can be found in the following Canada Infrastructure Bank link [49].

infrastructure. Individual Indigenous entrepreneurs and high-net-worth individuals are excluded as eligible borrowers. The ICII lays out a three-stage process that takes at minimum 10 months to navigate, and includes ongoing reporting to remain in compliance with loan requirements. The interest rates are never quoted, but are promised to be “below market rates” with factors including “involvement of private investors” determining the rates. Terms in excess of 35 years are possible on a case-by-case project basis.

There are caveats for community involvement. In addition to the “Eligible Project Category” being highly prescriptive, applicants must provide “evidence that no other lender will provide financing at terms and conditions that make the project viable”. This means no economically viable projects (at least as measured by private sector banks) are allowed. Moreover, there are high financial barriers to entry, for Indigenous communities would have to incur the costs of planning, engineering and feasibility, permitting, licensing and other approvals, as well as develop a detailed financial model to begin the application process.

#### 4.2.2. The Indigenous Equity Initiative

The IEI’s objective is to assist Indigenous communities in owning a minority stake in an infrastructure project that CIB is “considering” investing in [28]. The loans are for up to 90% of Indigenous equity targeted at 15 years utilising a 75% cash sweep of equity distributions. The interest rates again are not quoted, but will be determined by CIB at “lower than” market rates. Other eligibility criteria include that the project must be located in Canada, have a market capitalization of over \$100 million, be new or primarily greenfield, align with the CIB’s five priority sectors, be deemed “in the public interest,” demonstrate reasonable potential for revenue generation, achieve a Technology Readiness Level (TRL) of 8 (indicating it has been proven effective in its final form under expected conditions), and be capable of attracting private sector investment. In order to qualify, Indigenous communities must additionally be situated in proximity to the project, demonstrate a “financing gap” via rejection from major banks, and (although not stated) provide free, prior, and informed consent to the project in question in accordance with United Nations Declaration on the Rights of Indigenous Peoples (or “UNDRIP”, to which Canada is a signatory).

The CIB has set a \$1 billion target to invest in revenue-generating Indigenous infrastructure across their five priority sectors: renewable energy, green infrastructure, public transit, broadband internet service, and trade and transportation. The IEI has been designed to mirror the mainstream CIB programming, but is geared towards smaller deal sizes between \$5 million and \$100 million. While the full extent of this program remains to be seen, it is clear that these priorities as mandated by CIB do not necessarily align with Indigenous priorities such as Self-Determination (“let us decide for ourselves”), Self-Government (“let us manage ourselves”) and Recognition of Treaties (“honour previously made promises before making new ones”). It should be noted that many Indigenous peoples in Canada consistently respond to blanket solutions such as these with doubt and scepticism, largely due to unfavourable prior experiences with federal, provincial, and municipal governments.

## 5. Other opportunities on the horizon

During our time in the field, we have observed a number of exciting Indigenous community trends that include:

- Expanding international Indigenous cooperation and inter-tribal trade
- Increasing control over Indigenous wealth
- Growing sophistication and knowledge of Indigenous rights and sovereignty
- Accessing new capital and improving business acumen
- Encouraging more Indigenous people to seek higher education and apply their knowledge in the community

**Table 3**

Summary of emerging opportunities, along with possible options.

Emerging opportunity	Example(s) in the field
New technology experimentation across traditional territories	Novel small-scale hydroelectric facilities
Other linked electricity system infrastructure	Indigenous-led electricity transmission projects
Stay attuned to broader technological evolutions	Indigenous direct air capture facilities
Consider Indigenous premiums, such as the models historically used in electricity generation procurement	Facilitating Indigenous participation in high-impact transmission facilities
Seek out additional sources of financing	Canada’s well-capitalized institutional investors, such as pension funds or insurance companies

- Facilitating access to software and infrastructure for faster communication with external experts and consultants
- Driving successful economic development activities to create greater autonomy from non-Indigenous government

Based on these macro-level observations, we present the following clean technology financing-specific ideas for additional areas of joint exploration between policymakers, industry, and Indigenous organisations and Nations. A summary of these options is contained below in Table 3, and expanded upon below.

### 5.1. Continue to expand experimentation with novel community-specific clean technology and electricity generation opportunities

The primary focus should remain on unlocking Canada’s vast renewable energy resources, including decentralised energy systems and smaller-scale approaches, as well as exploring novel technologies that support alternative fuels, innovative configurations, and advanced materials that need assessment in real world, applied settings. According to the Government of Canada [29], renewable energy provided 16.9% of total primary energy supply as of 2022 – a number in the low double digits that is both comparable to many other nation-states and has remained surprisingly fixed for over a century. A spatial analysis by Barrington-Leigh & Ouliaris [30] confirms that most provinces (except Alberta and Ontario) possess the physical resources for a purely renewables-powered (with no nuclear integration) grid, but it is clear that society still has a long way to go to achieve that vision. There is an abundance of clean technologies that would benefit from relatively early-stage de-risking opportunities. Targeted approaches may be necessary; for example, bioenergy as a form of renewable, clean energy has the potential for replacing fossil-based energy use in remote communities in Canada. Collaborative resource management and participatory decision-making processes around biomass resources should be developed with Indigenous knowledge and land use, which can make bioenergy a viable community-based solution [31].

These energy developments, we note, have the potential to accommodate many aspects of social well-being, namely subjective, relational, and material dimensions of well-being in Indigenous communities [32]. Relational approaches explore the ontological question of what energy is about, rather than just focusing on what energy is or what it does [33], enabling a great sense of well-being for community engagement. This focus creates space for co-creating the subjective and complex aspects of energy transition, encouraging collaborations that highlight meaning beyond financial outcomes and aim to foster relationships for sustainable futures. Zapata [34] also notes the size and capacity of renewable energy projects in Indigenous communities in Canada is highly associated with higher community well-being. As energy is intertwined with food, water, education, housing, and other services, not just as co-benefits, but holistic ways of understanding the connectivity that leads to well-being should be adopted.

Creating meaningful incentives for communities will therefore be

key. West Moberly First Nations (WMFN) in Northeastern British Columbia<sup>10</sup>, for instance, recently received \$299,404 to support a geothermal facility linked to a commercial-scale greenhouse [35]. More recently, WMFN (along with Sauteaux First Nations) has received BC Indigenous Clean Energy Initiative (BCICEI) funding to support design and engineering work for a geothermal facility to supply energy for an Indigenous plant nursery. The BCICEI is funded by a clean energy partnership between the Province, the Government of Canada, and New Relationship Trust [36]. WMFN has also received funding from BCICEI to install solar power systems on 48 residential homes [37]. This was made possible by funding through BCICEI and Pacific Economic Development Canada, and further funding was acquired through W Dusk Energy Group, an Indigenous-owned clean energy company supporting communities to become self-reliant through renewable energy empowerment.<sup>11</sup>

### 5.2. Consider broader enabling green infrastructure-particularly transmission

But the challenge is not merely one of generation, for many renewable energies are stranded without adequate transmission infrastructure. One of the critical challenges for renewable energy is that the place in which power can be most efficiently generated is rarely the same place where it is needed. This usually means that Indigenous communities are impacted by-and can potentially benefit from-involvement in electricity transmission projects. According to the 2022 *Waves of Change* report by Indigenous Clean Energy, there are 19 electricity transmission projects with Indigenous participation across Canada-including projects directly accessing the grid, off-grid community interconnection, and grid strengthening [38].

Transmission projects present substantial opportunities for employment, training and equity involvement. In the case of the publicly available history of Five Nations Energy Inc. (a joint venture between the Indigenous communities of Attawapiskat, Kashechewan, Fort Albany, Moose Cree, and Taykwa Tagamou Nation), this particular unified Indigenous group was rejected dozens of times in their requests for meaningful participation during their journey to successfully building high voltage transmission lines [39]. The First Nations sought to reduce dependence on diesel for electricity, not only because of environmental concerns, but also because it hindered growth of the community until diesel generators could be upgraded by the federal government. The communities were using as much as 5 million litres of diesel per annum (which had to be barged in) in order to meet their basic needs, and spillage and leakage was a common occurrence. While incumbent transmitter Hydro One initially rejected Indigenous inclusion, Five Nations Energy Inc. asserted their stance and demonstrated both environmental and economic benefits of partnership. An evolution did occur, for in 2022, Hydro One announced their new Equity Partnership Model, offering First Nations a 50% equity stake in all new transmission projects, highlighting Indigenous access to capital through a variety of financing methodologies [40].

<sup>10</sup> They are a proud community of Dunne-za, Sauteaux, and Cree people, whose ancestors have lived in northeastern B.C. since time immemorial. WMFN has opposed the construction of Site C dam on the Peace River based on the concerns for cost, the environmental impacts, the loss of sacred archeological and burial sites, and the impacts on Treaty rights [50]. With these long historical contexts, energy has been the forefront topic in WMFN. From the recognition of WMFN as a leader in green energy in the late 2000s [51] to Zonnebeke Wind Energy Project initiated in mid 2010s [52], the Nation has embraced innovation in clean technology.

<sup>11</sup> W Dusk's president David Isaac talks about how colonialism is tied with nonrenewable resource extraction, and the Indigenous community-led clean energy transition initiatives are really about decolonization [53].

### 5.3. Seek innovative approaches-including underutilised or untested technologies

Similarly, given the accelerating threat of climate change, one must look beyond decarbonization and plausibly assume that despite their uncertain (and potentially small) contribution to meaningful emissions abatement, negative emissions technologies, such as direct air capture (DAC) and bioenergy carbon capture and storage (BECCS), will also proliferate. As one example, modelling scenarios show economic potential for BECCS to contribute to emissions reductions with carbon dioxide permits [41], even as traditional forms of renewable energy remain the most important. Indigenous communities are often reluctant to invest in, or partner with, yet unproven technologies (regardless of projected environmental and financial benefits). However, communities are often receptive to credible, well-capitalized counterparties who are keen to participate with equity, employment, educational, and/or environmental benefits as equal partners. Facilitating Indigenous financial inclusion is important here.

### 5.4. Continue to expand the offering of Indigenous premiums and credits

The concept of a premium is very straightforward-generation projects with meaningful Indigenous ownership would receive an additional bonus for every kilowatt-hour generated, above and beyond the rates already being offered by the offtaker. The lead author of this paper has argued that the existing foundation of having offered Indigenous price adders for electricity generation projects, such as those found in past legislation from the Province of Ontario, could evolve into the integration of an adder model in transmission procurement [10]. Credits of some sort-including voluntary ones-may also be something that can be facilitated through the broader capital markets. For instance, many investment houses have set ESG investment parameters at the behest of their investor clientele, as some investors are concerned about the non-financial outcomes of their financial returns (e.g. the environmental and social impacts). Mutual fund dealers and other financial architects have created a variety of metrics to score the ESG worthiness of investment, and within these grading schemes, Indigenous-generated carbon credits have sold at a premium to regular carbon credits (not unlike the differences between grey, blue and green hydrogen). If the market for Indigenous carbon credits evolves, Indigenous renewable energy producers may be incentivized to expand their operations to meet demand.

### 5.5. Continue to expand the universe of capital sources

The final area in which we urge additional consideration is in drawing new capital sources to the space. Nelson [42] highlighted the substantial clean energy transition financing opportunities available via direct investments from institutional investors such as pension funds and university endowments, as cost of capital reductions for project proponents are possible in cases where these investors compete amongst themselves for limited opportunities and investors are actively involved in structuring the deal. Collectively referred to as The Top 10 (Boston Consulting Group, 2013), multiple pension fund structures exist, including industry-specific (Ontario Teachers' Pension Plan in Ontario), provincial (e.g. Alberta Investment Management Corporation (AIMCo) in Alberta or British Columbia Investment Management Corporation (BCIMC) in British Columbia), and national (CPP Investments, the global investment management organisation for the Canada Pension Plan). With over \$400 billion invested in Canada as of 2013 (Boston Consulting Group, 2013), a substantial minority of this could be invested in the support of economic reconciliation that simultaneously supports decarbonization.

## 6. Conclusion and policy implications

There is a saying among Indigenous knowledge keepers—“education is the new buffalo”. The meaning is that a new way of life must be identified, for the old one is no longer viable. This is especially relevant for financing, where all stakeholders must continue to evolve and improve the existing models. Electricity is a need relatively new to Indigenous communities, but one that seemingly cannot be lived without. Indigenous people, while often holding fast to tradition, are still a part of the modern, power-hungry world, and would like to continue to adopt new technologies and modern lifestyles. It is a fallacy that Indigenous peoples wish to return to a hunter-gatherer existence—one that would be unsustainable in most areas where the population of an Indigenous community exceeds 150 individuals.

Indigenous culture abhors prescribing ways of doing or knowing to others, as each individual is said to be on a unique journey in life. Indigenous knowledge keepers advise youth to seek a new path, but to always be mindful of remembering where they come from and the community that claims them. Each Indigenous person is expected to seek knowledge and resources, and then to return to the community as a hunter returning from the hunt.

There are profound lessons here for academics. By being mindful of how academia can assist Indigenous community energy efforts, researchers can help shift away from historically extractive practices that, while often beneficial for the researchers, can sometimes fail to adequately serve the communities involved. Collaborative projects between Indigenous and non-Indigenous partners, whether experimental or established, present opportunities to leverage expertise and technological knowledge (frequently funded by government initiatives) to advance clean energy projects aligned with Indigenous interests.

Smil [43] has quantitatively demonstrated the immense difficulty of overhauling an estimated \$440,000,000,000,000 in legacy, primarily fossil-fuelled global energy infrastructure. A part, albeit not the whole, of the requisite “all of the above” clean technology response needed to reach such scale involves Indigenous energy projects playing a critical role. As outlined here, there are crucial philosophical, legal, policy, and financial reasons for supporting Indigenous financial participation. We invite others to join us on this journey of growing the share of global clean energy transition finance claimed by Indigenous communities.

### CRedit authorship contribution statement

**Joel Krupa:** Writing – review & editing, Writing – original draft, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Frank Busch:** Writing – original draft, Formal analysis, Conceptualization. **Derek Gladwin:** Writing – review & editing, Writing – original draft, Supervision, Funding acquisition. **Naoko Ellis:** Writing – review & editing, Writing – original draft, Supervision, Funding acquisition.

### Declaration of generative AI and AI-assisted technologies in the writing process

Statement: During the preparation of this work, the author(s) used the GPT for Docs™ extension in Google Docs in order to ensure there were no gaps in their depiction of the Canada Infrastructure Bank. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the published article.

### Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Joel Krupa reports financial support was provided by Mitacs. Joel Krupa, Derek Gladwin, and Naoko Ellis report that financial support was provided by Canada First Research Excellence Fund.

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## Data availability

No data was used for the research described in the article.

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