

Green Skills for Sustainable Economic Growth

The Role of Canadian Colleges and Institutes in Advancing Education for Sustainability in Canada and Overseas

September 2016





Colleges and Institutes Canada (CICan) is the national not-forprofit membership association of Canada's publicly-funded colleges, institutes, Cégeps and polytechnics. Known previously as the Association of Canadian Community Colleges (ACCC), CICan and its members are committed to driving Canadian prosperity by being global leaders in applied education and partnered innovation.

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ACKNOWLEDGEMENTS

Helen Knibb, Canadian Studies Doctoral Program (2nd Year), Trent University was the primary researcher and author of this report. She would like to acknowledge Paul Brennan, Vice-President International Partnerships at Colleges and Institutes Canada (CICan) and Alex Stephens, Specialist, Monitoring, Evaluation and Learning at CICan who acted as guides and collaborators on this project.

THE COLLEGE AND INSTITUTE APPROACH TO DEVELOPMENT

Colleges and Institutes Canada (CICan, previously known as ACCC) is the national not-for-profit membership association of Canada's public colleges, institutes, cégeps and polytechnics. It represents its members at the national and international levels and is committed to quality education and skills development opportunities for all Canadians to maximize labour market participation and support Canada's prosperity and nurture global citizenship.

Canada's colleges and institutes are major drivers of human capital development in Canada. They are found in over 3,000 communities across Canada, serving 1.5 million Canadians every year, and they offer more than 8,000 different education and training programs leading to formal qualifications tailored to the needs of individual learners. Internationally, they have shared this knowledge and know-how through strong and sustainable institutional partnerships with counterparts in developing countries to help them strengthen skills development capacity and create pathways to employment or self-employment in key economic sectors, including agriculture, health care, renewable energy, natural resources, construction, food processing, fisheries, logistics and tourism, to name but a few. This network of public institutions has also engaged more and more Canadians from big cities and small communities in international development assistance efforts. "Development Days" and reports back from missions in the context of institutional partnerships are routine now and educate and engage not only students and faculty but also the broader community.

For more than forty years, ClCan and its member colleges and institutes have been actively engaged internationally in strengthening access to relevant, quality education and training for employment and self-employment, working in partnership with the Government of Canada to implement more than 700 development assistance projects in over 100 countries. Our *Education for Employment* approach contributes to sustainable economic and social development in our partner countries by supporting governments, institutions and the private sector to collaborate in providing learning that is relevant to local skills demand and that leads to employment and selfemployment for youth, greater gender equality, green economic growth and poverty reduction.

CICan believes that the **institutional partnership approach** that grounds all our Education for Employment (EFE) programs is an effective strategy for bringing about comprehensive and sustainable change to education and training systems in the development context (see Fig. 3 below). Setting up technical partnerships by twinning education and training institutions in Canada and developing countries has long been our core approach to ensure effective knowledge sharing and adaptation of Canadian expertise. Our EFE programs integrate further partnerships with ministries of labour, education and specific economic sectors, education and training authorities, private sector employers and associations and local community or civil society groups all in support of the overarching goal of creating pathways to decent employment.

Institutional partnerships deliver good program management results on many fronts. They create a useful mechanism for direct private sector involvement. They allow government partners to ensure an alignment between institution-level change with broad reform policies or strategies. They create strong linkages between individuals and organizations that support effective knowledge exchange, continuous follow-up of activities and the effective coordination of a systems-based approach to education reform. We have seen how they can minimize certain project risks, such as the unexpected departure of key individuals. We have also observed that this approach is effective at mobilizing unforeseen institutional expertise and contributions beyond the planned and funded project outputs. Finally, in several countries, including Brazil, China and Senegal, initial partnerships have developed into decades-long relationships.

Because of the results of these international activities, CICan has also been selected as the UNESCO-UNEVOC Pan-Canadian Centre and lead for North America, and as chair of the World Federation of Colleges and Polytechnics (WFCP). This is also because the Canadian college and institute system is now viewed by many around the world as one of the two models, along with the German/Swiss apprenticeship system, most relevant to developing countries in the process of reviewing their education and training systems.

TABLE OF CONTENTS

	Exe	cutive Summary	i
1	Intr	oduction and Overview	1
2	Met	hod	3
3	Key	definitions and concepts	8
	3.1	Sustainable Development & Education for Sustainable Development	8
	3.2	Climate change impacts, adaptation, mitigation and resilience	12
	3.3	From "Green Economy" to "Inclusive Green Economy" (IGE)	13
	3.4	The Changing Role of TVET in the Context of Climate Change and ESD	14
4	The	context in Canada: policies, strategies & action	17
	4.1	The Role of Canada's Colleges & Institutes in Promoting ESD Internationally	19
5	A F	ramework for Understanding ESD & GTVET Policy, Programs and Practice	25
	5.1	Assessment of policy recommendations for promoting ESD and GTVET	25
	5.2	Building at the Institutional Level: Canadian College and Institute Capabilities	27
		5.2.1 Green Campus	30
		5.2.2 Green Curriculum	35
		5.2.3 Green Community	53
		5.2.4 Green Research	60
		5.2.5 Green Culture	69
6	Sur	nmary and Conclusion	77
Bibl	iogra	aphy	81
Арр	end	ix A. Colleges participating in 2016 ESD Survey	86
Арр	end	ix B. CICan's Approach to TVET Capacity Building in Developing Countries	87
Арр	end	ix C. ESD Survey Questions	88
Арр	end	ix D. Green skills typology for technical and technology-based TVET	89

LIST OF ABBREVIATIONS

ACCC	Assoc. of Canadian Community Colleges (now Colleges and Institutes Canada)
Cedefop	European Centre for the Development of Vocational Training
Cégep	Collège d'enseignement général et professionnel (Quebec)
ClCan	Colleges and Institutes Canada (formerly ACCC)
CoP 21	Conference of Parties - an annual meeting to review implementation and progress on the Rio Convention (1992) and the UN Framework on Climate Change
EFE	Education for Employment
EfS	Education for Sustainability
ESD	Education for Sustainable Development
GAP	Global Action Programme (GAP) on Education for Sustainable Development 2013
GGKP	Green Growth Knowledge Platform
GHG	Greenhouse Gas Emissions
GIZ	Die Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) A German service provider working in the field of international co-operation and sustainable development.
GTVET	Greening of Technical and Vocational Education and Training
IGE	Inclusive Green Economy
INDCs	Intended Nationally Determined Contributions
ILO	International Labour Organization
LMI	Labour market Information
MDGs	United Nations' Millennium Development Goals
MINT	Mathematics, Information Technology, Natural Sciences and Technology
NSERC	National Science and Engineering Research Council
OECD	Organization for Economic Co-operation and Development
PAGE	Partnership for Action on the Green Economy
SDGs	UN Sustainable Development Goals for 2030
SMEs	Small-to-medium sized enterprises
STEM	Science, Technology, Engineering and Mathematics
TAFE	Technical and Further Education (Australia)
TVET	Technical and Vocation Education and Training
UNESCO	United Nations' Educational, Scientific and Cultural Organization
UNEVOC	UNESCO International Centre for Technical and Vocational Education and Training
UNFCCC	United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

OVERVIEW

Following the United Nations (UN) Climate Change Conference in Paris in 2015 and the adoption in the same year by the United Nations General Assembly of the 2030 Sustainable Development Goals (SDGs), there is a new sense of urgency about escalating the global response to climate change. This should drive an increase in demand across the globe for new types of skills—**"green skills"**—that will equip people to drive "clean" or "green" economic growth. For Technical and Vocational Education and Training (TVET) in both developing and developed countries, the challenge is not only building the capacity to deliver a "next generation" of technical skills development, but the need to rethink education "post-2015"—in effect, to reconsider the culture of education as it is known, in order to respond to the pressing issues of our time.

This report, commissioned by Colleges and Institutes Canada, positions Canada's colleges, institutes and Cégeps within the rapidly changing global landscape of **Education for Sustainable Development (ESD)**. It examines the capacity of Canadian colleges and institutes to contribute to, and partner in, what is now increasingly known as the "Greening" of Technical and Vocational Education and Training (GTVET). It provides an overview of this capacity against the backdrop of a growing demand for transforming education and skills development systems globally to address climate change. The study also serves as an important first, though far from comprehensive, effort to assess the range and scope of what might be referred to as the "greening" of Canada's colleges and institutes and how these activities measure up with the current state of knowledge and practice in ESD and GTVET.

STRUCTURE

The study is made up of several components:

- An examination of international literature (after 2012) on climate change and the role of TVET in anticipating and responding to rapid developments in skills needs and professional training;
- A review of key definitions and concepts related to climate change, sustainability and the "greening" of the economy, and their relevance to TVET (Section 3);
- An assessment of the literature addressing the primary functions of TVET and the need to adapt institutional policies, processes and practices to respond effectively to the post-2015 Education for Sustainable Development (ESD) agenda (Section 3.4);
- An overview and assessment of the current activity of Canada's colleges and institutes in furthering ESD and technical skill development for a greening economy, including the ways in which sustainability has been infused across institutional policy, processes and practices (Section 4);

• Identification of Canadian examples and case studies to help illustrate the depth and breadth of institional capacity and potential in ESD as well as responsiveness to the greening of the economy (Section 5.2).

GREEN CAMPUS	GREEN CURRICULUM	GREEN COMMUNITY	GREEN RESEARCH	GREEN CULTURE
 Managing campus energy management water management waste management pollution management 	 Integrating ESD green technology clean technology green jobs greening existing jobs 	Adapting Community • capacity building • renewable technology • resource support • unique practices	 Fostering Research renewable energy water treatment green innovations waste recycling 	 Promoting culture green values green attitude green ethics green practices
	KEY E	LEMENTS & INDICA	ATORS	
 Green policy and objectives Resource management Management systems in monitoring & evaluation 	 Green programs & courses Green practices in classroom and lab Industry- institute interaction 	 Green practices at community level Community participation Innovative programs and projects 	 Applied research programs Impact and outcome Management and monitoring 	 Values and practices Participation Innovative programs

UNESCO-UNEVOC's Five Dimensions of Greening TVET

UNESCO-UNEVOC's *Five Dimensions of Creening TVET* is a key framework for understanding the GTVET approach to Education for Sustainable Development, and influenced the way this study organizes and describes the many different practices in Canada's colleges and institutes that were collected. Defined as *green campus, green curriculum, green community, green research* and *green culture*, they have been assumed by UNESCO UNEVOC as the lens through which to view the greening of TVET.

FINDINGS

The *current* capacity and expertise of Canada's colleges and institutes to design and develop Education for Sustainable Development (ESD) and to drive the growth of green skills is considerable and, in many cases, innovative and unique in the world. Compared to the perceived need, this capacity represents an untapped reservoir of knowledge that could help to make Canada a leader in the new sustainable development agenda. The Canadian programs and practices examined illustrate how Canadian colleges and institutes have been:

- responsive and nimble in their approach to integrating sustainability within their institutions and educational offering, and;
- forward thinking and innovative despite—or perhaps because of—the lack of an overarching public policy framework to stimulate and support the growth of ESD.

The range and scope of initiatives related to the **greening of campuses** has in many instances gone far beyond the "low-hanging fruit" of modelling good practices related to waste management or the conservation and reduction of energy and water resources. There is widespread adoption of "whole of institution" approaches to campus greening that seek systemic changes to policy and procedures related to facilities management and campus operations and extend into local communities through partnerships and engagement (e.g., sustainable commuting).

Colleges and institutes have also been leaders in advancing the use of **sustainable building technologies** and integrating student life, academics and community service in new kinds of **cross-over learning spaces**. Green campus initiatives have also been closely tied to efforts to promote inclusiveness, gender equality and social justice.

In the area of **applied research**, Canadian colleges and institutes have been particularly successful at partnering with small- to medium-sized enterprises and community organizations. Applied research is a vehicle for collaborating on problem-solving at the community level to address issues of local and regional significance and to bring products or services to market with a quick turn-around. In the context of the SDGs and climate change adaptation and mitigation, it is well worth evaluating such an approach to developing regionally-based economic solutions, one in which TVET institutions not only are able to engage students in applied solutions but also help stimulate green economic growth, steer graduates to green jobs and develop practical responses to local development needs.

Curriculum and program development is a core business for Canada's colleges and institutes. It is through curriculum innovation and program design that colleges and institutes respond to emergent needs, both in the form of flexibility and responsiveness in program delivery and in the development of new education and training content. Canadian institutions have become adept at the integration of sustainability across the curriculum and in developing programs in emergent and cross-sectoral occupational areas related to sustainability. They have nurtured a competency-based culture of quality assurance, qualifications frameworks and credentialing that are important in promoting student academic and workplace mobility in an evolving labour market.

Canada's colleges and institutes have always had a strong mandate to **engage with the community**. This longstanding function has allowed them to develop good models for **experiential learning** such as co-op, internships, field work and field placements, service learning and community based research. These are models which will be of increasing relevance as GTVET further engages in community development through a sustainability lens. Public-private partnership development and experience working with not-for-profits and nongovernmental agencies at all levels are important elements for GTVET in developing countries. And in Canada, these activities are being developed in an institutional culture that reflects the social principles of the SDCs including working with Indigenous communities and respecting local knowledge.

CANADIAN ESD EXPERTISE & INTERNATIONAL DEVELOPMENT

Many Canadian colleges, institutes and CEGEPs are engaged in international education cooperation projects in which environmental sustainability is a significant point of focus of the activities. In some cases, this has been through Colleges and Institutes Canada's *Education for Employment* (EFE) projects in Africa, Latin America and the Caribbean, where Canadian institutions develop partnerships with local institutions in developing countries to share their expertise, with TVET reform as a main programmatic objective.

The cases examined in this study show that partnership mechanisms already exist to adapt the core competencies and capacities of Canadian colleges and institutes to the international development context. These core competencies combine these institutions' strengths in applied education and training with specializations in environmental and sustainability education. Canadian colleges collaborate with partners in education in developing countries to build skills development capacity in key areas such renewable energy, water conservation and treatment, sustainable agriculture and many others. As a part of this activity, they:

- Work with local TVET partners to develop environment- or sustainability-focused academic programs, curricula and professional qualifications, e.g., solar and wind energy technology;
- Share approaches to integrating and embedding sustainability into all TVET curricula, teacher training programs and vocational qualification frameworks in partner countries;
- Support the development of "green campus" activities to help TVET schools in developing countries develop institutional sustainability practices and culture, often as demonstration or "living laboratory" projects involving students, and;
- Managing applied research projects (involving students) to address environmental issues, e.g., improving extraction processes in artisanal mining.

These competencies allow colleges to respond effectively to local and community needs in developing countries while assisting local partners to build lasting capacity in education systems. Canada's colleges and institutes have demonstrated a state of readiness for change and are positioned to respond to the overarching goal of the 2014 UNESCO Road Map for Implementing the Global Action Programme on Education for Sustainable Development, "to generate and scale up action in all levels and areas of education and learning to accelerate progress towards sustainable development."

1 INTRODUCTION AND OVERVIEW

This report was commissioned by Colleges and Institutes Canada (CICan) to locate Canada's colleges, polytechnics, institutes and Cégeps within the rapidly changing global landscape of Education for Sustainable Development (ESD), the Inclusive Green Economy (IGE). It situates itself amidst a growing sense urgency among many nations to scale up efforts to mitigate and adapt to climate change and to pursue "clean" or "green" economic development. Following the United Nations (UN) *Climate Change Conference* in Paris, (Nov 30-Dec 12, 2015), and the release of the UN 2030 *Sustainable Development Goals* (SDGs) (adopted September 25, 2015), this new sense of urgency has translated into an ambitious agenda for change and a potentially significant commitment of resources from government and international bodies to bring this change about. Education—specifically, education that deeply integrates principles of sustainability and ecological stewardship and prepares future skilled workforces to work in a green economy—has a potentially significant role to play in developing the capacity of countries to address climate change effectively.

The goal of this report is to assess the capacity of Canadian colleges and institutes to contribute to, and partner in, what is now commonly known as the "Greening" of Technical and Vocational Education and Training, (or GTVET), in developing nations.¹ The report is a high-level overview of the changing global needs and challenges to which GTVET must respond. It also seeks to address some of the questions raised by the Government of Canada's 2016 consultation process on refocusing assistance priorities.²

It focuses on broad patterns of thinking around ESD over the period 2009 to the present and, in particular, the emerging trends of this post-2015 period—a watershed year for climate change and sustainability that saw the signing of the Paris Climate Accord and the ratification of the UN 2030 Agenda for Sustainable Development. It examines the ways in which Canadian institutions are not only aligned with current global directions but arguably ahead of them in many ways, particularly at the level of institutional transformation. Most important, it presents an opportunity to 'reflect critically on current initiatives to chart more effective ways forward for transformative TVET', both in Canada and overseas.³

The paper sets out to demonstrate that:

There is consistency across multiple, global reports, declarations, forums and conferences in the identification of key policies, strategies, action areas and recommendations for the greening of Technical and Vocational Education and Training

¹ It should be noted that in many developed nations the term now used is Technical and Professional Education and Training because of the historic image and condescension towards the word 'vocational' and the inclusion of higher levels of professional education into the field, but for this paper we will use TVET.

² Global Affairs Canada. *International Assistance Review: Discussion Paper*. Ottawa, 2016. Colleges and Institutes Canada's submission in response to the International Assistance Review can be accessed at the following URL: http://www.collegesinstitutes.ca/file/skills-for-sustainable-development/.

³ UNESCO-UNEVOC (2015) Global Forum on *Skills for Work and Life*, 41.

(TVET) and that these are of relevance to both developing and developed countries, although institutions may be at different places on the ESD continuum;

There is a high level of consistency in the themes and issues that are identified as being of greatest concern, and which apply to TVET in both developed and developing countries, and around some of which, progress has been slow;

A 'whole of institution' or 'institution-wide' approach' to sustainable development (SD) based on 'Green Campus, Green Curriculum, Green Community, Green Research, and Green Culture' is 'increasingly seen to advance the sustainability agenda;⁴

Canadian colleges and institutes have both depth and breadth of experience across policy, practice, innovation, and implementation in developing this holistic approach, as well as a history of responsiveness, flexibility and partnership development which can contribute significantly to the global development of ESD in TVET;

There is a new sense of urgency in this 'post-2015' period with respect to the transformation of TVET into GTVET to meet the need to 'generate and scale-up action in all levels and areas of education and learning in order to accelerate progress towards sustainable development.⁵ This is a process in which Canadian colleges and institutes can readily engage and make a substantial contribution..

Canadian colleges have demonstrated their capacity to respond to the greening of the economy and issues of environmental sustainability through technical skill development, and education for sustainable development. The challenge now is developing institutional capacity to respond to the next phase of ESD and the ambitious agenda set by the *2015 Sustainable Development Coals for 2030.*⁶ For TVET in developing countries, that challenge is not only building the capacity to deliver a 'next generation' of technical skill development, but the need to 'rethink' education post-2015, in effect to reconsider the culture of education as it is known, in order to respond to the pressing issues of our time.

Although progress was made on the earlier United Nations (UN) *Millennium Development Goals*⁷ there is much that remains unresolved. These goals targeted eliminating poverty, environmental sustainability, promoting gender equality and the rights of girls and women, reducing child mortality rates, access to education, and combating HIV/Aids and disease in developing countries.

Evidence of the effects of climate change, specifically anthropogenic (human caused) climate change are pronounced and the need to respond is increasingly urgent. Flooding and droughts, soil erosion, loss of biodiversity, extreme weather patterns such as more frequent and stronger cyclones or monsoons, and the degradation of coastlines and marine habits. All are

⁴ UNESCO-UNEVOC (2015) *Global Forum on Skills for Work and Life post 2015*, 42.

⁵ UNESCO (2013) *Proposal for a Global Action Programme on ESD*, 1.

⁶ http://www.un.org/millenniumgoals/

⁷ http://www.un.org/millenniumgoals/

expected to increase in frequency and severity over the coming decades. The resulting threats arising from these effects are already evident in the developing world and, it is assumed, will only become more common. Water scarcity, the loss of food security, the failure of local economies, threats to public health such as increased prevalence of vector-borne diseases, disenfranchised youth, conflict, human displacement and sometimes mass migration, are only a few examples. These problems are compounded by other other human-caused damage to ecosystems, such as deforestation and land use conversion, and these can arise from, and further drive, social and economic inequalities in many societies.⁸

Such impacts are not limited and localized, but of increasingly global significance. In Canada, that includes a 'a higher rate of warming than in most other regions of the world'; a trend particularly pronounced in the far north.⁹ Changes in the "amount and distribution of rain, snow, and ice and the risk of extreme weather events such as heat waves, heavy rainfalls and related flooding, dry spells and/or droughts, and forest fires" are anticipated, as well as changes in "ocean environments," in "sea levels," "wave regimes," "ice conditions and ice levels."¹⁰

2 METHOD

The primary purpose of this research was to position Canadian colleges and institutes within the local, regional and global landscape of GTVET in terms of their capacity to engage internationally, and contribute usefully to Education for Sustainable Development. Over the past two years CICan has been developing an increasing presence in this work, participating in an APEC sponsored project on the Systematic Design of Green Skills led by PR China (2015-16); in a panel on TVET and greening of the economy for the UNESCO-UNEVOC World Youth Skills Day, (July 19, 2016), and contributing several papers on the responsiveness of Canada's colleges and institutes to the greening economy, with a focus on curriculum.

A major challenge in designing the study was synthesizing the outcomes from the Education for Sustainable Development (ESD) literature in a meaningful way, responding to the literature on green skills, as well as the emerging skills associated with climate change impacts, and finding an approach to presenting the collective strengths of Canadian colleges and institutes. To that end, commonalities of practice, and shared values across, and between Canada's institutions, regardless of jurisdictional differences, and in the absence of a single, Pan-Canadian college system, were identified. The goal was to align these attributes with

⁸ United Nations Framework Convention on Climate Change. *Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries* https://unfccc.int/resource/docs/publications/impacts.pdf

⁹ See: *Nunavut Climate Change Centre*: http://climatechangenunavut.ca/en/understanding-climatechange/climate-change-impact

¹⁰ Web page: Government of Canada – Impacts of Climate Change. URL: www.climatechange.gc.ca/default.asp?lang=En&n=036D9756-1. See also Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, a 2014 update to the 2008 science assessment report, From Impacts to Adaptation: Canada in a Changing Climate. www.nrcan.gc.ca/environment/resources/publications/impactsadaptation/reports/assessments/2014/16309.

international GTVET activity, an evidence-based approach, creating a comparative framework within which to position Canada and Canadian colleges and institutes.

It was important to develop a strategy that helped to illustrate the depth and breadth of Canadian experience in as systematic a way as possible.

Step 1: Literature review - assessment of need

Key studies and grey literature reports¹¹ from the years 2009–2016 related to GTVET, ESD, the Inclusive Green Economy (IGE), sustainable development and climate change were reviewed at the high level. While there are earlier landmark events and publications, 2009 was the half-way point of the UN *Decade for Education for Sustainable Development* (ESD) and the beginning of a new phase in the greening of TVET and specificity around action areas. That year, the Bonn Declaration (2009) was a call to governments to develop ESD policies and frameworks ensuring access to quality education for all, and raising awareness about sustainability issues.

The literature was selected based on international relevance to the role of TVET and green skilling and/or developing a culture of sustainability as well as the emerging conversation around climate change. It included the outcomes of summits, declarations, forums, and conferences, as well as academic research. Most studies are published by international agencies such as the International Centre for Technical and Vocational Education and Training (UNEVOC), Partnership for Action on the Green Economy (PAGE), and the Organization for Economic Co-operation and Development (OECD). A few, are more regionally specific, such as the work of the European Centre for the Development of Vocational Training (Cedefop) in the European Union, but were referenced because the outcomes are transferable and are of relevance to the Canadian as well as global TVET context.

The literature was examined for identified needs – the key *recommendations, policy, strategies, goals, action areas, and commentary* that would further the sustainability agenda in GTVET and its capacity to respond to the economic, societal and environmental issues associated with climate change and sustainable development. These outcomes were then clustered in two areas:

At the *global, jurisdictional or national level*, this comprised policy, strategy, and recommendations considered to be critical in building a more effective TVET infrastructure to support an inclusive green economy and culture of sustainability.

At the *institutional* level, the outcomes were clustered around common operations and practices required in the greening of TVET, such as program

¹¹ Of the many documents reviewed, only those cited are included in the bibliography.

development and review, faculty development, community engagement or quality assurance.

Key definitions critical to positioning ESD in relation to TVET were reviewed, (e.g. climate change impacts, adaptation, mitigation and resilience), and concepts (e.g. the Inclusive Green Economy) for consideration of their impacts on skill development and ESD.

Step 2: Alignment of need with green/sustainable practices common to Canadian colleges and institutes.

A second step was to align these key needs or recommendations for transforming GTVET against what might be considered the standard practices, processes, approaches and values central to the operation of *all* Canadian colleges and institutes, regardless of jurisdiction. The focus was on how, and in what ways, these systems and processes have *already* been adapted to address the issues and challenges identified in the ESD literature.

Developing a Creening TVET Framework,¹² written in 2010 by Shyamal Majumdar, head of UNESCO's International Centre for Technical and Vocational Education and Training (UNEVOC), was used to organize key concepts and map to indicators of Canadian college/institute capacity and core projects. The resulting framework captures institutional operations and values across five dimensions: green campus, green curriculum, green community, green research and green culture. This basic framework, and the associated 'whole institution' approaches to promoting education for sustainable development were affirmed in the 2013 UNESCO *Proposal for a Global Action Programme on ESD*, (or GAP),¹³ and the UNESCO-UNEVOC report on the global forum on *Skills for work and life: post-2015*¹⁴ as being useful in the furthering of sustainable development goals.

Moreover, this framework aligns TVET core functions with those of Canadian colleges and institutes and helps to illustrate common Pan-Canadian institutional strengths, as against areas of institutional need in countries with developing TVET systems and processes.

¹² Majumdar, Shyamal (2010) *Developing a Greening TVET Framework*.

<u>http://www.unevoc.unesco.org/fileadmin/user_upload/docs/Greening_TVET_Framework-Bonn-Final_Draft.pdf</u> ¹³ UNESCO (2013) Proposal for a Global Action Programme on ESD, Annex I, 3.

¹⁴ UNESCO-UNEVOC (2015) Global Forum Report. Global Forum on Skills for work and life: post-2015, 42.

Step 3: Alignment of practices with select case studies representative of pan-Canadian accomplishments in ESD

Case studies from Canadian colleges and institutes were selected in order to illustrate the ways in which they demonstrate the responsiveness, flexibility, and dexterity required in order to meet the identified challenges and needs of GTVET. They were chosen not necessarily because they were large, or well-funded projects, but because individually and collectively they help to illustrate the depth and breadth of experience of the colleges; their innovation, their responsiveness to community and their 'whole of institution' approach to tackling sustainability. **Appendix A** lists the Canadian colleges that provided information in response to a survey questionnaire sent out to CICan's member colleges and institutes. Information on programs and practices in Canadian colleges, institutes and Cégeps was also obtained through internet searches.

Step 4: Alignment of practices with Canadian ESD international development projects

A final step was to select TVET projects in which Canada has been, or is, involved internationally, and which demonstrate institutional capacity to engage in complex, sometimes multi-sector, or long-term projects, adapt greener practices to new regional contexts, or develop new ones.

The goal was to try and move from showcasing 'stand-alone' Canadian projects, or, at best investigating 'islands of alternative practice' to addressing the real challenge of "affecting a wider transformation of approaches to growth."¹⁵

While this exercise, based on pattern recognition and mapping, is not an exact science, it helped establish the global landscape of change in GTVET and the place of Canadian colleges and institutes within it, including for example:

- a) Establishing a chronology of development from TVET to GTVET over the last six years and the significant shifts in ESD scope and process;
- b) Assessing colleges' and institutes' responses to greening in a pan-Canadian context, based on common values and approach;
- c) Summarizing policies, strategies, action areas and recommendations that are relevant to TVET across all jurisdictions in both developing and developed countries;
- d) Illustrating the extent to which there are commonalities in the challenges, needs, and processes of greening TVET, as experienced across all jurisdictions, in both developed and developing countries;
- e) Identifying some of the distinctions in practice and priority between developing and developed nations, as well as areas of growth that are of mutual interest;

¹⁵ UNESCO-UNEVOC (2015) Global Forum Report. Global Forum on Skills for Work and Life, 48.

- f) Demonstrating the depth and breadth of experience across Canadian institutions and their capacity to adapt practices and effect change in moving towards a sustainable future;
- g) Demonstrating, through use of case studies, the responsiveness and innovation of Canadian colleges in pursuing a sustainability agenda, regardless of scale;
- h) Creating an approach to sharing effective practices and promising next practices that is scalable and transferable.

The process also served as a gap analysis. Despite the numerous recommendations for moving TVET to GTVET, there seem to be few commonly endorsed methods, resources and tools that would significantly help change the rate of progress, or better systemize the change process.

METHODOLOGICAL CONSTRAINTS & LIMITATIONS

There has been a proliferation of publications of merit over the last six years, as well as growth in the number of international and national agencies producing and collaborating on them. There are new bodies of literature on ESD developing around the Asia-Pacific region, and Africa. A major challenge was untangling the agendas of the various agencies, and developing a clear chronology, given the time lapse between an event and a publication, or a declaration being drafted, approved and subsequently interpreted.

A challenge is that the ESD literature is written at the high level; it is rich in agendas and expectations for TVET performance and transformation, but weak on practice and assessment of practice, (although there are indicators that this is changing at the jurisdictional level). While there is a significant practical literature on TVET processes, the same cannot be said of the greening of those processes.

Identifying college projects that are not only representative of the kinds of exemplary and innovative developments happening across Canada but are representative of general practice and appropriately distributed by region and by sector, was aided by a survey sent to CICan's member colleges and institutes. A copy of the survey questionnaire sent to these colleges and institutes is included in **Appendix B**. In total, 23 colleges and institutes responded; a list of the participating colleges and institutes appears in **Appendix A**.

There is also a lack of specificity in the recent literature around skills needs. A consideration is the extent to which climate change impacts, mitigation, and adaptation, as well as resilience, will expand the scope and understanding of education for sustainability and the green skills mix, both in terms of recognized technical specialist skills, broad-based technical skills, and the more generic 'change agent' skills, habits of mind, and combinations thereof. Nor is there a significant body of knowledge based on evaluation of earlier technical, green skills identification and development processes, (and related training), or their lasting impacts on the economy and/or the employability and career mobility of the individual.

Much of the recent literature promotes GTVET as an agent of change and transformation of the individual that goes far beyond a technical education. There is little suggestion as to how this should be accomplished in terms of teaching and learning strategies, and minimal discussion of the scope and complexity of the generic skills required.

A peculiarity in reviewing the literature is the near absence of Canada as an international presence, or contributor to the global discussion, either in a leadership role, or as a change agent in the practice of greening of TVET. This is not a reflection of the lack of activity in Canadian colleges. US colleges are similarly lacking in visibility.

3 KEY DEFINITIONS AND CONCEPTS

Several terms are important in understanding the context for and challenges facing GTVET, post 2015. They are included here, as definitions and common usage have changed over the last few years,¹⁶ and in some areas, there is also a change in emphasis.

3.1 SUSTAINABLE DEVELOPMENT & EDUCATION FOR SUSTAINABLE DEVELOPMENT

Sustainable Development

The Bruntland Commission's 1987 definition of sustainable development remains in common use and is a foundational concept:

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Despite a criticism that we cannot account for what future needs will be, what is often omitted in discussion are the two key clarifying points:

the *concept of needs*, in particular the essential needs of the world's poor, to which overriding priority should be given; and

the *idea of limitations* imposed by the state of technology and social organization on the environment's ability to meet present and future needs.¹⁷

¹⁶ For example, there is evidence of a shift in Canadian policy usage from 'environment' to 'sustainability' and 'a marked increase in the use of the term 'sustainability' in policy', post 2005. See: Beveridge, D., McKenzie, M., Vaughter, P., & Wright, T. (2015). 'Sustainability in Canadian post-secondary institutions: The interrelationships among sustainability initiatives and geographic and institutional characteristics.' *International Journal of Sustainability in Higher Education*, 16(5): 611-638.

¹⁷ http://www.un-documents.net/ocf-02.htm

The definition can also be interpreted more broadly in the context of values associated with sustainability.

2015 Sustainable Development Goals (SDGs) for 2030

The 2015 SDGs are updated from the eight original U.N. *Millennium Development Coals*, (MDGs)¹⁸ which, though targeted for completion by 2015, are considered unfinished. The new SDGs were adopted at the United Nations *Sustainable Development Summit* on Sept 15, 2015.¹⁹ There are 17 goals and 169 targets. They attempt to both address what was left incomplete in the MDGs and set ambitious, new development goals. Environmental sustainability and climate change are addressed explicitly through several of the 17 SDGs, and can influence the rest.²⁰

SDG 4—"Quality Education"—calls international partners to ensure "inclusive and equitable quality education and promote life-long learning opportunities for all."²¹ Figure **[1 or 2]** provides a visual approach to understanding the role that education plays in the SDGs. Targets include 'enabling all young people to complete a basic education cycle including quality pre-primary education; acquiring knowledge, skills and competencies for work, entrepreneurship and life; experiencing good quality teaching and inclusive classroom practices; and accessing educational opportunities based on equity, flexibility and adaptability.²² The goal emphasizes moving beyond *access* to education to ensuring access to *quality* education.²³

The SDGs, together with their targets, serve as one of the most comprehensive and detailed road maps currently available of the need for, and scope of skill development aligned with climate change impacts and the evolving concept of sustainable development. Analysis of the targets provides direction for technical skill requirements as well as addressing the more pressing needs around social and cultural aspects of sustainability and soft skill development.

In most cases these skills are not new, but they do suggest a need for skill modification, new skills combinations, and a repositioning of existing curriculum to address them. Technical skills include for example:

- sustainable management of water and sanitation
- sustainable agriculture in relation to poverty reduction
- nutrition and health
- renewable energy and energy efficiency

¹⁸ http://www.un.org/millenniumgoals/

¹⁹ See: *Transforming our world: the 2030 Agenda for Sustainable Development* for the full agenda and details of goals and targets: https://sustainabledevelopment.un.org/post2015/transformingourworld.

²⁰ The United Nations Environment Program (UNEP) provides a useful visual approach in its publication The United Nations Environment Programme and the 2030 Agenda: Global Action for People and the Planet, accessible at URL: http://www.unep.org/pdf/UNEP_and_the_2030_Agenda.pdf.

²¹ UNESCO (2014) *Sustainable Development Begins with Education,* 5.

²² Ibid, 5.

²³ Ibid, 5.

- development of safe, healthy and resilient urban and rural communities
- disaster risk reduction
- sustainable production and consumption
- conservation and sustainable use of oceans, seas and marine resources
- protection, restoration and promotion of sustainable use of terrestrial ecosystems
- sustainably managed forests
- combatting of desertification, halting and reversing land degradation
- halting biodiversity loss.

These technical skills do not stand alone. Cultural diversity, achieving peaceful, just and equitable societies, gender equality and the rights of minorities²⁴ are all integral to the way they must be taught.

Education for Sustainable Development (ESD)

Although there are many variants on the definition of ESD, this post- 2015 UNESCO definition presents a succinct, inclusive, and powerful concept:

Education for Sustainable Development (ESD) is about enabling us to constructively and creatively address present and future global challenges and create more sustainable and resilient societies.²⁵

It is also about empowering individuals to effect positive change. ESD:

Allows every human being to acquire the knowledge, skills, attitudes and values necessary to shape a sustainable future.²⁶

The intended outcome is more than technical competence. ESD:

Empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity. It is about lifelong learning, and is an integral part of quality education. ESD is holistic and transformational education which addresses learning content and outcomes, pedagogy and the learning environment. It achieves its purpose by transforming society.²⁷

ESD has shifted from education *about* sustainable development that was content-oriented, to the more action-oriented 'education *for* sustainability.' Much of the recent literature goes further, and emphasizes the transformational and transformative nature of ESD.

²⁴ Ibid, 1-14.

²⁵ http://en.unesco.org/themes/education-sustainable-development

²⁶ PAGE (2015) *Paris Summary Statement on Learning for a Green Economy*, Preamble.

²⁷ UNESCO (2014) Roadmap for Implementing the Global Action Programme on Education for Sustainable Development, 12.





3.2 CLIMATE CHANGE IMPACTS, ADAPTATION, MITIGATION AND RESILIENCE

The United Nations Framework Convention on Climate Change (UNFCCC)

The UNFCCC, an outcome of the Earth Summit in Rio, came into force on 21 March 1994. To summarize, its key principles include, (at the most basic), recognition of the climate change problem, and binding member states "to act in the interests of human safety even in the face of scientific uncertainty."²⁸ Of particular significance is *Article 6* of the Convention which recognizes the importance of education: "understanding the reasons for climate change and its impacts are of critical importance to grasp the urgency of why everyone must act to reduce greenhouse gas emissions as rapidly as possible."²⁹ It placed "great importance on achieving education, training and public awareness" globally as well as locally but also recognized "the huge range of opportunities and co-benefits" that arise from mitigation and adaptation action.³⁰

The 2014 *Lima Call for Climate Action*³⁷ invited all Parties to develop and communicate *Intended Nationally Determined Contributions* (INDCs) in building towards "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system," (Article 2 of the UNFCCC). The INDCs are of particular importance for Least Developed Countries and Small Island Developing States allowing them to state their special circumstances and identify areas where they need specific support.³²

The Paris Agreement (COP 21) Nov-Dec, 2015

COP 21 (the 'Conference of Parties' which ratified the UNFCCC), marked the culmination of efforts to limit the rise in global temperature by reducing Green House Gas emissions (GHG). The Agreement reaffirms the goal of "keeping average warming below 2 degrees Celsius" while urging greater efforts to limit it to 1.5 degrees. It establishes "common binding commitments,"

²⁸ Other principles included setting a primary goal of stabilizing greenhouse gas concentrations 'at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system'; putting 'the onus on developed countries to lead the way'; providing financial support to developing countries; monitoring progress; recognising the challenge faced by developing countries in relation to economic growth and emissions, and the need for adaptation as well as mitigation strategies. See United Nations Framework Convention on Climate Change <u>http://unfccc.int/essential_background/convention/items/6036.php</u>

²⁹ 'What is Article 6 of the Convention?' United Nations Framework Convention on Climate Change, http://unfccc.int/cooperation_support/education_outreach/overview/items/8950.php

³⁰ Ibid.

³¹ The Lima Call to Action, UNFCCC's COP20, Dec 2014; see www.unfccc.int/files/meetings/lima_dec_2014/ application/pdf/auv_cop20_lima_call_for_climate_action.pdf

³² Climate and Development Knowledge Network (2015) *A Guide to INDCS Intended Nationally Determined Contributions* 2nd ed.

as well as "built in flexibility" for countries with less capacity. The Agreement requires reporting and technical review and, for developing counties, there is a major focus on adaptation.³³

3.3 FROM "GREEN ECONOMY" TO "INCLUSIVE GREEN ECONOMY" (IGE)

TVET institutions are tasked with responding to labour market needs through the development of relevant programs. A decade ago, the green economy was emergent, ill-defined and a somewhat limited concept, often with a focus on environmental goods and services, clean technology or renewable energy. In 2010, ECO Canada defined the green economy as:

The aggregate of all activity operating with the primary intention of reducing conventional levels of resource consumption, harmful emissions, and minimizing all forms of environmental impact. The green economy includes the inputs, activities, outputs and outcomes as they relate to the production of green products and services.³⁴

It could be said that in the absence of alternate definitions from other agencies and sector councils in the same period, environmental sustainability became the de facto definition of the green economy in Canada for some years, although that has changed more recently.

The 'integrated' or 'inclusive' green economy'

The inclusive green economy (IGE) marks a significant shift from the usual conventions of economic development. It is more complex, more holistic and addresses the social and cultural aspects of sustainability:

An *Inclusive Green Economy* (IGE) has evolved from earlier work on the Green Economy. In its simplest expression, such an economy is low carbon, efficient and clean in production, but also inclusive in consumption and outcomes, based on sharing, circularity, collaboration, solidarity, resilience, opportunity, and interdependence.³⁵

It is characterized by 'inclusive growth', and the notion of 'qualitative', economic growth, that is particularly valued in developing countries because it is sensitive to scale, localisation, and respect for limited, and exhaustible natural resources. The IGE aligns with the values and targets of the 2015 Sustainable Development Goals for 2030. It:

- Is "a prerequisite for development and poverty reduction";
- Benefits "broad sections of society over quantitative growth";
- Protects natural assets and habitats and "accounts for the regenerative capacities of ecosystems and the climate" (i.e. is sustainable);
- Is "decoupled from resource consumption and greenhouse gas emissions";

³³ Centre for Climate and Energy Solutions - C2ES (2015) *Outcomes of the U.N. Climate Change Conference in Paris*, 2-4.

³⁴ ECO Canada (2010) *Defining the Green Economy*, 5.

³⁵ UNEP (2015) Uncovering Pathways Towards an Inclusive Green Economy, 6.

- "Recognizes and places a true value on environmental services";
- Uses a decentralized approach, and supports localized markets and industries.³⁶

3.4 THE CHANGING ROLE OF TVET IN THE CONTEXT OF CLIMATE CHANGE AND ESD

This section investigates the shift to greening TVET, green economy learning and the ways in which TVET is a central actor in the growing literature on education and climate change and ESD. It illustrates the ways in which the roles of ESD, GTVET and learning for an inclusive green economy are increasingly aligned.

Greening TVET (GTVET)

Greening TVET or *GTVET* has entered common usage. It is a holistic, dynamic, approach that also goes far beyond the conventional definition of technical and vocational education and training. In 2010, UNESCO defined it as follows:

Greening TVET aims to promote creativity, innovation, critical thinking and the ability to recognize opportunity and stimulate social awareness around the central issue of environmental protection. It helps learners acquire skills, knowledge and attitudes needed to address environmental issues as these issues relate to their field of work.³⁷

Later, in 2015, at the UNESCO-UNEVOC forum on *Skills for Work and Life post-2015*, the emphasis on environmental sustainability was broadened. GTVET was described as:

A continuous process towards a sustainable future. It responds to the technical, economical, societal and environmental changes induced by the challenges of the 21st century such as climate change, degradation of ecosystems and social inequities.³⁸

Green Economy Learning

Building on the definition of the IGE, the 2015 *First Global Forum on Green Economy Learning* produced a working definition of 'Learning for an Inclusive Green Economy' and why it is worth investing in. It is a way of looking at the world that aligns with formal and informal learning and goes beyond technical skill development. It:

- i. promotes interdisciplinary, multi-sectoral and multi-level approaches to empower individuals, communities and societies towards the achievement of the SDGs;
- ii. puts sustainability at the heart of economic policies and practices and is founded on concepts such as green growth, ecological civilization or low carbon and climate resilient growth;

³⁶ Adapted from BMZ-GIZ (2011) *TVET for a green economy* 8, 10, 20 & OECD (2011, 4).

³⁷ UNESCO Climate Change Initiative (2010) *Climate Change Education for Sustainable Development*, 13.

³⁸ UNESCO-UNEVOC (2015) *Skills for Work and Life post- 2015,* 46.

- iii. focusses on changing attitudes, mindsets and behaviour to support a reframing of the current economic growth paradigm;
- iv. seeks to inform the earliest stages of educational development in ways that are constructive, positive and solution-oriented, and;
- v. makes learning and knowledge available to all in society, through open access methods and approaches and by seeking to "reach the furthest first" and "leave no one behind."³⁹

The role of TVET and Climate Change Education

As far back as 1992, *Agenda 21* (the *Rio Declaration*) spoke to the value of training as not only having a "job specific focus" and being "critical for promoting sustainable development" but of "improving the capacity of people to address environment and development issues."⁴⁰ In 2013, the German study *TVET for a Creen Economy* emphasized that Agenda 21 urged that "integrating sustainability into TVET cannot be reduced to individual vocational subjects or occupations," but that nevertheless technical skill development had increasingly become isolated from the more far reaching and ambitious concept of "education for sustainability," of which technical skills are a subset. The report emphasizes that both are important if GTVET is to produce graduates with the capacity to respond to the social, cultural and environmental impacts of the greening economy.⁴¹ Bringing together these two important aspects of GTVET is critical if GTVET is to develop the capacity to graduate the kind of "thinking practitioner" that the post-2015 world needs.

The 2010 UNESCO report, *Climate Change Education for Sustainable Development,* acknowledged that TVET not only plays a critical role in developing skills required for the "world of work and human wellbeing" but an essential role in a country's economic growth. It also recognized its impact in helping young people to "develop competences and skills that can help them contribute to the mitigation of climate change" as well as those "affected by climate change, to adapt to the changing environments through skills training."⁴² The report committed to two action areas critical to the functionality of TVET:

Preparation of guidelines for the incorporation of elements of climate change adaptation and mitigation into TVET programs that will contribute to reductions in energy consumption and CO2 emissions, create opportunities for marginalized and vulnerable groups, and enhance the cognitive and life-skills needed in socio-economic contexts affected by climate change.

³⁹ PAGE (2015) The Paris Summary Statement on Learning for an Inclusive Green Economy, 14.

⁴⁰ U.N. (1992) Chapter 36, 'Promoting Education, Public Awareness And Training.' Agenda 21, http://www.undocuments.net/a21-36.htm

⁴¹ BMZ-GIZ (2013) *TVET for a Green Economy*, 27.

⁴² UNESCO (2010) Climate Change Education for Sustainable Development, 12.

Development of a framework for skills needed in communities affected by climate change (e.g. climate refugees) to help affected youth adapt to their changing environment.⁴³

Intended outcomes include 'operational TVET programs with climate change and sustainability integrated, and aligned with new trends in skills development' and a 'functional TVET strategy focusing on skill development for adaptation to climate change.'⁴⁴ There appear to have been few concrete outcomes, tools, frameworks or processes from these priority action areas, a pattern that does not seem atypical. A 2011 ILO-Cedefop study concluded: 'the skills response component in most of the documentation for adaptation and mitigation measures, policies, strategies, action plans and programs initiated in response to climate *is either limited or non-existent.*⁴⁵

Similar initiatives have brought together state actors at the regional level. For example, the 2012 Arusha Declaration⁴⁶ by Africa's environment ministers pledged as part of the African strategy for sustainable development to enact measures to strengthen environmental education and training across all education sectors. The ministers followed up with the Africa Environmental Education and Training Action Plan, a ten-year plan to 2024. A GTVET strategy is proposed and identifies priorities such as: "demonstration learning environments for green TVET, competency based models for GTVET, career guidance and pathing support, teacher training, and training for decision makers.⁴⁷

TVET could be the education provider with the greatest capacity to support the 2030 SDG agenda due to its strengths in developing localized, technical and vocational education, formal and informal learning, continuous and work place learning, and pathways to more advanced credentials. By design, TVET has a responsiveness and flexibility in its approach to development of timely, relevant, and useful curriculum for specific learner needs; it has a proven record in responsiveness to and partnering with industry and small-to-medium sized enterprises (SMEs) to meet emerging work force needs and a developing track record in applied and community based research.

Global Action Programme (GAP) on Education for Sustainable Development

The 2013 Global Action Plan (GAP) is intended as a follow-up to the *United Nations Decade of Education for Sustainable Development* (2005-2014). Endorsed in 2013, at the 37th session of the General Conference of UNESCO, and launched in 2014, it 'seeks to generate and scale-up concrete actions in ESD' with a focus on the post 2015 education agenda. Its two primary objectives are:

⁴³ Ibid, 12-13.

⁴⁴ UNESCO (2010) Climate Change Education for Sustainable Development 13.

⁴⁵ Cedefop-ILO (2011) *Skills for Green Jobs: a Global View,* xix, xx.

⁴⁶ http://sd.iisd.org/news/amcen-14-adopts-arusha-declaration-on-africas-post-rio-strategy/.

⁴⁷ http://en.unesco.org/greencitizens/stories/africa-environmental-education-and-training-action-plan-aeetap

Objective 1: "to reorient education and learning so that everyone has the opportunity to acquire the knowledge, skills, values and attitudes that empower them to contribute to sustainable development."

Objective 2: "to strengthen education and learning in all agendas, programs and activities that promote sustainable development."⁴⁸

The GAP is accompanied by the more detailed 2014, *Roadmap for Implementing the Clobal Action Programme on Education for Sustainable Development*,⁴⁹ designed for stakeholders, and with suggestions for implementation. It is an important publication because it shifts to the operational, and in practical terms draws connections between ESD and GTVET.

4 THE CONTEXT IN CANADA: POLICIES, STRATEGIES & ACTION

Historically, Canada was an early leader in the promotion of Education for Sustainable Development (ESD). Pan-Canadian initiatives, such as the incorporation of sustainable development in primary and secondary education policy across Canada's provinces and territories began as early as 1991 under the leadership of the not-for-profit *Learning for a Sustainable Future*. Early on, The Council of Ministers of Education, Canada (CMEC) assumed a leading role in the implementation of ESD activities; aligning with international efforts.⁵⁰ It has also done much to ensure that sustainability and/or environmental awareness is infused across the curriculum from Kindergarten-to Grade 12 and in faculties of education.

In 1992 Colleges and Institutes Canada (CICan, known then as ACCC), collaborated on the development of the *Green Guide: A User's Guide to Sustainable Development for Canadian Colleges*, a joint publication with the National Round Table on the Environment and the Economy (f.1988). In 1998, the student-led Sustainable Campuses project of the Sierra Youth Coalition, was founded, which gave students an on-campus voice and empowered them to fully engage in campus reform and greening strategies. ⁵¹

Post-secondary institutions also began to embrace sustainability in their operations and culture with universities (*The Halifax Declaration* 1991) and colleges and institutes (The *Pan-Canadian Protocol for Sustainability* 2007) developing "whole of institution" voluntary protocols. More recently, (2012), the *Sustainability and Education Policy Network* (SEPN), was established as a national network of researchers and organizations advancing sustainability in education policy and practice in colleges, institutes and universities; examining pan-Canadian commonalities, as well as regional distinctions in institutional approaches to sustainability. The Network is

⁴⁸ UNESCO (2013) Proposed Global Action Programme on Education for Sustainable Development, 1

⁴⁹ http://unesdoc.unesco.org/images/0023/002305/230514e.pdf

⁵⁰ Council of Ministers of Education, Canada (2012) Education for Sustainable Development in Canadian Faculties of Education, 1. http://www.cmec.ca/publications/lists/publications/attachments/279/esd_dean_reporten.pdf

⁵¹ The organization also collaborated with provincial-level organizations in BC and Quebec. <u>http://www.syc-cjs.org/sustainable-campuses/</u>.

a partnership between Canadian and international researchers and leading Canadian and North American policy and educational organizations.⁵²

Responding to the ESD agenda and the greening of the economy has not been easy for colleges and institutes. Over the last ten years the landscape has been particularly challenging and difficult to negotiate, in part because of the fragmentation of initiatives. In early 2015, the author observed:

There is no single, federal government agency tasked with either the leadership of, or accountability for, the greening of the economy. Sustainability is a cross-sectoral issue, and is being applied broadly to all areas of government, society and the economy. There are currently no, national strategies for green jobs, [or] green skills although these may exist at the provincial level. Leadership on climate change and mitigation has mostly been assumed by the provinces. Most municipalities are making integrated sustainability planning a priority, as well as cutting greenhouse gas emissions and seeking energy efficiencies/alternatives. Data collection and metrics related to the scope, scale and growth of the green economy, as well as Green House Gas Emissions (GHG), rests with no single level of government. Projections of pan-Canadian human resource needs for a greening economy are largely diffused. Provincial and/or federal policy initiatives have periodically stimulated job creation in areas associated with the greening economy, such as research, development and commercialization in the clean technology industries, Feed in Tariff programs, or subsidies for energy conservation and building retrofits.⁵³

Despite these challenges—or in part because of them—colleges have, of their own volition chosen to assume a leadership role. They have "greened" their campus operations, programs and curriculum, engaged with local, regional, and international communities and partnered with industry and small-to-medium-sized business (SMEs) on greening initiatives. They have sometimes taken financial risks, investing in first generation technologies, such as renewables. As **Section 5.2** amply demonstrates, Canadian colleges and institutes have significant capacity in these areas. But they also bring something more: they sustain institutional cultures that are particularly well aligned with the social and cultural aspects of the SDGs.

Colleges and institutes have *chosen* to make sustainability an important part of how they see themselves and how they are seen. It has become embedded in institutional culture. The change agents in that process are positioned at all levels within the organization. Change has been student-driven (e.g. Sierra Youth Coalition);⁵⁴ and faculty-driven (through disciplinespecific networking as well as approaches to changing teaching and learning strategies). It has

⁵² Web site: <u>http://sepn.ca/the-project/</u>

⁵³ H. Knibb. (2015) *The Systematic Design of Green Skills in Canada's Colleges.* Background paper to the APEC project: *Systematic Design of Green Skills Development in TVET* (2014-15).

⁵⁴ The *Sierra Youth Coalition* coordinates the national *Sustainable Campuses* project http://www.climatenetwork.org/profile/member/sierra-youth-coalition-syc.

been demonstrated at the leadership level, as manifested in changing academic and operational policies across multiple colleges, and as stimulated by the 2007 CICan *Pan-Canadian Protocol for Sustainability*, and in response to sector, industry or community needs.

4.1 THE ROLE OF CANADA'S COLLEGES & INSTITUTES IN PROMOTING ESD INTERNATIONALLY

Some colleges and institutes have also made available their accumulated experience in GTVET available to TVET partners in developing countries as part of international cooperation projects; these experiences, in turn, have provided beneficial learning opportunities for Canadian institutions. Information collected from the various institutions that responded to the questionnaire circulated as part of the primary research that informed this report, shows that many colleges, institutes and CEGEPs are engaged in international education cooperation projects in which environmental sustainability is a significant point of focus of the activities. In some cases, this has been through Colleges and Institutes Canada's *Education for Employment* (EFE) projects in Africa, Latin America and the Caribbean, where Canadian institutions develop partnerships with local institutions in developing countries to share their expertise, with TVET reform as a main programmatic objective.

There is, as best as can be ascertained, no research *systematically* documenting the *international* knowledge transfer activities of Canada's post-secondary institutions with respect to the environment, ESD and green skills. Case examples of CICan member colleges and institutes' activities appear in section 5.2 of this report and are addressed in this section. These should not, however, be interpreted as an accurate representation of the breadth and depth of the international ESD activities of Canada's colleges and institutes. However, the case examples provided below illustrate the idea that there already exist mechanisms to convey Canadian ESD and GTVET expertise from Canadian colleges to the international development context. Furthermore, the cases described below match up well with the sorts of GTVET and ESD strengths discussed in this report.

International ESD Activities of Canadian Colleges and Institutes

Internationalization is a growing organizational priority for colleges and institutes across Canada. As with other post-secondary institutions, colleges and institutes are increasingly reliant on the recruitment of international students, and are active in numerous countries in developing partnerships and promotional campaigns to interest students in pursuing their studies in Canada. At the same time, these same institutions see the development of international linkages not only in terms of potential revenue, but increasingly as a vital means to expose both students and faculty to applied education opportunities in different contexts. Various forms of study abroad (overseas internships, study visits, semesters abroad, etc.) are popular with students and actively supported by many colleges. Many colleges have been involved in international development projects as TVET experts sharing knowledge and contributing to building the capacity of education systems. Data on the international activities of colleges is not systematically collected, and it is not known how many are (or have been) involved in international development projects, and how many of these are related directly or indirectly to the environment, sustainability, or climate change. However, a brief examination of some examples, presented in **Table 1** is instructive in demonstrating the core college strengths underpinning these projects.

Partner Country	Canadian College	Project or Activity	Key College Competency
Mexico	Dawson	Participatory research project with various Mexican PSE institutions to "support the establishment of sustainable campuses" ⁵⁵ , including curriculum and research projects, community initiatives, and greening of institutional operations; supported by IDRC and SSHRC in different phases.	 Campus sustainability initiatives Integration of sustainability into curricula, teaching Student and community engagement
Egypt	Camosun & Seneca	Partners with the AKDN ⁵⁶ Aswan Skills Development Program to "help train electrical instructors in competency-based education; and developing electrical training modules, including specialty components to meet the needs of the burgeoning solar energy industry in southern Egypt."	 Green technical skills Renewable energy technology programs Competency-based education, instructor training
Senegal	Cégep de Sherbrooke	Moulins du solei/ ⁵⁷ project installing solar- powered milling equipment and water treatment systems in two villages, and developing local capacity to replicate the technologies; includes internships for the Cégep students.	 Mechanical engineering and industrial maintenance Applied research Student or faculty led initiative
Tanzania	Nova Scotia Community College	The <i>Mikumi Solar Project</i> ⁵⁸ involves 2 nd year students of various technical disciplines to collaborate with faculty and staff at a Tanzanian VET institution to set up solar power supply systems and "research and develop a locally appropriate demand side management plan to foster the wise use of energy to reduce demand"; includes development of technical curriculum modules, entrepreneurship training and soft skills.	 Applied research Green technical skills Renewable energy

Table 1. Canadian Colleges or Institutes Involved in International ESD Work

⁵⁵ The project is extensively documented here: https://www.dawsoncollege.qc.ca/sustainable-campuses/aboutus/.

⁵⁶ Aga Khan Development Network. See: http://camosun.ca/international/programs/international-projects.html/

⁵⁷ https://www.lojiq.org/actualites/actualite/article/oqmj-les-moulins-du-soleil-un-projet-engage-et-qualifiantpour-des-etudiants-du-cegep-de-she/.

⁵⁸ http://international.nscc.ca/wp-content/uploads/2013/08/Student-Application-and-Info-package-Mikumi-Tanzania-Solar-Project-2014.pdf.

Partner Country	Canadian College	Project or Activity	Key College Competency
Nicaragua	Cégep régional de Lanaudière à Joliette	Students in the horticulture and environment program participate in an ongoing project in rural Nicaragua to support artisanal production based on local medicinal plants and other products. ⁵⁹	Green technical skillsStudent engagement

The selected examples presented in Figure 1 above help to demonstrate how core competencies or capacities of Canadian colleges and institutes are brought to bear on cooperation projects with developing countries. These core competencies (extensively detailed in Section 5.2 below) combine *generic strengths* in applied education and training with specializations in domains related to environmental and sustainability education. Of the latter type, the examples above represent a small fraction of the various *technical* disciplines and skills areas in which Canadian colleges and institutes have developed significant expertise. Renewable energy technology (e.g., solar and wind power generation) will strike most readers as a recognizable example of green technical skills. Canadian institutions are also involved in projects where a "whole of institution" approach is the basis of cooperation projects with counterparts in developing countries. This includes efforts at integrating sustainability concepts and competencies into TVET curricula and teacher training programs; and it includes initiatives where Canadian experience with "green campus" approaches are shared with partners in developing countries.

CICAN's Education for Employment (EFE) Approach

Colleges and Institutes Canada (CICan) has been an active international development partner, working in Africa, Latin America and the Caribbean through its *Education for Employment* (EFE) projects to build demand-driven and competency-based TVET systems that can better address key economic development objectives, such as poverty-reduction and employment. The defining feature of these projects is the use of technical partnerships between Canadian colleges and institutes and TVET institutions in developing countries; these partnerships facilitate knowledge sharing for TVET reform in areas such as curriculum development, teacher training, educational leadership and management, labour market information, private sector engagement and others.

Funded for the most part by the Government of Canada (Global Affairs Canada, or the former Canadian International Development Agency), CICan's EFE projects incorporate environmental sustainability as a cross-cutting theme informing all development activities in partner countries. All such cooperation projects draw from the expertise of Canadian colleges and institutes. The expertise applied is varied and covers a number of different fields and functions within TVET, including:

⁵⁹ http://www.presse-lanaudiere.ca/2016/04/voyage-pedagogique-nicaragua-enrichissant-etudiants-cegep-regional-de-lanaudiere-a-joliette/.

- Working with local TVET partners to develop environment- or sustainability-focused academic programs, curricula and qualifications, e.g., renewable energy technology;
- Sharing approaches to integrating sustainability as a transversal theme across TVET curricula, teacher training programs and vocational qualification frameworks in partner countries;
- Various "green campus" activities to help TVET schools in developing countries develop institutional sustainability practices and culture (often as demonstration or "living laboratory" projects involving students)
- Working to develop applied research projects (involving students) to address environmental issues, e.g., improving extraction processes in artisanal mining.

Table 2 below provides an overview of the types of EFE projects. Like the cases presented in the preceding section, Canadian colleges and institutes leading the technical cooperation projects under EFE projects apply their experience in technical disciplines related to the environment, renewable energy and sustainable development to their collaboration with TVET partners in developing countries to integrate sustainability thinking into curriculum design, create technical programs in green skills areas, develop vocational qualifications and train teachers. Within the EFE approach, these activities are carried out under broader program objectives of working with partners in developing countries to develop capacity in education systems.

Partner Country	Areas of Capacity Building Cooperation related to Sustainability	Canadian Institution
Barbados, St. Vincent & the Grenadines (CARICOM)	 Development of Renewable Energy and Energy Conservation program and associated National Vocational Qualifications 	Sault College
Belize, Suriname (CARICOM)	 Development of Renewable Energy & Efficiency Technology program and Caribbean Vocational Qualification 	Lakeland College
Bolivia	 Integration of environmental sustainability principles in agriculture and industrial mechanics TVET curricula and teacher training programs Development of institutional sustainable development policies (agriculture) 	College of the Rockies Niagara College Cégep de Trois- Rivières
Colombia	 Application of clean technologies and environmental recovery process for gold mining 	Cégep de Abitibi- Témiscamingue Cégep de Sherbrooke

Table 2Environmental Sustainability in Selected Current or Recent CICan Education
for Employment Projects 60

⁶⁰ Internal project documentation provided by Colleges and Institutes Canada.

Partner Country	Areas of Capacity Building Cooperation related to Sustainability	Canadian Institution
Dominica, St. Lucia (CARICOM)	 Development of an Agri-business Entrepreneurship program integrating environmental sustainability 	Dalhousie Univ. Agricultural College
Grenada, Dominica (CARICOM)	 Development of a training program in Environmental Sustainability Practices and corresponding Caribbean vocational qualifications; 	Canadore College Cégep de la Gaspésie et des Iles
Guyana, Suriname (CARICOM)	 Development of Environmental Stewardship Program Establishing Campus Green Teams 	Marine Institute of Memorial Univ.
Jamaica, St. Kitts & Nevis (CARICOM)	 Development of Renewable Energy & Efficiency Technology program and Caribbean Vocational Qualification 	St. Lawrence College
Jamaica, Trinidad and Tobago (CARICOM)	 Development of an Associate Degree program in Logistics Management, integrating sustainability in Supply Chain Management curriculum Supported development of campus green teams and sustainability committees 	Niagara College Marine Institute of Memorial Univ.
Peru	 Development of a national "Green Seal" system for participating TVET centres in Peru Establishment of environmental "good practices" micro labs. 	Centennial College Cégep Saint-Jean- sur-Richelieu Cégep Édouard- Montpetit Nova Scotia Community College Niagara College Conestoga College
Senegal	 Support for local reforestation initiatives, recycling, green space development, water conservation, sustainable agriculture in partnership with partner TVET institutions Development of renewable energy teaching student projects Student project to develop mercury recovery techniques associated with gold mining. 	Various
Suriname (CARICOM)	 Development of a Geriatric Nursing Program and Caribbean Vocational Qualifications 	Selkirk College

Partner Country	Areas of Capacity Building Cooperation related to Sustainability	Canadian Institution
	 Integration of sustainability and community issues into curriculum, including waste reduction, environmental hazards 	
Tanzania	 Embedding of environmental sustainability principles into all TVET curricula and teaching/learning materials developed in partnership with Tanzanian institutions Development of environmental sustainability toolkits 	Various

These institutions ally their expertise in environmental and sustainability education with several core competencies characteristic of Canada's colleges and institutes. In the context of international development cooperation, these institutions draw on strengths such as:

- Responding and adapting well to evolving labour market demand
- Addressing accessibility for excluded or vulnerable populations (e.g., women in nontraditional occupations, Aboriginal people, immigrants)
- Effective engagement of employers to create better transitions to the labour market
- Applied research and innovation of either a technical or community-based nature to develop solutions locally
- Developing student-centred approaches to skills development
- Developing education programs and supports to accommodate the needs of various learners (e.g., literacy, essential skills, second-language training, recognition of prior learning).⁶¹

These competencies are well suited to international cooperation projects that need to respond effectively to local and community needs while collaborating with local partners to build lasting capacity in education systems. In the context of addressing climate change adaptation and mitigation and green growth through ESD and GTVET, these same core competencies may be particularly effective. The literature reviewed during this study strongly suggests that there is little documented evidence on effective approaches to GTVET in the developing world. This may be a result of poor coordination of policies regarding the environment and those regarding labour market development. It also seems likely that many of the mechanisms needed to coordinate policy and programs and conduct research and evaluation await critical decision-making at the international and national level with respect to the mechanisms and funding needed to implement climate change mitigation and adaptation strategies and make progress on the 2030 SDGs.

⁶¹ These observations are derived primarily from Asian Development Bank (2015), *The Role of Community Colleges in Skills Development: Lessons from the Canadian Experience for Developing Asia*, pp. 12-16.

5 A FRAMEWORK FOR UNDERSTANDING ESD AND GTVET POLICIES, PROGRAMS AND PRACTICES

The discussion is developed around two frameworks. The first, a "three tier approach to greening skills," illustrating roles and accountabilities at the institutional, national and global levels, was devised by Shyamal Majumdar, Head of the UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training (see Figure 2). It provides a context for the second framework (see Figure 3), also developed by Majumdar, focusing at the institutional level on the "whole institution" approach to greening. This second framework is an especially important tool to describe the capabilities of Canadian TVET institutions.

Figure 2. UNESCO-UNEVOC's Three-tier Approach to Greening Skills⁶²

Institutional Level	 Institutional transformation (e.g. practice, frameworks) A 'whole of institution' approach Strengthening local initiatives Developing capacity 	
National and/or Provincial Level	 Coherent and co-ordinated policies for green growth A national sustainable development strategy Strengthening partnerships between stakeholders 	Strategic Strands for Action
Global Level	 Sharing evidence-based policies and practice Facilitating interagency co-operation Supporting capacity-building and research 	

5.1 ASSESSMENT OF POLICY RECOMMENDATIONS FOR PROMOTING ESD AND GTVET

Globally, policy initiatives have been criticized for their failure to effectively integrate and promote the role of TVET in areas such as the green economy and environment. This includes an apparent lack of coherence, failure to recognize and build on work that has gone before, and strategies that are not cross- sectoral.

International reports from 2009 onwards that look at policy and practice in different countries promote a need for "systematic policy perspectives"⁶³ including "joined-up" policy or "whole of government" approaches; "strategic & collaborative approaches to green economy learning," and "an enabling policy framework."⁶⁴ There is a need for effective policy integration and co-

⁶² Adapted from S. Majumdar (2010), and referenced in UNESCO-UNEVOC (2015) *Skills for Work and Life*, 46.

⁶³ Cedefop (2015) Green skills and innovation for inclusive growth, 82-97.

www.cedefop.europa.eu/files/3069_en.pd

⁶⁴ "IGE learning should be fully integrated to a strategic and collaborative governance approach and enabling policy framework."." PAGE (2015) *First Global Forum on Green Economy Learning, 4...*

http://www.un-page.org/files/public/paris_summary_statement_ige_learning.pdf

ordination not uncertainty and fragmentation⁶⁵. TVET appears not to have been well integrated into national sustainability strategies and programs, and environmental and vocational training policies, in particular, are often not harmonized.⁶⁶ Labour market intelligence (LMI) and job forecasting around green skills and the Inclusive Green Economy is weak in most, if not all, jurisdictions⁶⁷. In Canada, the greening of sectors is uneven, as is the level of activity of national sector councils, and cross-sectoral dialogue around green skills, although ECO Canada, sector council for the environment, has taken a significant leadership role in this regard. Its work includes early, if not ground-breaking, publications on the green economy,⁶⁸ as well as work around the 'sustainability sub-sector'. Colleges and institutes, caught between being too far ahead of market needs, or too far behind, need more informed and current LMI, occupational profiles and career trajectories across all sectors to better respond to upskilling or re-skilling requirements, transition existing programs, and invest appropriately.

For example, the early phase of skill development for the renewable energy sector challenged colleges and institutes in designing the right type of program, at the right skill level (often a higher level than first assumed), and finding the appropriate faculty expertise as well as program resources. A Cedefop study of 2013 noted that "time-lags between initial training and the eventual work placement, mean that decisions over TVET design often need to be made in advance of market needs to support low-carbon development, which may caution against the development of more highly-specialized courses."⁶⁹ Given that jobs in the emergent IGE are considered to require middle-skilling, (beyond high school graduate, but not necessarily undergraduate degree level), there are opportunities for colleges and institutes, if dependable and timely LMI is forthcoming.

A further "systems" concern at the institutional level is that credentials and qualifications frameworks be adapted to accommodate the changing vocational profiles of the inclusive green economy. Use of outcomes-based curriculum, program evaluation and monitoring, and quality assurance processes are directly related. These can help leverage improved academic pathways and curriculum transfer between institutions, and across sectors and jurisdictions, as well as promoting workplace mobility.

⁶⁵ OECD-Cedefop (2014) Greener skills and jobs, 13. https://biobs.jrc.ec.europa.eu/sites/default/files/generated/files/policy/OECD%20CEDEFOP%202014%20Report %20Greener%20Skills%20and%20Jobs.pdf

⁶⁶ GIZ (2013) *TVET for a green economy*, 10.

⁶⁷ 'Reliable data collection with respect to green skills needs is a considerable global challenge.' GIZ (2013) *TVET for a green economy, 10.* http://www.enterprise-development.org/wp-content/uploads/TVET_Green_Economy.pdf

⁶⁸ ECO Canada (2010) Defining the Green Economy http://www.eco.ca/reports/defining-the-green-economy-2010/ and (2012) The Green Jobs Map: Tracking Employment through Canada's Green Economy http://www.eco.ca/reports/the-green-jobs-map-series/

⁶⁹ Cedefop, 2013, *Skills for a low carbon economy*, 69.
5.2 BUILDING AT THE INSTITUTIONAL LEVEL: CANADIAN COLLEGE AND INSTITUTE CAPABILITIES

While there is no single, pan-Canadian college system, there are institutional commonalities in practices, processes and core business. Colleges have become adept at modifying or transforming these processes to introduce a greener, or more sustainable approach. This is the lens through which this section is developed – an examination of what colleges already do well and what the application could be in the context of transforming TVET in developing countries.

Canadian institutions have not had the leadership of a dedicated organization such as the Association for the Advancement of Sustainability in Higher Education (AASHE) which has a substantive North American, as well as international membership base, a rich program of activities and publications and extensive opportunities for networking. Nor have there been the kinds of incentives and funding programs that would help stimulate the institutional change process. Unlike Technical and Further Education (TAFE) in Australia, or higher education in the UK, there has been no systems-wide or systematic approach to the greening of curriculum and the introduction of ESD. There has been no independent research body such as that of Cedefop in the European Union. The UN Decade of Education for Sustainable Development provided impetus, but the education resources were not the best alignment with Canadian post-secondary curriculum.

It is not clear the extent to which the early college sustainability agenda was driven by management, faculty, staff or students, although today, it can certainly be said that the entire college community is engaged. The ACCC Sustainability Protocol, (2007), a voluntary initiative, and one competing with other higher profile protocols such as the Talloires Declaration, probably helped start conversations at the senior management level. As with many institutional initiatives there are always 'early adapters' whose practice influenced others. Institutional strengths in environmental programs helped provide foundation curriculum and an early program strength and focus on environmental sustainability.

Majumdar's (2010) *Five Dimensions of Greening TVET⁷⁰* (Figure 3) framework is used here to describe the capabilities of Canada's colleges and institutes. In their original conception, these dimensions are to some extent siloed; in the Canadian context, and likely others, they are of course interdependent and interconnected, even though these capabilities might evolve at the same rate.

⁷⁰ S. Majumdar (2010) Developing a Greening TVET Framework, 7. http://www.unevoc.unesco.org/fileadmin/user_upload/docs/Greening_TVET_Framework-Bonn-Final_Draft.pdf

Green	Green	Green	Green	Green
Campus	Curriculum	Community	Research	Culture
Managing	Integrating ESD	Adapting	Fostering	Promoting culture
Campus	in curriculum	community	research	
 energy management water management waste management pollution management 	 green technology clean technology green jobs greening existing jobs 	 capacity building renewable technology resource support unique practices 	 renewable energy water treatment green innovations waste recycling 	 green values green attitude green ethics green practices

Table 3. UNESCO-UNEVOC'S 5 DIMENSIONS OF Greening IVE I	Table 3.	UNESCO-U	NEVOC's 5	Dimensions	of Greening	TVET 71
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"Whole-institution approaches" are one of the priority areas identified by UNESCO in the *Clobal Action Programme for Education for Sustainable Development*, 2014⁷². They are considered "key leverage points" in the ESD agenda and "require not only the reorientation of teaching content and methodology, but also campus and facility management that is in line with sustainable development as well as the cooperation of the institution with sustainable development stakeholders in the community."⁷³

Figure 4 below summarizes some of the major program or policy elements associated with each of the 5 dimensions or pillars; these in turn suggest several indicators to assess progress in each of the five areas. The dimensions and indicators ought to be more complete and better defined based on more systematic reviews of GVET practices, programs and policies in different countries. Nevertheless, with a few minor variants this framework is useful for examining the Canadian experience. There are other far more substantive and elaborate indicator frameworks such as AAHSE's 'STARS' self-study, but at the high level and for the purposes of positioning the greening of Canada's colleges in a pan-Canadian context, this model works well. It has been further expanded in this study to include essential organizational infrastructure, that is, the common college practices and operations that underpin new sustainability initiatives or, in themselves are becoming progressively 'greener'.

⁷¹ S. Majumdar (2010), *Developing a Greening TVET Framework*, 7.

⁷² UNESCO (2013) Proposal for a *Global Action Programme*, 3.

⁷³ Ibid, 3.

Green Campus	Green Curriculum	Green Community	Green Research	Green Culture
Green policy and objectives	Green programs and courses	Green practices at community level	Research programs in SD	Values and practices
Resource management	Green practices in classroom and lab	Community participation	Impact and outcome	Participation and involvement
Management systems in M & E	Industry-institute interaction	Innovative programs and projects	Management and monitoring	Innovative programs

Table 4. Five Elements & Indicators of Greening TVET⁷⁴

Canada's colleges, institutes and Cégeps institutions possess considerable capabilities across all five areas, although each institution finds itself at a somewhat different place on the sustainability continuum. For TVET institutions in developing countries, development may occur more unevenly, probably initially in the area of green curriculum.

The dimensions are explored in the table that follows, in the context first, of the areas of activity, recommendations and practices being proposed as critical to the transformation of TVET to GVET and based on an analysis of the recent literature, and second in the context of the work of Canadian colleges and institutes both on campus, within their regional communities, and as part of the global community through international projects that extend these functionalities.

In describing institutional practices, the focus is on the ways in which core operations and practices have been modified to a more sustainable or greener approach. Examples have been selected from colleges, institutes and cégeps across Canada. This is not an exhaustive inventory. Rather, it shows broad areas of college strength, breadth and depth in a pan-Canadian context and showcases regionally specific projects that might be scalable and transferable.

What is not evident here are the differences between colleges in terms of their starting point, chronological development, how they embraced and developed these change strategies as a college community, and how they sustain their progress and re-energize. The discussion section included under each of the five pillars provides a high-level summary of some of the key discussion threads emerging in the literature. CICan's (formerly ACCC) 2007 Sustainability Protocol, a voluntary initiative that competed with other higher profile protocols such as the Talloires Declaration,⁷⁵ probably helped to start conversations at the senior management level in many colleges and institutes.

⁷⁴ S. Majumdar (2010) Developing a Greening TVET Framework, 9.

⁷⁵ See URL http://www.ulsf.org/programs_talloires.html.

5.2.1 Green Campus

"Transforming learning and training environments" is considered a priority action area in the UNESCO *Roadmap for Implementing the Clobal Action Programme on Education for Sustainable Development.*⁷⁶ Whereas Majumdar focusses on the Green Campus in an operational context with an emphasis on facilities management and reducing 'the carbon footprint of the institution,'⁷⁷ Canadian institutions have, over time, taken a more holistic and expanded view, developing projects that engage faculty, students and community in both the greening of buildings and infrastructure, its operations and all aspects of 'college life.' The examples in **Table 5** illustrate the type, scope, and depth of activity across Canada's colleges and institutions are engaged.

Canadian colleges and institutes can offer enormous depth and breadth of experience in supporting green campus initiatives in all areas from planning, to construction, to transportation. There are good examples of 'whole of campus' greening, in which all policies and practices are greener. Several institutions are now in their second iteration of a sustainability plan and many already have, or are setting, targets to monitor and reduce GHG emissions.

⁷⁶ UNESCO (2014) Roadmap for Implementing the Global Action Programme on Education for Sustainable Development, 18.

⁷⁷ UNEVOC (2015) *Skills for Work and Life*, 42.

Table 5. Green Campus: Core College Functions and Canadian Examples

Green Campus Area	Examples of Greening of Core College Functions	Selected Cases
Construction	Selecting and showcasing new green building technologies and design (living laboratory). Using green building certification such as Leadership in Energy and Environmental Design (LEED) to demonstrate commitment to the highest standards of sustainable design and construction.	 Integration of Energy Renewables <i>Niagara, Fleming, Durham, Nova Scotia,</i> etc., have integrated green technologies such as solar panels, geothermal heat pumps, wind turbines, rainwater capture, grey water systems, water and energy conservation technologies, and carbon neutral construction materials and methods in college buildings and/or renovations. <i>Northern, Lambton, Fanshawe, Fleming (Lindsay), & Humber</i> have extensive green roofs and/or living walls, some of which are maintained by students. <i>Red River College</i> pioneered the largest building-integrated photovoltaic (BIPV) array in Canada.
	Pursuing green retrofits of ageing college infrastructure. Positioning as community leaders and early adapters of sustainable construction methods; serving as case studies for broader public engagement and assessment of emergent greener technologies.	St Lawrence, Aurora, & Yukon colleges and Cégep de la Gaspé et des Iles, installed wind turbines for energy production and technical training. LEED Certified Buildings Humber's Learning Resource Centre (silver); Algonquin's Centre for Construction Excellence (platinum); George Brown's Daphne Cockwell Centre for Health Sciences at the Waterfront Campus (gold), and; NSCC's Centre for the Built Environment, a living lab to educate students in trades and technology in balancing the natural environment with the built environment (gold).
Operations	Initiating changes in policy and practice, in order to manage: college infrastructure, energy, waste, water, food services, transportation, resources, procurement, technology deployment, grounds-keeping,	Sustainability Offices Niagara, Fleming, Durham Colleges and others: There are numerous examples of successful staffing/ leadership models to promote sustainable practices across all academic and operational areas. Food Services and Food Production

Green Campus Area	Examples of Greening of Core College Functions	Selected Cases
	etc., through the sustainability lens. Voluntary management and reduction of campus	<i>Fleming and Durham</i> : college food service providers purchase sustainably grown local food, including that from student farms and gardens.
		<i>Seneca</i> : permaculture (garden/apiary) project on suburban, unproductive, land inspired by visiting "Science Without Borders" students from Brazil.
	Greenhouse Gas Emissions (GHGs)	Green Procurement
	Sustainability initiatives supported through various	<i>Humber, Fleming, St. Lawrence</i> : green procurement strategies reflected in purchasing policies.
	staffing models such as a centralized Office of	Transportation
	Sustainability, management	Humber: alternate transportation strategies and 2016 'Smart Commute' gold award.
	roles or faculty release time. Development of a corporate business case for sustainability.	<i>St Lawrence</i> : integrated sustainable transportation initiatives including solar e-bike and vehicle recharging stations, and transit pass programs for students and
		employees.
		<i>Niagara:</i> a sustainable transportation strategy that includes active transportation, ride sharing, carpooling, car sharing, parking management and public transportation. ⁷⁸
		<i>Cégep Garneau</i> : developing a sustainable commuting strategy that will align with the municipal sustainable transportation plan.
		Waste Management and Housekeeping
		Numerous initiatives across many colleges including expanding recycling programmes, managing food waste and composting; changing campus housekeeping processes and products to green.
		Greenhouse Gas Emissions (GHG):

 $^{^{\}rm 78}$ Funded by TD Friends of the Environment Foundation.

Green Campus Area	Examples of Greening of Core College Functions	Selected Cases
		<i>St Lawrence</i> : multi-year facility greenhouse gas (GHG) emission inventories for the years 2010- 2014 across all campuses resulting in a 10% reduction in GHG emissions. Project to be extended to commuter and college travel.
		<i>Algonquin</i> : attaining carbon neutrality as a goal of the college 2017-2022 Strategic Plan; integrated energy partnership with Siemens (energy efficiency, electricity cogeneration, new technologies).
		<i>Canadore</i> . Five year energy conservation and demand management program 2014-2018.
		George Brown: 2014 - 19 Energy Conservation and Demand Management Plan.
		<i>Niagara:</i> Sustainability metrics and progress in use/reduction of water, electricity, paper, waste diversion, GHGs measured/monitored over last 5 years.
		<i>Cégep de Sherbrooke</i> was the first organization in any sector to receive the Canadian Standards Association's (CSA) Registered Carbon Neutral™ program certification.
Student Engagement	Engaging students in green campus initiatives and monitoring of sustainability practices, through	Student activism Student 'green teams'; voluntary signing of individual commitments (green pledges, green flags) to sustainable lifestyles (Durham, Fleming, St Lawrence, George Brown, etc.)
	organizations such as the Canadian Sierra Youth Coalition, or campus groups.	Student participation <i>St Lawrence: Footprint – Sustainability Hub</i> Outreach and engagement of staff, faculty and students in sustainability. <i>St Lawrence:</i> Enactus – faculty-mentored student-led research project converting coffee grounds to stove burning pellets
		<i>Cégep Garneau:</i> The Cégep's student-led École Entreprise (student business incubator) works with the school's Green Front committee and Bistro Garneau on student-run food waste reduction strategies.

Green Campus Area	Examples of Greening of Core College Functions	Selected Cases
Campus as Learning Laboratory	Using campus operations and infrastructure for green demonstration projects, faculty development and collaboration, community engagement, applied learning & research projects, across all programs and activities.	<i>Algonquin-Siemens</i> partnership - college as "living lab" of Siemens' leading edge green technologies.
		<i>George Brown</i> : encouraging 'inter-professional approaches to applied research, education, policy formation and information exchange on sustainability issues, including development of opportunities for transforming the college's campuses into learning laboratories for demonstration of sustainable technologies (Sustainability Guidelines). ⁷⁹
		<i>Niagara</i> 'driving a horizontally and vertically-integrated culture of sustainability that goes beyond operationsto create living laboratories for student, employee and community learning.'
		<i>Fleming</i> : In the 'Managing Technical Projects' course, skilled trades students design on-campus sustainability projects (e.g.: rain water catchment, roof gardens, a transit app and an interior LED lighting plan).
		<i>Durham</i> : a broad-based Sustainability Committee supports operations, planning, innovation, curriculum, stakeholder engagement. It includes between 20-30 employees and students. Initiatives include a "staff ambassador program."
Knowledge Exchange	Engaging with other colleges in sharing and disseminating promising practices through North American sustainability networks such as Cégep Vert du Quebec, the Atlantic Universities and Colleges Sustainability Network, CICan, and AASHE	There are numerous examples of formal and informal networking. One example of an international exchange is <i>Dawson</i> College, <i>QC</i> , engaged in sustainable campuses research in collaboration with several teaching universities in Mexico. ⁸⁰
		<i>Durham</i> : development of institutional "kits" for CICan <i>Education for Employment</i> international development projects that include a component on sustainability.

 ⁷⁹ http://www.georgebrown.ca/about/sustainability/guidelines/
 ⁸⁰ <u>https://www.dawsoncollege.qc.ca/sustainable/projects/mexico-project/</u>.

5.2.2 Green Curriculum

In the report from the forum *Skills for Work and Life post- 2015*, "Green Curriculum" is described as promoting sustainable development through 'cleaner technology, defining green learning outcomes, integrating ESD across the curriculum, [and] teacher professional development'. ⁸¹ Although there is not a Canadian curriculum development 'model', there are commonalities of practice across Canadian and institutes colleges in approaches to infusing principles of sustainability across the curriculum. Case examples from Canadian institutions appear below in **Table 6**. There is a multiplicity, complexity and interdependencies of academic processes to be accounted for in the process of curriculum greening which are increasingly being identified in the literature as areas of concern.

Labour Market Intelligence (LMI)

'Reliable data collection with respect to green skills needs is a considerable global challenge',⁸² but the impact is also felt at the institutional level. 'Systems for identifying and anticipating skill needs',⁸³ as well as 'comprehensive skills reviews, employment projections, and qualifications mapping'⁸⁴ are vital for program planning, positioning and development. This lack of LMI has been identified as a concern and a limitation for at least 10 years across most jurisdictions.

Skills Development for ESD

Of the specific skills required to better prepare GTVET graduates for work in a warming world, there is still a lack of resources that enable thoughtful implementation as well as gaps in skills identification.

There is acknowledgement of the need for students to have appropriate foundation skills such as 'competences in MINT- mathematics, information technology, natural sciences and technology considered 'preconditions for green economic growth',⁸⁵ and the more common STEM subjects (Science, Technology, Engineering and Maths).

There has been a discernible shift from the identification of 'new' specialist green technical skills, such as those in renewable energy, (and which, for example, characterized the early phase, and first generation of, 'green' technical education programs circa 2005–2012), to the transitioning and greening of *all* skills regardless of sector. There is also a more complex mix of different skill types. This includes technical skill development; generic 'skills for sustainability', (change agent or essential work place skills), as well as education/learning for

⁸¹ UNEVOC (2015) Skills for Work and Life post- 2015, 42.

⁸² BMZ-GIZ (2013) TVET for a green economy, 10.

⁸³ See, amongst other sources: ILO (2011) Research Brief. Anticipating skills needs for the low carbon economy? Difficult but not impossible. URL: <u>http://www.ilo.org/wcmsp5/groups/public/---ed_emp/---</u> ifp_skills/documents/publication/wcms_168352.pdf; IWG for G20 (2013) Meeting skill needs for green jobs, 5.

⁸⁴ Cedefop (2013) *Skills for a low carbon Europe*, 11.

⁸⁵ BMZ-GIZ (2013) TVET for a Green Economy, 2013, 10.

sustainable development, (changing habits of minds and behaviour), related to sustainable lifestyles and consumerism.

Appendix D provides a more detailed analysis of these skill types and a typology for their use in curriculum design and modification. A consideration in this emergent skills mix is the integration of Traditional Indigenous Knowledge. This may include traditional technologies as well as beliefs, values, and histories that shape and form practice.

In 2015, UNESCO-UNEVOC described a concept for a comprehensive *green core skills framework* of 'generic skills, key competencies, inter- and intra-personal skills, upskilling of existing skills, and specific skills related to new green occupations.'⁸⁶

The available literature occasionally suggests the specific skills or skill sets that require development by TVET systems. In *TVET for a Green Economy* (2013), broad-based technical skills that apply to *all* occupations and are infused *across* the curriculum were identified.' This includes 'knowledge, skills and abilities in the context of energy and resource efficiency, avoiding waste and waste management, knowing about the potential environmental impact of a respective occupational activity,' as well as risk avoidance and the ability and willingness to 'take responsibility for one's own actions' within the workplace context.⁸⁷

Overall, however, there appears to be little direction on skills development post-2015 addressed to specific challenges such as climate change mitigation, and adaptation or building community resilience, despite the apparent sense of urgency. Although there may be few "new" technical skills, it is the *skills mix* that may be the most challenging for design and implementation in training and professional programs.

Generic skills (also known as transversal skills in the TVET literature) have become increasingly important. In 2011, Cedefop identified 'leadership, adaptability, environmental awareness, holistic and interdisciplinary approaches, systems and risk analysis, entrepreneurial and innovations skills, communications and negotiation skills' as critical.⁸⁸ Generic skills are considered now to 'hold equal importance as specific skills for the green economy.^{'89} They are essential in the skill development of a different kind of graduate; one who is adaptable, who has a vested interest in the future of the planet and assumes a different level of responsibility as a change agent and leader; one who is, in effect, 'empowered'.

Canadian colleges and institutes have approached development of this skill mix in different ways. While there are a limited, but significant, number of new specialist green technical programs, (particularly in renewable energy and clean technology), there are a growing

⁸⁶ UNESCO-UNEVOC (2015) *Skills for work and life*, 2015, 47.

⁸⁷ BMZ-GIZ (2013) *TVET for a green economy*, 36.

⁸⁸ Cedefop (2011) *Skills for green jobs a global view*, 107.

⁸⁹ UNEVOC (2013) *Greening TVET: Qualification needs and implementation strategies*, 7.

number of 'greener' programs in traditional disciplines such as business and construction, as well as a general movement towards greening the curriculum across all programs. Curriculum greening may take the form of new, sometimes required institution-wide, learning outcomes; the greening of existing learning outcomes; new courses, such as those in general education covering themes related to sustainable development, or environmental sustainability; the greening of generic or essential employability skills, or a change in teaching and learning methods.

Outcomes-based Curriculum

An outcomes-based approach is essential to the design, implementation, assessment, and credentialing of green skills and quality assurance processes as well as promoting student academic mobility and the sharing of curriculum. It's a vital transition from skills identification, to the ways in which skills are integrated into curriculum. Yet, references to outcomes (as against more task-specific 'competencies') seem to have only recently entered the TVET literature. UNEVOC's *Skills for Work and Life post- 2015,90* references the use of 'green learning outcomes' over 'green skills' and the report *Sustainable Development Post 2015 Begins with Education* notes that 'proof of the economic effect of education would require measures of quality of learning outcomes.'91

Program Design and Development

It is now a general assumption that the number of actual new green skills is limited, that all levels of employment will require 'greening', ('every job a green job'), and thus 'all levels of education will have to be considered' as part of a change process. The challenge for GTVET is building on the skills base in established occupations, ('up-skilling'), and adjusting existing training programs/pathways and qualifications without starting anew.⁹²

This will require new strategies. New jobs for a low carbon economy will increasingly require greater complexity, such as cross-sectoral skill development, and new approaches to program design including interdisciplinarity, (e.g. sustainable agriculture *and* public education, sustainable building construction *and* renewable energy *and* energy efficiency) as well as combinations of social and cultural skills. There is also a need for better understanding of skills obsolescence and 'retiring' older programs.

GTVET providers will need to respond to the needs of life-long learning, upskilling and reskilling of the work force and work-place learning which will require institutional

⁹⁰ UNEVOC (2015) *Skills for Work and Life*, 42.

⁹¹ UNESCO (2014) Sustainable Development - Post 2015 Begins with Education, 7.

⁹² Cedefop (2013) *Skills for a low carbon Europe*, 70.

flexibility,⁹³ and responsive program design, as well as the capacity of faculty to deliver training "tailored to industry and enterprise need."⁹⁴

A concern is GTVET capacity for 'speed to market' and the danger of identifying skills shortages but not being apply to supply skills, particularly high level skills: "[w]here lead times in education are longest, the development of low-carbon technologies and services will be held back."⁹⁵

The greening of program design will also result in new and different academic constructs. Fig #4 illustrates the gradations of change from traditional programs (the past) through the present to a very different future.

Past	Present	Future
 Job specific, or limited in occupational scope 	 Provide entry to Reflect 'occupat technology, health 	emergent, diversifying, or evolving fields ional fusion' e.g. Health Informatics (business, 1)
Job may be terminal; or located on a career path or ladder	Located in a care	er matrix or lattice
Limited workplace mobility	Support vertical	lateral and possibly cross-sectoral mobility
 Skills/knowledge relatively stable 	• Time-sensitive a review	nd/or time-limited skills drive rapid development and
 Based on traditional job classifications 	Not listed in Nat multi-skilling)	ional Occupational Classifications (NOCs) (require
Limited academic mobility (foundation knowledge limited in breadth)	May enable acad foundation knowl energy)	lemic mobility; may require trans-disciplinary edge (e.g. materials science, electrical engineering,
 Programs siloed; single point of entry 	Programs cluster multiple points of	red around hub of common curriculum elements; entry
Meet needs of traditional school-leaver	Meet needs for and re-entry to th	up-skilling', 're-skilling', 'middle skilling' , multi-skilling e workforce
Focus on vocational skills	Require new mix	of generic/sustainability skills
Quality based on reputation	Program aligned	with external standards and QA processes

Table 6	The	Greening	of Academic	Program	Design	96
Table 0.	THE	oreening	OF ACCOUNTING	FIOGIAIII	Design	

Strategies for Teaching and Learning

In order to "reach goals of Sustainable Development and to implement GTVET" it is necessary "to rethink and reorient methodologies for teaching, learning and training" in order to both teach to sustainable development effectively and "change behaviour and attitudes."⁹⁷ In 2011, the UNESCO report *Education for sustainable development: An expert review of processes and learning* noted that: "ESD requires participatory teaching and

⁹³ Cedefop (2013) *Skills for a low carbon Europe*, 13.

⁹⁴ Ibid, 12.

⁹⁵ Ibid, 12.

⁹⁶ H. Knibb (2013) *Presentation on ESD, Fleming College*.

⁹⁷ UNESCO-UNEVOC (2015), Skills for Work and Life, 45.

learning methods like critical thinking, imagining future scenarios and making decisions in a collaborative way in order to empower learners to take action for sustainable development. ESD learning also refers to: learning to ask critical questions; learning to clarify one's own values; learning to envision more positive and sustainable futures; learning to think systemically; learning to respond through applied learning; and, learning to explore the dialectic between tradition and innovation."⁹⁸

The Canadian publication *Connecting the Dots (Learning for a Sustainable Future, 2014),⁹⁹* also builds on these strategies. It is a much needed "systems perspective of learning" to help educators "transform learning experiences to meet the needs of 21st Century learners" and teach to ESD. The interconnected strategies considered essential to 'profound learning' include inquiry, learning locally, acting on learning, integrated learning, real-world connections, sharing responsibility for learning, considering alternative perspectives. Teaching and learning approaches for ESD also need to promote "interdisciplinary, multi-sectoral and multi-level' approaches."¹⁰⁰

This is a demanding agenda, one perhaps not easily aligned with some of the conventions of teaching in technical vocational education in developing countries. Teaching and learning strategies for TVET in developing countries may also take different forms than that of Canadian institutions in order to use educational media that are the most familiar, accessible and with the greatest reach and effect. For example, it is proposed that the CICan EFE Andes-Peru initiative is supported by 'Good Practices Micro Labs," which will be established at each of the eight participating TVET Centres. The goal is to use the often neglected medium of exhibition and interpretation to reach not only students but local SMEs and entrepreneurs in illustrating and contrasting poor practices with improved, environmentally sustainable ones.¹⁰¹

Credentials and Qualifications Frameworks

As "changes in existing occupations far out-number new occupations," ensuring credentials frameworks are flexible, relevant and aligned with the greening of work processes is a particular concern for TVET, where "skills often lag behind job needs."¹⁰² Including sustainable development within existing qualifications frameworks and credentials is "much more effective" than "creating new training standards."¹⁰³ Effective qualifications

- ¹⁰⁰ PAGE (2015) Paris Summary Statement on Learning for an Inclusive Green Economy, 4.
- $http://www.un-page.org/files/public/paris_summary_statement_ige_learning.pdf$
- ¹⁰¹ CICan (n.d.) *EFE Andes Environmental Sustainability Briefing Paper, 4*.

⁹⁸ UNESCO, (2011), Education for sustainable development: An expert review of processes and learning, 8.

⁹⁹ LsF is a Canadian charitable organization founded in 1991 to promote, through education – the knowledge, skills, values, perspectives, and practices essential to a sustainable future: www.lsf-lst.ca.

¹⁰² OECD (2014) *Greener Skills and Jobs*, 91.

¹⁰³ Cedefop (2010) Skills for green jobs, 21.; BMZ (2013) TVET for a Green Economy..

frameworks are key in helping to "ease the process of labour mobility across employment sectors, regions and countries."¹⁰⁴

Majumdar urges a new perspective on qualifications, one in which *both* TVET and its graduates have a transformative role. Rather than being "mere suppliers in the labor supply chain," he urges green institutions to determine the nature, quality and qualifications of its "supplies," in this instance graduates, with the capacity to "influence green development, rather than purely satisfy the economic aspect of labor."¹⁰⁵

Quality Assurance

Quality assurance and monitoring processes are vital and required "to improve the quality of VET delivery and assess the relevance of learning outcomes to the labour market."¹⁰⁶ Institutions are urged to "benchmark against accepted good practices to effectively assess, validate and showcase performance."¹⁰⁷

The extent to which green skills and ESD are integrated into any governmental and internal institutional QA processes in Canada, or elsewhere, is not known, but there are new models emerging. The CICan supported EFE Andes-Peru project, is investigating the possibility of a 'green seal' quality assurance process adapted to higher education, "certifying that participating TVET Centres have created a culture of environmental management related to eco-efficiency, environmental education and good workplace safety practices."¹⁰⁸

Prior Learning Assessment and Recognition

In order to facilitate access and mobility, a "green core skills framework should be integrated into recognition of prior learning processes."¹⁰⁹ This is particularly important in the context of the pervasive need for up-skilling and re-skilling the existing work force, the potential rate of change in some emergent industries (such as solar) and the need to recognize skills transferable from older 'brown' industries to greener industries. Canadian colleges and institutes have for many years been invested in this process as a means of fast tracking program completion and facilitating access to formal learning and credentials to those with rich, informal learning experiences.

Career Guidance and Career Mobility

Facilitating student mobility through strengthening "career guidance on green jobs";¹¹⁰ improved "signposting of career paths" in sustainable energy sectors through the creation

¹⁰⁴ Allais, (2010) in *Skills Development for Inclusive and Sustainable Growth in Developing Asia- Pacific*, 18.

¹⁰⁵ UNESCO-UNEVOC (2010) *Developing a Greening TVET Framework*, 7.

¹⁰⁶ Cedfop (2013) *Skills for a low carbon Europe*, 14.

¹⁰⁷ PAGE (2015) *Report. Global Forum on Green Economy Learning*; UN (2014) *Global Action Plan for Sustainable Development, 4.*

¹⁰⁸ CICan (n.d.) *EFE Andes Environmental Sustainability Briefing Paper*, 4.

¹⁰⁹ UNESCO-UNEVOC (2015) *Skills for Work and Life*, 47.

¹¹⁰ For example: IWG for G20 (2013) *Meeting skill needs for green jobs*, 7.

of "information portals for learners";¹¹¹ and the "development of portable skills throughout life"¹¹² all contribute to occupational mobility, and one would expect to see this increase as labour markets for green skills mature. Given the variables and unknowns of work in a warming world, this may require some very different approaches to conceptualizing career paths (or matrices) that may have an impact on how students are advised, as well as elements such as program design and attitudes towards lifelong, workplace and informal learning.

Teacher Training and Faculty Development

"Building capacities of educators and trainers" is considered a priority action in the UNESCO "Road Map" for implementing UNESCO's Global Action Program on ESD.¹¹³ The shortage of qualified trainers in newly emerging fields, and the need for the integration of ESD into preservice and in-service TVET teacher training is a pervasive theme – as well as how to enable trainers and teachers to "keep skills for green jobs up to date,"¹¹⁴ and ensuring trainers get environmental updates.¹¹⁵ Of equal significance, is the emphasis on strengthening "the capacity of educators, trainers and other change agents to become *learning facilitators* for ESD"¹¹⁶ and the need to "network, develop and research sound pedagogical practice."¹¹⁷

Leadership and ESD

The GAP also urges the integration of sustainable development perspectives (e.g. resource efficiency, and social corporate responsibility) into "post graduate education, capacity building and training of decision-makers."¹¹⁸

Based on the literature review, it could be argued that greening the curriculum is the most critical area of development. It carries the most significant expectations yet is still relatively under developed in GTVET. Canadian colleges and institutes, a few of whose practices and programs appear in **Figure 6** below, can make a significant contribution to the design and implementation of tools, systems and support structures required in this area, especially in program design and modification; teaching, learning and assessment strategies, (faculty development), and design and implementation of alternate delivery modes.

¹¹¹ Cedfop (2013) *Skills for a low carbon Europe*, 14.

¹¹²; IWG for G20 (2013) *Meeting skill needs for green jobs*, 6.

¹¹³ UNESCO (2014) Road Map for Implementing the Global Action Programme, 20.

¹¹⁴ For example: IWG, for G20, *Meeting skills needs for green jobs, 7*, UNESCO (2013) *Proposal for a Global Action Programme for ESD,* 3.

¹¹⁵ OECD (2014) *Greener Skills and Jobs,* 91.

¹¹⁶ UNESCO (2013) *Proposal for a Global Action Programme for ESD*, 4.

¹¹⁷ UNESCO (2009) World Conference on ESD, Bonn Declaration, 4.

^{&#}x27;¹¹⁸ Ibid, 4.

Table 7. Green Curriculum: Core College Functions and Canadian Exar	nples
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Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
Labour Market Intelligence (LMI)	The collection, analysis	Sector Councils
	and systematic application of labour market intelligence for a	The sector council ECO Canada works with colleges on developing skills for environmental sustainability, based on National Occupational Standards that align with their certification program for Environmental Practitioners.
	curriculum development	Industry Advising
and review. Industry Working with sector	and review. Working with sector	Use of industry-driven, college-level, <i>Program Advisory Committees</i> (PACs) to ensure program relevance and currency in greening curriculum (PACs are a Ministry requirement for Ontario colleges)
Partnerships cc er st. de	councils, industry and emergent industry standards for green skills development. Environmental scanning to inform program design and modification	The <i>Advisory Committee</i> model has also been adapted by CICan to international development projects. It has been used to ensure that local businesses are engaged in developing curriculum and work placement opportunities relevant to the region and context ¹¹⁹ as well as being the means to introduce local employers to the principles of environmental sustainability as it relates to product selection and practices. ¹²⁰
		Examples of Industry-College Partnerships
	Working with industry to develop emergent industry standards.	<i>Algonquin-Siemens Partnership:</i> Co-development of an internationally recognized applied research centre and sustainability focused research projects; co-creation of sustainability-oriented curriculum, new career opportunities, new curricula in building technologies and environmental sciences.
	Collaboration with industries/sectors to develop 'signposts and portals' for green or	<i>Humber-BlueGreen Consulting-NSERC Partnership</i> Sustainable Energy and Building Technology Program.

¹¹⁹ See briefing notes, CICan CFE *Youth Skills Development Program*. ¹²⁰ CICan (n.d.) *EFE Andes Environmental Sustainability Briefing Paper*.

Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
	alternate career choices and pathways.	<i>Canada Green Building Council:</i> multiple pan-Canadian college partnerships to deliver 3 core green building courses for F/T students and for professional development (e.g. Cégep de Jonquière, Cégep du Vieux Montréal, Lakeland, Red River, Douglas, NAIT, SAIT, NSCC, Conestoga, Humber, George Brown, Seneca).
		<i>BCIT-BC Hydro:</i> Sustainable Energy Management program funded by Natural Resources Canada - Office of Energy Efficiency.
		<i>ECO Canada</i> helped stimulate and support the affinity group the <i>Canadian College and University Environmental Network (CCUEN)</i> facilitating dialogue on curriculum and work transitions.
Curriculum Design and/or Modification	Anticipating and/or responding to changing skills needs for a greening/low carbon economy through design of new or modified learning outcomes, programs, or courses.	Many colleges, too numerous to list, have modified, or are modifying, program outcomes to reflect aspects of sustainability, as part of a cyclical program review process. Of interest is direct college response to climate change impacts. Northern College is considering new curricula in agriculture, in response to climate change and farming moving north in Ontario.
Green Technical Skills	Integrating <i>technical</i> green skills - both specialist and broad- based, across the curriculum, building on and modifying existing skills sets.	Select examples of green technician/technology programs and 'green-er programs' ¹²¹ <i>Environmental Sustainability</i> Wildlife Conservation Technology (<i>Holland</i>) Environmental Engineering -Water Resources (<i>NSCC</i>) Environmental Reclamation (<i>Olds</i>)

¹²¹ Includes programs in which sustainability principles are central to the student learning outcomes.

Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
	Developing technician/technology	Conservation and Restoration Ecology, & Environmental Conservation and Reclamation (<i>Lakeland</i>)
	training in a wide range	Environmental Assessment and Conservation (Lethbridge)
	environmental	Environmental Health (<i>BCIT</i>)
	sustainability, water,	Brownfield Redevelopment (<i>BCIT</i>)
	wildlife and fisheries	Land Reclamation (<i>Northern Lights</i>)
	management, natural	Sustainable Resource Management (<i>BCIT</i>)
	sustainable agriculture; clean and green	Water Engineering Technology -Water/Waste Management and Environmental Monitoring options (<i>Okanagan</i>)
	technologies and renewable energy and conservation; green building, etc.	Applied and Community Based Research - focus on solving environmental and social problems and community engagement (<i>Fleming</i>).
		Green Building
	Doveloping cross sectoral	Green Architecture (<i>Algonquin</i>)
	Developing cross-sectoral programs to align with the Integrated Green Economy.	Building Energy Resource Management (<i>Douglas</i>)
		Building Environmental Systems (<i>Seneca</i>) Sustainable Building Design & Construction (<i>Fleming</i>)
	Greening curriculum in	Sustainable Carpentry (<i>Durham</i>)
	traditionally brown industries such as natural resource extraction and mining operations. Integration of Traditional Indigenous Knowledge with environmental	Natural Building (<i>College of the Rockies</i>)
		Building Renovation Technician (<i>George Brown</i>) LEED Training Facility Certification (<i>Cégep de Jonquière</i>)
		Professional courses in Green Roofs and Green Walls, GHG accounting and reporting (<i>BCIT</i>).
		Skilled Trades

Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
	science-based curriculum.	Updating of skilled trades programs to integrate renewable technologies into existing curriculum (e.g. plumbing and pipe fitting, electrical) (<i>Camosun</i>)
		Aircraft maintenance technician program includes components on GHG emissions and alternative fuels (<i>Cégep Edouard-Montpetit)</i>
		Green Automotive (<i>Niagara</i>)
		Renewable Energy
		Sustainable Energy and Building Technology (Humber)
		Energy Systems Engineering Technician/Technologist' & Wind Turbine Technician Training (<i>Lethbridge</i>)
		Technologies des energies renouvelables et rendement energetique (<i>Cégep</i> de Jonquiere)
		Wind Turbine Technician, Solar Thermal Certification, Geoexchange Technician (<i>Northern Lights</i>)
		Electronics and Computer Engineering Technology – Renewable Energy (<i>Camosun</i>)
		Energy Systems Engineering Technology – Clean & Renewable Energy (<i>Mohawk</i>)
		Alternative Energy Technology (<i>NA/T</i>)
		AEC ¹²² in Renewable Energy Technology and Energy Efficiency (<i>Cégep de Jonquière</i>)
		Aswan Skills Development Program to address solar training needs in Egypt - electrical teacher training and curriculum development (<i>Camosun and Seneca for</i> Aga Khan Foundation Canada)
		Food and Agriculture
		Sustainable Agriculture Co-op, (<i>Fleming</i>)

Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
		Horticulture – Food and Farming (<i>Durham</i>)
		Sustainable Local Food (St Lawrence, and other colleges via Ontario Learn)
		Greenhouse Technician, Commercial Bee-Keeping (<i>Niagara</i>)
		Sustainable organic agriculture (Cégep Victoriaville)
		Tourism and Hospitality
		Culinary program, focus on waste management (<i>Niagara)</i>
		"Field to Fork" concept developed in partnership with the Food and Farming program, ensuring joint planning of crops and harvest schedules to support culinary classes. ¹²³ (<i>Durham)</i>
		Tourism and Hospitality Management - sustainable tourism option (<i>North Island</i>)
		Natural Resource Management
		Renewable resources (<i>NA17</i>);
		Renewable Resource Management (<i>Lethbridge</i>)
		Wildlife and Fisheries Conservation (Lakeland)
		Sustainable Aquaculture (<i>Marine Institute</i>)
		Applied Coastal Ecology (<i>Northwest</i>) - focus on assessing, mitigating, and monitoring environmental issues; field work and small-scale research projects on wildlife, soil and water quality;
		Water Treatment Technology (<i>Cégep du Saint-Laurent</i>)
		Community Planning

¹²³ This approach has been adapted and scaled to an international project in Peru where urban gardens have been developed for the college's local partner's culinary program and restaurant.

Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
		Assoc Arts/Science degree in Sustainable Communities (<i>Northwest</i>)
		Environmental Planning (<i>Selkirk</i>)
		Applied Urban and Rural Planning (<i>Langara</i>)
		Business Management
		Business Management - incl. Corporate Social Responsibility (<i>Niagara</i>)
		Green Business Management (<i>Seneca, Conestoga</i>); Sustainable Business Leadership (<i>BCIT</i>)
		Health Care
		Dental Care programs integrating environment and waste reduction (<i>Cégep Édouard Montpetit</i>)
Skills for Sustainability	Integrating ' <i>skills for</i> <i>sustainability</i> ' (essential employability, workplace or generic 'change agent' skills) across the curriculum.	The <i>Essential Employability Skills</i> required of Ontario college graduates have been aligned with generic skills for sustainability and are being used on a voluntary basis.
		<i>Algonquin-Siemens Partnership</i> : integration of 'values, knowledge and skills related to corporate social responsibility and ecological stewardship to all career paths offered through the college, such as nursing, policing, recreation and culinary arts'. Focus on student growth as global citizens and preparation for "every job is a green job" future.
	Also referenced as transversal skills in TVET.	<i>Humber's Sulawesi Economic Development Strategy Project</i> (SEDS) design and delivery of entrepreneurship curriculum/network linkages to student entrepreneurs, business start-
	* Entrepreneurship has been identified as a critical skill for engaging youth in developing countries.	ups and SMEs; a 5-year project supporting 7 universities contributing to sustainable economic growth. ¹²⁴

¹²⁴ https://business.humber.ca/idicentresofexcellence/the-institute/projects/sulawesi-economic-development-strategy-project-seds.html

Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
Education for Sustainability	Integrating <i>education for</i> <i>sustainable development</i> across all college programs	<i>Vanier:</i> 2014-15 moved from a focus on 'environmental impacts of our systems' to the more holistic 'integration of sustainability into academics' and 'educating citizens who will be leaders for sustainability'.
		<i>Georgian:</i> all programs adding program level learning outcomes directly related to environmental sustainability.
		Nova Scotia: All courses assessed for aspects of sustainability, and student capacity to:
		 Develop skills necessary to implement sustainable solutions. Make connections between their chosen program of study/career path and sustainability. View themselves as part of inter-connected world systems. Synthesize understanding of social, economic, and environmental systems and discuss practical solutions to sustainability issues. Understand how sustainable thinking and decision-making contributes to the process of solution-building for social, environmental, and economic crises.¹²⁵.
		<i>Red River College:</i> Commitment to implementing College-wide Learning Outcomes (CWLOs) ¹²⁶ one of which focusses on sustainability (valuing the interdependence of social justice, sound economics and meaningful environmental practices in relation to their chosen profession).
Leadership and ESD	Integrating principles of sustainability and corporate social	There are numerous graduate certificates in 'green' specializations including:

 ¹²⁵ http://www.nscc.ca/explorenscc/sustainability/education.asp
 ¹²⁶ http://air.rrc.mb.ca/sem/college-wide-learning-outcomes.aspx.

Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
	responsibility into graduate programs.	Green Business (<i>Algonquin</i>); Green Management (<i>Conestoga</i>); Lean Six Sigma (<i>Mohawk</i>); Green Business Management, (<i>Seneca</i>); Sustainable Business Leadership (<i>BCIT</i>).
Strategies for Teaching, Learning and Assessment	Integrating innovative teaching and learning strategies and learner- centred approaches that engage students in learning 'for', not just, 'about' sustainability. ¹²⁷	Strategies include moving to a learner-centred approach; project-based activity; the solving of 'real world problems'; managing complexity; learning activities that engage students in 'deep' learning (vs rote learning); place-based learning (i.e. learning outside the classroom) and 'authentic' assessment.
Program Delivery	Reconfiguring curriculum as needed, where needed, to respond to skills needs with flexible delivery (e.g. modularization for work place learning).	<i>Northern College</i> is making a breadth of programming and credentials available through 'flexible program offerings and technology-enabled, blended delivery 'in order to respond 'to the needs, choices and directions of Aboriginal peoples and their communities.' ¹²⁸
Faculty Development	Developing effective leadership and professional learning for greening the curriculum.	<i>NSCC</i> : Education for Sustainability (EFS) is a five day, 39-hour faculty development course devoted to the examination of sustainability through the lens of higher education. EFS is an elective credit course in the NSCC Community College Education Diploma Program (CCEDP); required of all NSCC faculty and professional support employees.
	Reward and recognition for faculty innovation.	<i>Camosun</i> : ensures currency of faculty in energy renewables through North American Board of Certified Energy Practitioners (NABCEP) certification.

¹²⁷ Practices in sustainability at the course level that focus on teaching, learning and assessment strategies do need better documentation. Information often does not go below the program level.

¹²⁸ Strategic Mandate Agreement, 10. http://www.northernc.on.ca/docs/northerncollegestrategicmandateagreement.pdf

Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
Qualifications Frameworks & Credentials	Ensuring currency and relevance of credentials and Qualifications Frameworks through 'greening' and infusion of sustainability across the standards.	'Skills for sustainability' have been mapped to the CAAT <i>Essential Employability Skills</i> and aligned with the <i>Ontario Qualifications Framework</i> (use is voluntary).
Student	Aligning program	Numerous examples of program laddering, e.g.:
Academic Mobility	curriculum with qualifications frameworks to promote	<i>North West College</i> : Diploma in Applied Coastal Ecology ladders into Environmental Science, Forest Conservation, BSc Integrated programs;
	student mobility and	Fleming: joint diploma-degree with Trent University in Ecological Restoration
	reduce duplication (credit transfer, program laddering, stackable credentials, joint degree programs).	<i>St Lawrence:</i> "Stackable" credentials in energy renewables.
Continuous Learning for the Green Economy	Reconfiguring curriculum for retraining and workplace needs such as 'upskilling', and 're-skilling' and reaching the private sector.	Canada's colleges and institutes have a long history in the research, design and delivery of web-based distance education (distributed learning) formats, 'hybrid' courses, and the use of handheld computing devices in the integrated learning environment.
		<i>Cégep Victoriaville</i> operates a private sector contract training service for the wood and furniture manufacturing sector aimed at converting operations of companies in the sector to the use of sustainable finishes.
	Design and implementation for alternate delivery modes for workplace, rural and off- campus learning.	

Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
Quality Assurance	Although there are provincial/territorial quality assurance processes, it isn't known whether any have elected to benchmark programs against indicators for education for sustainable development. This may be happening at an institutional level of QA. Colleges are benchmarking against independent, NGO sustainability QA	 Examples of campus sustainability rating systems Cégep Vert du Québec - 39 cégeps participating. As a part of ClCan's EFE project in Peru, Cégep Edouard-Montpetit will work with local Peruvian partners to introduce a green certification process based on Cégep vert. Sierra Youth Coalition 'CSAF' - a student led assessment. AASHE 'STARS': Although there are a number of Canadian colleges that have started the process, top rated colleges include: Gold: NSCC, UIOT. Silver: Camosun, Fanshawe, George Brown, Mohawk, NAIT, Okanagan, Sheridan. Bronze: Loyalist, Niagara. Brundtland Green Establishment certification.¹²⁹
	study tools to assess progress.	

¹²⁹ This certification was developed by the *Conseil des syndicats nationaux (CSN)* labour federation; while primarily designated for primary and secondary schools, some Quebec institutions, such as Cégeps Garneau, Victoriaville and others, hold the certification.

Green Skills Areas	Examples of Greening of Core College Functions	Selected Case Examples
Prior Learning Assessment & Recognition (PLAR)	Development of rigorous PLAR processes and their promotion to prospective students with diverse educational backgrounds and life experiences.	<i>Holistic Portfolio PLAR:</i> There is a growing body of knowledge on the application of PLAR to 'Aboriginal Self (Re) Construction' ¹³⁰ . Known as "holistic portfolio PLAR" this was pioneered at Northlands College, Saskatchewan.
	NB: Canada has a mature PLAR culture. It is not known the extent to which students are challenging course work based on green or related transferable skills.	

¹³⁰ See: L. Lloyd Hawkeye Robertson, *Prior Learning Assessment and Recognition in Aboriginal Self (Re) Construction, 2011.* http://www.pimatisiwin.com/uploads/jan_20112/11Robertson.pdf

5.2.3 Green Community

At the core of this dimension is TVET "interfacing" with the "wider community" in areas such as "capacity-building, renewable technology adoption, resource support, [and] unique practices."¹³¹ Community building is identified as a key activity/growth area over multiple reports and includes inter-institutional partnerships, networks and sharing of promising practices at the regional to global levels, as well as engaging community and multi-stakeholders locally.

Working at the Local Level

"Encouraging local communities and municipal authorities to develop communitybased ESD programs" is considered one of the five "priority action areas" of the Global Action Programme. It is recognized that "effective and innovative solutions to sustainable development challenges are frequently developed at the local level"¹³² in both urban and rural communities. With a mandate to respond to local economic development needs, Canada's colleges and institutes are closely aligned with and attuned to their local and regional communities and work with them in many formal and informal dimensions.

The GAP also calls for accelerating the search for sustainable development solutions at the local level through ESD as well as the development, diversification or expansion of local networks that "facilitate multi-stakeholder learning for sustainable development" the goal being the integration of "new and more stakeholders," "including indigenous communities."¹³³ It also recognized the role of local government in supporting, the integration of ESD at the local level, into formal and informal education accessible to all members of the community.¹³⁴

Professional Networks

The recent literature emphasizes the development of inclusive networks; the promotion of "information exchange, experience sharing and co-ordination for green economy learning;"¹³⁵ the need to "bridge across academic silos" and to "motivate buy-in at all levels, from students to teachers to administrators."¹³⁶ TVET institutions are urged to "to create, share and promote knowledge, good practice, and innovation, as well as increase the "reach" of their action;"¹³⁷ "assess, validate and showcase performance" and

¹³¹ UNEVOC (2015) Skills for Work and Life, 42.

¹³² UNESCO (2013) Proposal for a Global Action Programme for ESD, Annex 1, 4.

¹³³ Ibid, Annex I, 5.

¹³⁴ Ibid, Annex I, 5.

¹³⁵ PAGE (2015) First Global Forum on Green Economy Learning Report, Paris, 10.

¹³⁶ Ibid, 20.

¹³⁷ Ibid,20..

good practice,"¹³⁸ "disseminate good practice,"¹³⁹ and "build on well documented success stories which demonstrate... institutional capacity for "transformative change."¹⁴⁰ This, in effect is becomes "a community of practice of green economy learning professionals and institutions."¹⁴¹

The *Green Growth Knowledge Platform* (GGKP) notes that "organizations are eager to collaborate and learn from each other in the generation of green growth knowledge," but that "knowledge curation is important [in order to] to cut through the noise."¹⁴²

CICan has an important role in catalyzing and brokering professional networking for ESD as well as in "knowledge curation." There is a need not only to share effective practices but to help reduce duplication of effort.

Partnerships and Alliances

ESD is dependent on partnership development with multi-stakeholders at all levels and in all contexts from all levels of government to civil society, public and private sectors, non-governmental organizations (NGOs), media and development partners as well as community members and special interest groups, linking "the local to the global."¹⁴³

Partnerships can help position skill development, and "enrich programs with the latest needs assessments and IGE materials as well as... improve alignment with private sector demand."¹⁴⁴ They can strengthen "existing alliances to support employer engagement in VET"; and create "channels for dialogue between new and non-traditional industries across the value chain."¹⁴⁵ Partnerships potentially "increase institutional 'reach'¹⁴⁶ and "compensate shortcomings of individual institutions."¹⁴⁷ This is something at which Canadian colleges and institutes excel – Public Private Partnerships (P3s) are well established in institutional culture.

Student Engagement in the Community

Student engagement in the community at the local level does not appear to be referenced as an approach in the literature, despite the desire to engage in youth in a transformative capacity.

¹³⁸ UN (2013) *Proposal for a Global Action Programme on ESD*, Ibid, 16.

¹³⁹ Cedefop (2013) *Skills for a low carbon Europe*, 2013,14.

 ¹⁴⁰ PAGE (2015) First Global Forum on Green Economy Learning Report, Paris, 16.
 ¹⁴¹ Ibid, 10.

 ¹⁴² Amanda McKee (2015) *Generating, Managing and Sharing Green Growth Knowledge* Presentation. GGKP

http://www.unosd.org/content/documents/1104McKee_GGKP_Presentation(24March).pdf GGKP

¹⁴³ UNESCO (2013) *Proposal for a Global Action Programme on ESD*, 4-5.

¹⁴⁴ PAGE (2015), *First Global Forum on Green Economy Learning Report* 20.

¹⁴⁵ Cedefop *Skills for a low-carbon Europe*, 12.

¹⁴⁶ PAGE, First Global Forum on Green Economy Learning, 2015, 16.

¹⁴⁷ Ibid, 20.

Canadian colleges and institutes have a long tradition in community-based student project work including formal 'for credit' work placements such as co-op, internships and field courses, as well as non-credit volunteer activity or service learning and increasingly, community-based research. A strength of Canada's approach is the integration of outcomes from those experiences in core curriculum. These activities can help build healthy and sustainable communities, as well as contribute to the viability and sustainability of community organizations. In some cases, it could be argued that students and new graduates could become a primary conduit for greening of practice in SMEs and those small community organizations that might not otherwise have access to this information or resources for professional development. This type of learning is not referenced specifically in the TVET/ESD literature but represents an ideal means of engaging students with community, at the local level, to tackle the problems of climate change.

As a national level organization representing Canada's public college, institutes and Cégeps, Colleges and Institutes Canada has been able to play a leadership role in the global TVET community. It was a lead actor in founding the World Federation of Colleges and Polytechnics (WFCP) in 1999, (Quebec City), and chaired the organization for many years, including at present. The WFCP has also established an international green network, the members of which include China, Australia and the United Kingdom. CICan has been selected by UNESCO-UNEVOC as the Coordinating Centre for North America, and is a key player in the global UNEVOC network. It has also been elected Vice President of the Canadian Commission for UNESCO and chairs its Education Committee.

Green Community Area	Examples of Greening of Core College Functions	Selected Case Examples
Student Placement	Student participation in sustainability projects and workplace experience through experiential learning, field placements, field work, internships and co-op placements.	<i>CICan Clean Tech Internship Program</i> in partnership with Environmental and Climate Change Canada: Through workplace subsidies provides PSE graduates in STEM subjects with opportunities to work for eligible employers that are improving environmental and economic outcomes in Canada.
		The Current CICan <i>Youth Skills Development Programs</i> being implemented in the Caribbean ¹⁴⁸ have adapted the traditional college/institute field placement to basic training in developing countries. The projects are building partnerships and signing MOUs with local businesses in order to provide work experience for vulnerable youth and young adults and help the transition to employment. In both projects, environmental sustainability is integrated across the 'in-class' curriculum in order to help students address issues such as health and safety and environmental impacts of product selection when 'on the job'.
		<i>Cégep Edouard Montpetit</i> : offers various sustainability focused internships and overseas work- study initiatives, most notably the "Défi environnement" ¹⁴⁹ program in which students are exposed to at least one significant environmental issue in their program of studies, an internship with researchers or communities, and a knowledge dissemination project to raise awareness about the chosen issue.
Local SD networks	Leadership and engagement of college in regional SD planning and project activities.	<i>Fleming College's</i> lead role in 'Sustainable Peterborough', a community-based, regional collaborative working on implementation of a regional Community Sustainability Plan.
		<i>Cégep Garneau's</i> strategic plan includes the development of a sustainable commuting plan to favour the use of public transportation, carpooling and cycling by students and staff. Currently under development, the plan will be aligned with Quebec City's sustainable transport (<i>Mobilité durable</i>) plan.

Table 8. Green Community: Core College Functions and Canadian Examples

 ¹⁴⁸ CICan (n.d.) Youth Skills Development Program, Partnership Briefs, CAR 18 and CAR 19, 2015-2017.
 ¹⁴⁹ http://defienvironnement.cegepmontpetit.ca/

Green Community Area	Examples of Greening of Core College Functions	Selected Case Examples
		<i>CCNB</i> , with the University of Moncton, are the only two Canadian members of the multidisciplinary partnership <i>Empowering Regional Development and Innovations</i> (ERDI), a largely European initiative supported by ERASMUS. The participation of CCNB students and faculty in training and knowledge development in Europe related to sustainable regional economic development, is supported by Government of New Brunswick through bursaries.
Community	Faculty-mentored,	Food security
Outreach &	student-led engagement in	On-campus community gardens: Mohawk, Fleming, Vanier & Niagara
Sustainable Development Partnerships	le program-based community outreach projects Student participation in various forms of service learning and volunteerism related to green initiatives and social programs.	<i>Food Banks:</i> Contribution to local and/or student foodbanks through campus grown produce (e.g. Niagara).
Service Learning		<i>The Inuvik Community Greenhouse</i> is a partnership between The Community Garden Society of Inuvik (CGSI) and Aurora College, to convert a decommissioned arena into a community greenhouse where it is now "a focal point for community development".
		<i>Food procurement:</i> Mohawk-led, Ontario-wide initiative to develop local food procurement policies; source local food for catering services and shift to seasonal produce. Funding partnership between the ON government, the Greenbelt fund and Mohawk.
		Renewable Energy
		<i>St Lawrence-Energy Systems Engineering Technology</i> : community outreach includes: Renewable Energy Generator & Energy Storage (REGES) Trailer for community events; free energy audits for homes and businesses; participation in annual community events such as 'Green Doors' and a 'Manage Your Energy' conference.
		<i>Camosun</i> : <i>Emerging Leaders for Solar Energy (ELSE) Ambassador Program</i> , where students are provided with toolkits and mentorship to host on-campus events.
		"Solar Saturday" – a renewable energy exposition for the public to learn about the world of alternative residential energy systems.

Green Community Area	Examples of Greening of Core College Functions	Selected Case Examples
		<i>Niagara: The General Motors Clobal Rivers Environmental Education Network (CM GREEN)</i> - encourages a community-wide approach to help youth better understand their impact on local watersheds and build their environmental knowledge and capacity for informed decision- making. Employees from St. Catharines Powertrain, students and staff from the College's School of Environment and Horticultural Studies and Earth Force will mentor young people as they conduct water quality testing in local streams, the findings to be used in a sustainable action plan addressing water quality issues in the Niagara region.
		<i>Norquest</i> : partnership with Drayton Valley Community Learning Association and Town of Drayton Valley in building a Clean Energy Technology Centre and positioning the area as a clean energy leader. Focus is on research and clean energy, corporate training and business development: "The more community partners can collaborate on learning needs, the better we can serve our community."
		<i>Durham</i> : partnerships created with General Motors of Canada and local environmental organizations such as Durham SustainAbility, Friends of the Green Belt and Ontario Sustainable Energy Association as well as being active on regional committees such as Durham Region Roundtable on Climate Change.
Community- Based Education (Extension)	Capacity to respond to community education and training needs.	<i>The Marine Institute</i> has been delivering education and training programs in communities across Newfoundland and Labrador and in other areas of Canada since 1964, via The Community Based Education Delivery Unit (CBED). It offers 'industrial response training' supporting key training priorities by organizing, facilitating, and leading training in areas such as aquaculture, environmental, fish harvesting, and food processing. Training can also be adapted to the needs of developing countries.
Global Learning Community	Engaging students in the global learning community through college curriculum, college	<i>Nova Scotia Community College</i> : The Mikumi Solar Project is a joint initiative between faculty and students at the Mikumi Vocational Education Centre in Tanzania and NSCC. It began in 2014, as a small-scale solar electrical system to provide more consistent power to campus, added a solar powered water pumping system in 2015, and this year will expand to the design/install of a solar water pasteurization system and a weather station to monitor the effect

Green Community Area	Examples of Greening of Core College Functions	Selected Case Examples
	values, working with international students, opportunities for overseas placement and shared learning	of weather on the solar panels. The indirect benefits include curriculum modules for skills training in installation, maintenance and repair of small scale solar systems, to enhance electrical trades, technician and technology training programs. Entrepreneurship, problem solving and teamwork are all valuable "soft skills" that have been developed through project work.
		Cégep régional de Lanaudière à Joliette: Students in the horticulture and environment program participate in an ongoing project in rural Nicaragua where they help to transfer knowledge to support various types of artisanal production based on local medicinal plants and other products.

5.2.4 Green Research

To date, there are few GTVET reports that have identified applied research as a vital area for development but Majumdar obviously not only anticipated this expanding role, but its importance in the 'whole of institution' approach to greening. In the 2015 UNESCO-UNEVOC Report *Skills for Work and Life*, 'Green Research' was described as 'fostering research' in areas such as "renewable energy, water treatment, green innovations, waste recycling" and "ascertaining the impact of interventions." It was also noted that "action research is likely to be important."¹⁵⁰ All are areas of strength and expertise for Canadian colleges and institutes.

Research projects in which students are working with SMEs also help develop what is now considered an essential employability skill in developing countries: "entrepreneurship training and business coaching for young people and adults to start up green businesses in conjunction with microfinance projects."¹⁵¹ Likewise, "capacity building for employers in the informal economy and micro and small enterprises to enter green markets in localities where they are most needed."¹⁵²

Expanding the GTVET Research Agenda

There are indicators of a shift to more coordinated global research efforts and capacity building. For example, The *Green Growth Knowledge Platform* (GGKP), a consortia of global partners based in Switzerland, is focusing on collaboration and coordinated research in the green economy itself, in order to address "knowledge gaps in green growth theory and practice"¹⁵³ and reduce "research redundancies and increase efficiencies."¹⁵⁴ Its research committees, experts from partner organizations, and regional workshops "aim to build research capacity in developing countries, facilitate knowledge exchange and engage regional researchers from these countries in the GGKP."¹⁵⁵

The GAP 2013 advocates for the integration of ESD into professional academic development in post-secondary institutions including higher level functions such as "conducting and supervising solution-oriented interdisciplinary research, and informing policy-making on ESD and sustainable development."¹⁵⁶ It affirms the importance of work at the local level between multi-stake holders such as those between local governments, NGOs, the private sector, media, education and research institutions and individual citizens.¹⁵⁷

¹⁵⁰ UNEVOC (2015) Report - Global Forum on Skills for Work and Life, 42.

¹⁵¹ ILO/CEDEFOP (2011) Skills for Green Jobs. A Global View, xxvi.

¹⁵² Ibid.

¹⁵³ Green Growth Knowledge Platform (2014) *Generating, Managing and Sharing Green Growth Knowledge*, 1. ¹⁵⁴ Ibid, 3.

¹⁵⁵ Ibid. 5.

¹⁵⁶ UNESCO (2013) Proposal for a Global Action Programme on ESD, 4.

¹⁵⁷ ibid, 4.

Institutions are also urged to "measure, record and report on results" of their own efforts in transformation to GTVET¹⁵⁸ as part of institutional quality assurance processes and assessing the "relevance of learning outcomes to the labour market."¹⁵⁹

Applied Research and Canada's Colleges and Institutes

Some years ago, a small number of Canadian colleges participated in a pilot project, funded by the federal government's National Sciences and Engineering Research Council (NSERC). The goal was to demonstrate college capacity in the design and implementation of applied research projects. Until then, colleges could only access NSERC funding as a partner to a lead applicant university. The pilot was a success and subsequently, colleges have more than proven their capacity to engage in a broad range of applied research activity, especially in the area of clean technology and environmental sustainability. NSERC now funds a number of grants specifically for colleges through the College and Community Innovation program¹⁶⁰ including environmental science and technologies and natural resources and energy. It includes funding for research, and development, tools and instruments, product development and research chairs. NSERC's criteria for project success include increased awareness of college applied research capacity by local companies; stakeholder engagement; increased involvement of faculty in applied research; increased applied research capacity at colleges; engagement of college students in applied research and "exposure to business work environments"; adoption of technologies and processes; increased collaborations and R&D investment by local companies and other organizations; increased productivity and competitiveness of local companies and other organizations; and enhanced reputation of colleges as applied research partners¹⁶¹. This is an excellent model suitable for adaptation to any GTVET community-based, applied research project.

Where Canadian colleges and institutes excel, is in small-scale and locally relevant projects, partnering with small-to-medium sized enterprises, and bringing product to market, (an area in which universities do not often engage) in a timely fashion. They have also initiated complex, long-term, international projects with multiple partners, drawn from across sectors.

An environmental scan of pan-Canadian college/institute activity, (2012-13), identified 654 areas of research specialization and 489 specialized research centres and labs, engaging nearly 30,000 students. Small and medium sized enterprises accounted for 78% of the business/industry partnerships with a growing number of social innovation projects.

¹⁵⁸ UNEVOC (2015) *Report - Global Forum on Skills for Work and Life*, 18.

¹⁵⁹ Cedefop (2013) *Skills for a Low Carbon Europe*, Synthesis Report, 12.

¹⁶⁰ These include the following grant categories: Applied Research and Development (ARD); Applied Research Tools and Instruments (ARTI); College-University Idea to Innovation (CU-I2I); Engage; Industrial Research Chairs for Colleges (IRCC); Innovation Enhancement (IE); Synergy Awards for Innovation (for colleges); Technology Access Centreshttp://www.nserc-crsng.gc.ca/Institutions-Etablissements/InstCollProg-EtabCollProg_eng.asp

¹⁶¹ College and Community Innovation Program http://www.nserc-crsng.gc.ca/Professors-Professeurs/RPP-PP/Info-Info_eng.asp

Environmental science and technologies, natural resources, and energy and clean tech sectors¹⁶² were strongly represented, with projects in areas such as mine remediation, clean water, and organic food production.¹⁶³

The 2015 SDGs for 2030 align with many areas of applied research in Canada's colleges: clean technologies, renewable energy and conservation, water and waste water management, environmental sustainability, food security and, increasingly, life sciences and health and social justice and innovation. SDGs 6 and 7 relate to water and energy sustainability, and SDGs 11 to 15 are concerned with human settlement and sustainable and resilient communities, consumption and production patterns, conservation of oceans, seas and marine resources, and protecting and restoring territorial ecosystems, forests and land degradation, as well as loss of biodiversity.¹⁶⁴

The Social Sciences and Humanities Research Council (SSHRC) Community and College Social Innovation Fund is another pilot initiative designed to "connect the talent, facilities and capabilities of Canada's colleges and polytechnics with the research needs of local community organizations." Oriented to community engagement, the goal is to "enable colleges to increase their capacity to work with communities... developing partnerships that foster social innovation in areas such as education, integration of vulnerable populations, and community development."¹⁶⁵

This research capacity could be described as a unique identifier for Canadian colleges, one that will become increasingly important, if not vital, in the era of post-2015 education. Many Canadian colleges are now engaged in applied research, regardless of institutional size and location. The ability to engage with local community and grow small projects is the kind of scalable and transferable enterprise that is being advocated as an emergent role for GTVET in developing countries. The goal is not only locally relevant research, but stimulating employment and creating regional SMEs and sustainable jobs for TVET graduates. Applied research contributes to innovation, increased productivity, and individual and community prosperity. Indirect benefits from these research initiatives include driving curriculum innovation, developing new approaches to teaching and learning, faculty and community engagement, providing opportunities for student learning in real world situations on research teams and engaging with the international community.

¹⁶² ACCC, Feb 2014 , i-ii.

¹⁶³ ACCC, Feb 2014, i-ii.

¹⁶⁴ UNESCO Sustainable Development Post 2015 Begins with Education, 9.

¹⁶⁵ SSHRC web page http://www.sshrc-crsh.gc.ca/funding-financement/programs-programmes/social_innovation_innovation_sociale-eng.aspx
Green Research Area	Examples of Greening of Core College Functions in Canada	Selected Case Examples
The Culture of Research in Canada's Colleges	Applied research activity is often stimulated by, and responsive to, local need, but is scalable and transferable to other contexts. Indirect outcomes include student and faculty engagement, development of new courses, programs and faculty expertise, and development of a college or regional specialization.	 New Brunswick Community College describes its vision of applied research as follows: build a supportive culture for applied research that contributes to the learning experience identify opportunities to serve the socioeconomic needs of communities through applied research be actively involved in and recognized for applied research activities identify and develop areas of expertise that connect the college with applied research opportunities.¹⁶⁶
	Funding may be based on public-private partnerships, an angle being promoted for TVET in developing countries.	
Partnerships	Responding to needs of Small- to-Medium Enterprise (SMEs); helping small firms commercialize new discoveries and adopt new clean technologies.	<i>Ontario Centres of Excellence</i> (OCE) helps take research from college labs to the marketplace, funding start-ups and product commercialization. ¹⁶⁷ All 24 Ontario colleges are part of OCE's <i>Colleges Ontario Network for Industry Innovation (CONII)</i> 'aimed at helping small-and medium-sized enterprises (SMEs) solve their technical problems, adapting new technologies for the marketplace, and developing new or improved products and processes.' ¹⁶⁸

Table 9. Green Research: Core College Functions and Canadian Examples

¹⁶⁶ http://www.nbcc.ca/docs/default-source/ari-documents/ari-report-card-2013-14_final.pdf?sfvrsn=4

¹⁶⁷ Web page: Ontario Centres of Excellence: http://www.oce-ontario.org/programs/commercialization-programs#sthash.4Pulip1D.dpuf

¹⁶⁸ Web page: http://www.oce-ontario.org/programs/strategic-initiatives/colleges-ontario-network-for-industry-innovation#sthash.euZwSiXe.dpuf

Green Research Area	Examples of Greening of Core College Functions in Canada	Selected Case Examples
	Development of various on- campus models to support SMEs, innovation and product development.	<i>SAIT</i> : Creating an environmental chamber for industry partners to test the insulation R-value of innovative, novel wall systems. ¹⁶⁹
-	Developing inter-institutional partnerships to support sustainability-related programs and associated applied research	<i>College-University Idea to Innovation</i> grant, part of the Natural Sciences and Engineering Research Council's (NSERC) College and Community Innovation (CCI) Program. Projects include: Trent-Fleming research on use of euglena algae in waste water management.
	(College-college; college- university).	The <i>PACTE2D</i> ¹⁷⁰ partnership brings together 5 Cégeps and 2 universities in Quebec to promote the integration of sustainable development in education. The centre is a research, professional development and knowledge exchange hub supported by two pedagogical experts.
	Managing complex inter- institutional, cross-sectoral partnerships, sharing costs, resources, responsibilities, decision-making, outcomes.	Fleming College's <i>Centre for Alternative Waste Water Treatment</i> and India's National Skill Development Corporation (NSDC) partnered on skills development in water quality management. The goal was to create a new Centre of Excellence for Water in India addressing major skill gaps through standards, certification, education and training, mentoring and research. ECO Canada partnered in the development of new National Occupational Standards.
Leadership	Establishing centres of excellence, institutes, or specializations in fields related to green/clean technology.	<i>Cégep de Jonquière</i> . Since 2012, has held the NSERC Industrial Research Chair in Sustainable Energy Technology and Energy Efficiency; the Chair is also supported through numerous partnerships with industry.
	Engaging in knowledge transfer, publication and dissemination.	

 ¹⁶⁹ http://www.saitarisblog.com/wall-to-wall-innovation-with-environmental-chamber/
 ¹⁷⁰ http://www.pacte2d.ca/

Green Research Area	Examples of Greening of Core College Functions in Canada	Selected Case Examples
Product Development/	Prototyping development, product testing, finalizing	Red River College, Electric Vehicle Technologies, partnering with Japan
Commercializa	designs, developing marketing	CC/1s (College Technology Transfer Centre) ¹¹ in Quebec
tion	strategies, field testing, etc.	<i>Cégep Victoriaville</i> operates Inovem, an applied research centre on Quebec's CCTT model that develops solutions, many focused on sustainable technologies, with private sector partners in the wood and furniture manufacturing sector.
		<i>Cégep Saint-Laurent's Centre for Water Technologies¹⁷²</i> addresses numerous sustainable water treatment issues.
Community- Engaged Action Research	Designing and implementing community-based and /or community driven action research projects (e.g. social justice, health and wellness, urban sustainability, food security).	<i>Collège Rosemont</i> created Cérsé, the Centre for the Study of Social Responsibility and Ecocitizenship, a social innovation CCTT that focuses its applied research services on projects that seek to understand social and behavioural change required for sustainable development. ¹⁷³

 ¹⁷¹ "Centre collégial de transfert de technologique." See <u>http://reseautranstech.qc.ca/</u> for further information
 ¹⁷² http://www.cteau.com/
 ¹⁷³ http://www.crosemont.qc.ca/cerse/a-propos

Table 9a. Applied Research Related to Sustainable Development and the Inclusive Green Economy

	Further Examples of Applied Research
Renewable Energy	<i>SAIT: Green Building Technologies</i> (GBT) research group (f. 2008), received NSERC funding to create a <i>Green Building Technologies Access Centre</i> (GBTAC) in 2014, focus on expanded GBT research capabilities in: net-zero energy and
Energy Conservation	energy positive design; building-integrated renewable energy; architectural ecology; energy management and monitoring; education and industry transformation; materials and advanced-component assembly. SAIT is also working on energy efficient housing for Artic living.
Energy Efficiency	College of the North Atlantic: Wave energy research
Emelency	Georgian College. Assessing heat stress in solar panels
	Cégep de Sherbrooke. Moulins du soleil project in partnership with Senegal
	Cégep de Jonquière: research chair on the production of green energy in northern climates
	<i>BCIT</i> : The Centre for Energy System Applications (CESA) focus on 'integration of energy systems applications through education and research' investigating both demand side and supply side management. ¹⁷⁴
	Camosun: Preliminary concept for a 'Centre for Excellence in Renewable Energy and Climate Adaption' (CERECA).
Clean Technology	<i>Colle¶ge Communautaire du Nouveau Brunswick</i> : biorefinery technology scale-up centre (BTSC) for the Atlantic region. Funded by NSERC, New Brunswick Economic Development Department, New Brunswick Department of Energy, Atlantic Canada Opportunities Agency (ACOA) to purchase equipment for pilot scale processes.
	<i>Camosun Innovates</i> : applied research unit, and one of Canada's Technology Access Centres. Connects industry to the college's technical resources and provides expertise in engineering design, automation, instrumentation, and reverse engineering provide product development and process improvement services to industry – occasionally in the broad area green/clean tech.

¹⁷⁴ Web page: http://commons.bcit.ca/energy/

Further Examples of Applied Research		
Urban Sustainability	<i>Humber</i> : focus on sustainable approaches to urban development/redevelopment and sustainable or green infrastructure.	
& Transportation	<i>Red River College</i> . Zero emissions public transit. Projects include: the electric bus project ¹⁷⁵ and the electric bike project. ¹⁷⁶	
Environmental	Cégep de l'Abitibi-Témiscamingue. Passive treatment of leachates from forestry waste	
Sustainability	Lambton: Wastewater recovery	
	Yukon College. Treating mine tailings effluent in Northern wetlands	
	Grande Prairie Regional College: Winter planting for enhancing wetland reclamation for oil sands	
	College of New Caledonia: Tackling the effects of climate change on BC forests	
	<i>Yukon College:</i> Cold Climate Innovation (CCI) - development, commercialization and export of sustainable cold climate technologies and related solutions for subarctic regions around the world (e.g. alternative energy, building construction, climate-related research, environmental remediation, food security and mechanical innovation)	
	NAIT: NSERC Research Chair in Peatland Restoration (since January 2013).	
	<i>Cégep régional de Lanaudière à Joliette:</i> Through the Cégep's department of horticulture and environment, a partnership was established with the Centre Hospitalier Régional de Lanaudière to develop agricultural uses for the dehydrated food waste produced by the hospital.	
Marine and Aquatic Conservation	<i>Fisheries and Marine Institute of Memorial University of Newfoundland (MI</i>): research programs include: Centre for Sustainable Aquatic Resources (CSAR); Centre of Marine Simulation (CMS); Centre for Fisheries Ecosystems Research, the School of Ocean Technology Applied Research and the Centre for Aquaculture and Seafood Development (with a focus on isolating and diverting by-products from sea food waste). Note that MI's research capacity includes addressing issues of climate change impacts such as Centre for Marine Simulation (CMS) the research focus of which	

¹⁷⁵ Electric bus project - http://blogs.rrc.ca/ar/2014/05/manitobas-new-electric-bus-and-charging-system-revolutionizing-clean-energy-public-transportation-systems/ ¹⁷⁶ Electric bike project: http://blogs.rrc.ca/ar/2011/09/rrc-research-innovation-fund-project-to-build-solar-ebikes/

	Further Examples of Applied Research
	is modelling and simulating harsh environment operations, particularly ice management, and reducing human error. Sample Expertise: Ice and Harsh Environment Operations.
Sustainable	Cégep de Jonquière. Protection of organic crops.
Agriculture	Cégep de Sainte-Foy: Growing hedgerows that produce food.
	College Boreal: Using wood ash as fertilizer.
	<i>NAIT</i> : roof top gardens (Assessing the benefits of living roofs including energy savings, management of storm water runoff, food production and extended growing seasons). ¹⁷⁷
	<i>Niagara College</i> : Canadian Food and Wine Institute (CFWI) – teaching and research in Canadian regional cuisine and culinary arts.
Social	Red River: Early Childhood Development research, in partnership with Switzerland;
Innovation & Health	Children's well-being project in partnership with Israel.
Treattr	<i>Red Deer</i> : Rural Health and Community Development a research priority area, supported by a Rural Health Research Chair. Focus on needs of the Region and helping participants apply and use knowledge in practical, local settings. ¹⁷⁸
	<i>Humber</i> : Youth Engagement in Organizational Decision-Making (2014). Focus on youth leadership and decision- making in programs and organizations, and positive youth. development (e.g. roles in youth councils, advocacy projects, peer leadership, program planning) and in the development of the '6 Cs': competence, social connections, caring, confidence, character, and contribution.) ¹⁷⁹
Various	<i>Lakeland:</i> Applied Research and Innovation activities focus on energy entrepreneurship, agriculture, sustainable environments and buildings, and fire and emergency medicine.

 ¹⁷⁷ http://www.techlifemag.ca/enjoy-centre-living-roof.htm
 ¹⁷⁸ Institutional Research Plan, RDC https://rdc.ab.ca/sites/default/files/uploads/documents/2206/rdc-institutional-research-plan-dec-2010.pdf

¹⁷⁹ http://humber.ca/research/project/453/youth-engagement-organizational-decision-making

5.2.5 Green Culture

The most challenging of Majumdar's fivefold framework of institutional pillars, 'green culture,' includes "green values, green attitudes, green ethics, [and] green practices." For the purposes of this study, green culture is aligned with issues that should be infused across the whole institution, such as access and equity, gender equality, inclusive societies, and justice - and TVET's capacity to respond to them. Canada's colleges and institutes have, for many years, been working to create institutional cultures that embrace these ideals through policy, practice and teaching and learning strategies.

Access

Making learning/knowledge "available to all in society through open access methods" is a key theme in the recent literature.¹⁸⁰ It is captured in SDG 4: "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." It includes "incentives and outreach strategies to promote uptake in training, particularly among vulnerable groups and SMEs" and might extend to targeting of specific groups as part of the conditions of project funding.¹⁸¹ Access in both developed and developing countries includes use of delivery modes that are aligned with learner needs and which are accessible to them on the continuum of lifelong learning.

Canada's colleges and institutes have a long history of working with learners who, for a variety of reasons, have been disadvantaged in accessing or transitioning to postsecondary education. These audiences include First Nations and Aboriginal youth, First Generation learners, 'second career' learners (those unemployed through job displacement), unemployed youth, rural learners, those with disabilities, and women.

Institutions have been responsive to these needs in adapting curriculum and teaching, learning and delivery strategies as well as creating an inclusive and welcoming college culture. Educational supports such as Prior Learning Assessment and Recognition services, pre-technology programs and initiatives aimed at improving women's successful participation in programs in which they have been traditionally underrepresented, are but a few examples of supports designed to improve access that are commonly found in Canadian colleges and institutes.¹⁸²

¹⁸⁰ PAGE (2015) First Global Forum on Green Economy Learning, 14.

¹⁸¹ Cedefop (2013) *Skills for a low carbon Europe,* 14.

¹⁸² For further information on the issue of access and the supports to enhance access, see Colleges Ontario (2004), Canada's Most Important Economic Investment: Increasing Access to College Education and Training, available at URL: http://www.collegesontario.org/policy-positions/positionpapers/CO_CANADA'S_MOST_IMPORTANT_ECONOMIC_INVESTMENT.pdf.

Gender Equality, Women, Youth and Inclusive Societies

SDG #16 aims at promoting "peaceful and inclusive societies for Sustainable Development; provide access to justice for all and build effective, accountable and inclusive institutions at all levels."¹⁸³ Recent literature places a special emphasis on the concept of social inclusion; ensuring that the most disadvantaged, often women and girls and youth, have access to training and education as well as a pathway to sustainable jobs. *The Muscat Agreement, 2014,* (an outcome of the Global Education for All meeting), focused attention on gender equality and the most marginalized and this is further emphasized across the Sustainable Development Goals. Educated women, it is argued, "have more power to act for the benefit of their children" as well as advocating for better nutrition and health (SDG 2).¹⁸⁴ SDG #5 also makes persuasive arguments for gender equality. Education 'empowers' the most vulnerable, especially women. It gives them voice, boosts self-esteem, gives them more control over factors such as family size, marriage and child birth.¹⁸⁵

Youth are a primary agent in "envisioning and shaping a more sustainable future." This is the generation that 'must not only cope with the consequences of unsustainable development today, but also bear the brunt of unsustainable development tomorrow'. Youth in emerging countries are finding their voice and seeking input in decision making. They "have the potential to propel sustainable development more widely and urgently."¹⁸⁶

The GAP is particularly forceful on their inclusion urging the empowering and mobilizing of youth, supporting them in their role as "change agents for Sustainable Development through ESD", and acquisition of participatory skills.¹⁸⁷ Education institutions must be responsive, engaging them via delivery modes and "multiple pathways of learning,"¹⁸⁸ that are safe and familiar, including informal learning, e-learning and use of mobile learning opportunities.¹⁸⁹

A *Youth Skills Development Program*,¹⁹⁰ (2015-17), which was delivered collaboratively by the College of the Rockies, Bow Valley, and NSCC on St Vincent and the Grenadines, Dominica, is one example of a youth/young adult program designed to respond to the specific needs of developing countries, as well as aligning with the SDGs for 2030. Intended to prepare "the most vulnerable 15-29 year olds", "who are not in school and

¹⁸³ UNESCO (2014) Sustainable Development Post- 2015 beings with Education,11.

¹⁸⁴ Ibid, 2.

¹⁸⁵ Ibid, 5.

¹⁸⁶ UNESCO (2014) Road Map for Implementing the Global Action Plan, 22.

¹⁸⁷ UNESCO (2013) Proposal for a Global Action Programme on ESD, 4.

¹⁸⁸ UNESCO (2014) *Muscat Agreement,* 2.

¹⁸⁹ UNESCO (2013) Proposal for a Global Action Programme on ESD, 4.

¹⁹⁰ Funded by Global Affairs Canada and the UK Dept. of International Development.

not employed" with basic skills in electrical installation, plumbing, hairdressing, food preparation, food and beverage, auto mechanics or data operations, the program not only provides basic training in the skilled trades but integrates essential employability skills, and entrepreneurship into the vocational curriculum.¹⁹¹ The project includes a Gender Specialist on the development team to ensure that the "cross-cutting theme of equality between men and woman is integrated into curriculum development, lesson planning, recruitment, retention and career advising."¹⁹² Train the Trainer workshops were developed for instructors with the goal of infusing "awareness and practice of equity" into classroom culture in the hope of promoting the same principles in workplace culture.¹⁹³ The program illustrates the ways in which multiple themes need to be addressed concurrently, and includes the integration of environmental sustainability and sustainability literacy across the curriculum.

Sustainable, Just and Peaceful Societies

GTVET is also leveraged as an agent for societal change. The 2014 *Muscat Agreement* urged that by 2030 "through global citizenship education and education for sustainable development" all learners would "acquire knowledge, skills and values and attitudes to establish sustainable and peaceful societies."¹⁹⁴ A year later, the UN SDG # 4, (Target 4.7), went further, ensuring that by 2030 all learners will acquire the knowledge and skills needed to promote "sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development."

Issues of access, equity, social inclusion, poverty reduction and social change as well as human rights are complex. Canadian colleges and institutes continue to work towards building institutional cultures that address these issues through curriculum, student engagement, policy and modelling effective practice and international development. Increasingly, they are choosing to address these issues in their mission and values, as well as adapting teaching and learning strategies to be more responsive to them. Those institutions in areas with high populations of First Nations and Indigenous youth have collaborated with their local communities in order to co-create an appropriate culture of teaching and learning. The Global Action Programme notes that ESD "is grounded in a rights-based approach to education."¹⁹⁵ This is a core strength of Canada's colleges and institutes and of Canada's cultural values.

¹⁹¹ CICan (2015) Youth Skills Development Program Institutional Partnership Brief.

¹⁹² Ibid.

¹⁹³ Ibid.

¹⁹⁴ UNESCO (2014) *Muscat Agreement,* Target #5, p3.

¹⁹⁵ UNESCO (2013) *Proposal for a Global Action Programme on ESD*, 2.

Green Culture Area	Examples of Greening of Core College Functions in Canada	Selected Canadian Case Examples
Access & Equity	rss & Creating institutional ty cultures that are safe and which welcome under served and disadvantaged student populations including First Nations and Aboriginal youth, First Generation learners, the unemployed and under-employed, youth, rural learners, those with disabilities, and	College programs and courses for traditionally under-served student populations - Indigenous Includes college preparation such as Indigenous Pre-Health Studies and Indigenous Preparatory Studies, (<i>Canadore</i>) as well as credentials such as: <i>Algonquin:</i> Indigenous cook pre-apprenticeship program with a focus on Aboriginal cuisine and culture taught by indigenous instructors <i>Aurora (NWT):</i> Environmental Monitoring Training Program -Aboriginal <i>University College of the North (UCN):</i> development of an Industrial Skills Trades and Training Centre (ISTTC) to ensure First Nations, Métis and Inuit populations have access to skilled trades training in multiple areas, including renewable energy. ¹⁹⁶ <i>Canadore:</i> Aboriginal Women in the Trades program (a 12-week certificate program covering building construction, electrical, plumbing, and carpentry).
Desig curric teach strate releva learni that le emplo	Designing and adapting curriculum and teaching and learning strategies to create relevant and accessible learning opportunities that lead to employment	St Clair: Native Community Worker - Aboriginal Healing Methods.Northwest College -partnerships with South America that align the institutional culture of working with Indigenous communities with sustainable practices in mining and resource extraction.Government sponsored college programs promoting access for traditionally under- served student populationsSecond Career: A Government of Ontario initiative supporting the transition of laid-off workers seeking skills training and helping them find jobs in high-demand occupations in Ontario

Table 10. Green Culture: Core College Functions and Canadian Examples

¹⁹⁶ http://news.gc.ca/web/article-en.do?nid=1078389&tp=1

Green Culture Area	Examples of Greening of Core College Functions in Canada	Selected Canadian Case Examples
		<i>Dual credit programs:</i> A Government of Ontario initiative supporting student transitions from high school to college/apprenticeship through learning options and building career awareness at community colleges. Includes Dual Credits, Specialist High Skills Majors and Cooperative Education. Credits count towards the OSSD and college credentials
Inclusive	Design of inclusive	Voluntary Protocols
Diversity	green skills with levels	CICan: pan-Canadian Indigenous Education Protocol. ¹⁹⁷
	of learning/specific	Required Protocols
	learner needs, including those vulnerable to exclusion	Ontario's Colleges are required to have an Aboriginal Council on Education.
		Examples of Inclusive Curriculum and Core Competencies
	Developing a global learning community through recruitment/hosting of international students from developing countries; providing opportunities for all students to engage in SD activity and cultural exchange, and the promotion of diversity and peaceful, just and civil societies.	<i>Centennial College:</i> Signature Learning Experience: Global Citizenship & Equity, the outcomes of which can be attained through a student portfolio
		<i>Northwest</i> (BC): integration of First Nations environmental principles into curriculum and teaching practice. Programming in Environmental Monitoring, Field Schools in Environment Science and Geography inclusive of First Nations traditions and environmental principles
		<i>Yukon</i> : a core competency in knowledge of Yukon First Nations, is now required of all students
		<i>Northern:</i> incorporation of Aboriginal Traditional Knowledge (ATK) across the curriculum; student support and success tools designed to attract and retain Aboriginal learners and support them at all stages in post-secondary educational attainment. ¹⁹⁸
		Services & Institutional Practices

 ¹⁹⁷ http://www.collegesinstitutes.ca/policyfocus/indigenous-learners/protocol/
 ¹⁹⁸ Strategic Mandate Agreement: http://www.northernc.on.ca/docs/northerncollegestrategicmandateagreement.pdf

Green Culture Area	Examples of Greening of Core College Functions in Canada	Selected Canadian Case Examples
		There are numerous examples of changes to institutional culture in order to better align with the needs of Indigenous students. These include: Indigenous-centred support services; creation of safe and culturally appropriate learning environments such as learning centres, student lounges, or on-campus tipis (Confederation, Northern); mentorships; access to Elder/Métis Senator services; integration of Indigenous history and culture across the curriculum, and fostering cultural and economic development relationships with local Indigenous communities. ¹⁹⁹
Mission, (vision t mandate and core values i i	Colleges present themselves to prospective students and to their communities as institutions that have integrated principles of sustainability into their core values, decision- making processes and academic culture.	Excerpts from College Mission, Vision Statements
		<i>George Brown</i> 'We will create a community of life-long learners, grounded in the principles of access, diversity, mutual respect and accountability'
		<i>University College of the North</i> : to ensure Northern Manitoba communities and people have access to educational opportunities, knowledge and skills, while being inclusive and respectful of diverse Northern and Indigenous values and beliefs.
		Excerpts from College Core Values
		Nova Scotia: diversity and inclusion, sustainability, accessibility, & innovation
		Northwest: inclusion of First Nations Heritage and Culture; sustainability
		Camosun: Indigeneity, diversity, sustainability
		Douglas: social, environmental and community responsibility.
		<i>Georgian:</i> Focus 2015 strategic plan highlights commitment to environmental sustainability as a core value.

¹⁹⁹ http://www.collegesinstitutes.ca/policyfocus/indigenous-learners/protocol/

Green Culture Area	Examples of Greening of Core College Functions in Canada	Selected Canadian Case Examples
InstitutionalSplans,astrategiccpriorities andapoliciesopstrategiccpddd	Sustainability principles are integrated into college strategic, academic and operational plans, policies and practices.	Sustainability Plans
		There are numerous examples of Sustainability (Green) Plans. Some, like George Brown are now on their second iteration with the opportunity to reflect on goals and targets met. Facilities Management, (Energy, Water, Waste, Housekeeping and Green Cleaning); and Policies and Practices (Green Purchasing, Paper, Food Services and Transportation). <i>Some</i> <i>have involved massive consultations: the Humber</i> Sustainability Plan, <i>2014-2019</i> was based on inputs from 5,000 community stakeholders.
	Stakeholder engagement in development of sustainability agendas.	Development of an institutional sustainability plan is a requisite for the basic Level 1 certification under the <i>Cégep vert</i> certification. Some 39 Cégeps are certified, most at the highest level.
		Excerpts from Strategic Priorities:
		<i>North Island, BC</i> : "Aboriginal Education and Indigenization"; includes: developing and implementing an Aboriginal Education Policy and action plans; ensuring governance structures recognize and respect Indigenous peoples; implementing intellectual and cultural traditions of Indigenous peoples throughout curriculum and learning; increasing the number of Indigenous employees; promoting understanding and reciprocity among Indigenous and non-Indigenous people; enhancing Indigenous-centred services and building relationships with Indigenous communities. ²⁰⁰
		<i>Fleming College "Leading in Sustainability":</i> includes: Infusing sustainability across the curriculum and across the student experience so that graduates understand and address sustainability issues; Designing and implementing community-based applied learning opportunities to contribute to sustainable communities. ²⁰¹
		In a 2012 survey, <i>The Sustainability and Education Policy Network</i> ranked Canadian colleges and universities on the presence of sustainability policies. ²⁰²

 ²⁰⁰ Web site: www.nic.bc.ca/about_us/governance/bog/policies/vision.aspx
 ²⁰¹ http://flemingcollege.ca/PDF/Fleming-College-Strategic-Plan-2010-2015.pdf
 ²⁰² Web site: http://sepn.ca/research_results/sustainability-initiative-scores-post-secondary-institutions/

Green Culture Area	Examples of Greening of Core College Functions in Canada	Selected Canadian Case Examples
Student and faculty	Students are immersed in a college culture of sustainability that permeates all aspects of	Work Culture
engagement		Humber, Mohawk, and Red River colleges listed in the top 100 Canada's <i>Greenest Employers</i> 2016 ²⁰³
sustainability	student life (food	Student Engagement
culture	services, waste management, transportation, energy conservation, green residences) Measurement of progress against sustainability indicators	<i>Sierra Youth Coalition - Sustainable Campuses</i> is a Canadian national initiative that inspires, informs, trains, and supports Canadian students working toward social equity, ecological integrity and economic prosperity on their campuses.' 'These changes are achieved through changing institutional operations, improving curricula and mobilizing campus community members' support.' The goals are to: 'Change environmental and social practices on Canadian campuses' and 'Empower youth to influence decision makers.'
		College Culture
		Some colleges such as <i>Loyalist</i> have a joint Sustainability Steering Committee – comprised of faculty members, administrators, staff and students. Loyalist also has a Sustainability Communications Plan to ensure the college community is fully aware of activity.
		Loyalist's Sustainability Plan integrates 'socio-cultural' sustainability principles into extra curricula areas such 'cultural, sports, recreational and other activities'.

²⁰³ www.canadastop100.com/environmental/

6 SUMMARY AND CONCLUSION

Canadian colleges and institutes have successfully engaged in the greening of their core business and in the integration of green skills and sustainability across the curriculum, though they are at different places on the sustainability continuum. Despite the absence of significant and effective national, and in some cases provincial, incentives, strategies and policy directives, there is evidence that they have the capacity to engage in GTVET and related sustainability initiatives from the local to the global level. They have demonstrated a state of readiness for change and are positioned to respond to the overarching goal of the 2014 UNESCO *Road Map for Implementing the Clobal Action Programme on Education for Sustainable Development* which is "to generate and scale up action in all levels and areas of education and learning to accelerate progress towards sustainable development."²⁰⁴

Policy and Labour Market Information (LMI)

The literature reviewed for this study advocates a 'whole of government' approach to skills development in order to ensure the integration and connectivity of policy and processes across sectors and at various levels of government. To date, there has been a lack of significant policy initiatives, and coordinated policy at the federal level in Canada that connects sustainable development, environmental sustainability, the inclusive green economy and technical/technology skill development and training. There is also a lack of reliable LMI. Human resource needs assessment and planning have, in the past, often been addressed in a sector-specific way that does not get to the emergent, greener, cross-sectoral occupations, the new skills combinations associated with climate change (that will, for example, cross health, social science, agriculture and technology) and the notion of an "inclusive green economy." In many jurisdictions, LMI remains a significant barrier in developing TVET capacity to meet and anticipate training needs. In Europe, Asia and Africa there are indicators that skills mismatches, skills shortages, underprepared graduates and skills bottlenecks are leading to unemployment and lost economic opportunities in emergent industries.²⁰⁵

Role and Positioning of TVET

The role of education is pervasive in the *2015 Sustainable Development Coals* for 2030, but the supporting UNESCO report, *Sustainable Development Post 2015-Begins with Education*, makes clear that education "is a catalyst for development," the full potential of which has yet to be realized. Moreover, it underscores the notion that "sustainable development for all countries is

²⁰⁵ For example: S4YE (2015) *Toward Solutions for Youth Employment A 2015 Baseline Report* <u>https://www.s4ye.org/sites/default/files/Toward Solutions for Youth Employment Full.pdf</u>; Cedefop (2014)
 Briefing Note. Skills Mismatch: More than Meets the Eye <u>www.cedefop.europa.eu/files/9087 en.pdf</u>; ILO (2011)
 Skills for Green Jobs A Global View Synthesis Report Based on 21 Country Studies.

²⁰⁴ UNESCO (2014) *Road Map for Implementing the Global Action Programme on Education for Sustainable Development,* 14.

http://www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/@publ/documents/publication/wcms_159585.pdf

only truly possible through comprehensive cross-sector efforts that begin with education." As such, TVET has a significant role in meeting the targets of each one of the SDGs.²⁰⁶

Climate change impacts, mitigation and adaptation, as well as resilience, are now referenced as an assumed and necessary re-positioning of TVET. This new layer of skill development is not only complex and challenging, but will push institutional capacity, not necessarily because of new skill requirements, but because of the challenges associated with new skills combinations as well as the effective integration of social and cultural issues. Often marginalized and sometimes omitted in the early development of the technical green economy, these are now integral to it, and require that TVET go beyond the vocational. In effect: "transformative TVET for sustainable development requires an insistence on an integrated notion of skills for work and life."²⁰⁷

After much effort in the earlier part of the decade to identify "new" green specialized skills, there is now general consensus that these are relatively few in number but that there are a much larger number of broad-based green technical skills (sometimes called transversal skills) that cross various sectors (e.g. energy conservation, waste management). There is a new focus on the transitioning or greening of existing skills in all occupational areas (every job a green job) and a need for a much stronger focus on the integration of essential, generic, or soft skills *for* sustainability across the curriculum. These are change agent skills such as systems thinking or taking accountability for one's actions and the capacity to solve complex problems. This is a significant agenda, and there appear to be few frameworks, tools and processes in order to help facilitate this change in a systematic way. Not only are these skills combinations still being mapped to occupational areas, different strategies for teaching and learning will be required to integrate them effectively, especially the "change agent" skills and habits of mind. Done well, these transformations will test institutional capacity.

Although there have been efforts in some provinces to promote academic and workplace mobility, the overall need for modification of qualifications and credentials to better respond to and align with the IGE has been identified as a concern across the literature. Canada already has multiple, and thus fragmented, credentials frameworks as well as relatively siloed, sectorspecific occupational standards.

The Role of CICan and Canada's Colleges and Institutes

This study has been an important first step, something of a bench mark—albeit an incomplete one—in assessing the level of activity, creativity and innovation of Canada's colleges and institutes in the integration of sustainability across operations and academic programs. Many institutions have reached a remarkable point of maturity in this regard, with projects and programs across many, or all, of UNESCO-UNEVOC's "Five Dimensions of Greening TVET." The study points to a number of future initiatives. One is engaging Canada's colleges and institutes

²⁰⁶ UNESCO (2014) Sustainable Development Post 2015- Begins with Education, preface, n.p.

²⁰⁷ UNESCO-UNEVOC (2015) *Skills for Work and Life*, 8.

in renewal of the CICan *Pan-Canadian Protocol for Sustainability*, developed in 2007, and ensuring its relevance in a post – 2015 world. More recently, the American Wildlife Federation engaged community colleges in a US-wide consultation in the interests of developing a national, voluntary, green-skilling strategy, with targets. It presents another model by which to engage colleges and institutes in dialogue around the SDGs for 2030 and ways to move forward on a common agenda, allowing for regional differences and without being prescriptive.²⁰⁸

Much of the literature identified the need for more mechanisms to facilitate the sharing of effective practices, promising or next practices, and case studies, through networking and other forms of information sharing. A "systematic" approach is being widely promoted in the development of "green-er" programs and curricula, and there is a need to identify and share this knowledge. Further research in this area would be useful and is another area to which CICan could contribute by assisting in brokering and promoting methods and practices that are scalable and transferable. In particular, Canada's colleges and institutes have developed institutional policies, processes, practices and models that align with and could help inform the Five Dimensions model.

There is a new focus on international co-operation, larger regional projects, networks, and an emerging global vision around sustainable development goals and the *transformation* of TVET. The critical question is the extent to which the attributes of Canada's colleges and institutes are more broadly scalable and transferable to an international context than has yet been demonstrated. Germany, for example, has a strong, national TVET system and is actively, sharing methods and programs internationally. In contrast, it might be said that Canadian institutions are operating as individual institutions, or in small-scale partnerships, where international work is, if not part of a concerted national agenda, is increasingly part of a de facto agenda.

A 2011 ILO-Cedefop study concluded that "the skills response component in most of the documentation for adaptation and mitigation measures, policies, strategies, action plans and programs initiated in response to climate *is either limited or non-existent.*^{"209} Canadian colleges and institutes and their faculty have significant capacity in these areas. TVET is positioned on a continuum where success, (social and economic stability), is measured in the form of long-term employability and sustainable work in a localized, greener economy and sustainable community. Canada's colleges and institutes, with a tradition of community engagement and responsiveness to local labour market needs, are uniquely positioned to respond to this agenda. But they also bring something more: they sustain institutional cultures that are particularly well aligned with the social and cultural aspects of the SDGs.

²⁰⁸ See *Greenprint: A Plan to prepare Community College Students for Careers in the Clean Economy, 2015*. The US strategy is not prescriptive, but it is directional and offers colleges a vision of a sustainable future, and their role in it.

²⁰⁹ Cedefop-ILO (2011) *Skills for green jobs a global view,* xix, xx.

In order to engage successfully in any of these activities, and to provide the leadership that is expected of its role as the UNESCO-UNEVOC Co-ordinating Centre for North America, CICan itself requires greater research capacity to investigate, mobilize and leverage the work of Canada's colleges and institutes in areas such as curriculum, applied research and campus greening.

Conclusion

Canadian colleges and institutes have, by any standard, done well in responding to the ESD agenda, especially in their capacity to mobilize ESD at the local level. They have been anticipatory, responsive and innovative in transitioning to supporting the greening of the workforce and developing an institutional culture of sustainability. They are able to mobilize quickly, adapt systems and processes on-the-fly, engage stakeholders effectively, build project teams, manage complex partnerships, engage in applied research, and adapt programs and curriculum to meet new and emergent learner needs and contexts. They have used their often-limited resources to contribute in significant ways to international development projects. It is also evident that individually and collectively they are limited by many of the same issues as TVET systems in developing countries, though the scale may differ.

Across the globe, education systems, including TVET, will increasingly be charged with significant responsibilities in both combating and coping with climate change impacts. There are expectations that TVET will both transform to a greener self and at the same time act as a transformative agent. As such an agent, it will be a lead actor in finding localized solutions to climate change impacts; developing effective training and educational opportunities in response to new and emerging technologies that will lead to secure, greener and sustainable local jobs, and; engage local communities in sustainable development initiatives by modelling effective practices and the provision of informal learning. Properly aligned with national development priorities and climate change strategies, GTVET could be a major force in reaching the targets established for the SDG goals for 2030. Most importantly, if TVET systems are able to integrate principles of ESD, they may have a profound effect on the individual, contributing to significant changes not only in skills but also in values and world-views. ESD has the potential not only to build workforces for the green economy, but to help develop a next generation of engaged, motivated, educated youth and adults committed to building a more sustainable future in their respective communities.

This is a huge agenda. It would be so for a well-funded, mature and high functioning collegiate system in a developed nation. The systems, methods, processes, and frameworks in developing countries are emergent. These are areas in which Canadian colleges and institutes could make a significant contribution, not just in areas of content expertise but in helping to think through the infrastructure required for sustainable economic development.

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APPENDIX A: COLLEGES PARTICIPATING IN 2016 ESD SURVEY

Algonquin College (QC) Camosun College (BC) Cégep de Jonquière (QC) Cégep de Sherbrooke (QC) Cégep de Victoriaville (QC) Cégep Édouard-Montpetit (QC) Cégep Garneau (QC) Cégep régional de Lanaudière à Joliette (QC) Collège communautaire du Nouveau-Brunswick (NB) Fisheries and Marine Institute of Memorial University of Newfoundland (MI) (NL) Fleming College (ON) Georgian College (ON) Humber College (ON) Lakeland College (AB) Niagara College (ON) Northwest College (SK) Norquest College (AB) Nova Scotia Community College (NS) Okanagan College (BC) Red River College (MB) Seneca College (ON) Southern Alberta Institute for Technology (SAIT) (AB) St Lawrence College (ON)

APPENDIX B. THE CICAN APPROACH TO TVET CAPACITY BUILDING IN DEVELOPING COUNTRIES



APPENDIX C: ESD SURVEY QUESTIONS

Among colleges, there is an emerging pan-Canadian approach to learning for sustainability and the development of green skills and technologies. Regardless of institutional and/or provincial differences, it builds on existing core functions and what colleges traditionally do well and demonstrates college responsiveness, flexibility and adaptability.

- Select a case study/project from your own institution, or a partnership project, that best exemplifies how commonly held college values as well as academic, research, or operational practices can be successfully applied, modified, and combined, in the interests of green skilling/sustainability. If possible, also identify an example from an institution with which you are not affiliated, but which you think has merit. Briefly describe the projects and the approach. They don't have to be large-scale, but consider scalability and transferability, as well as relevance to the greening of TVET in a more global context. An example might include re-skilling an existing workforce through strategies such as a cross-sectoral initiative, collaboration with SMEs, flexible and responsive program design, or 'up-skilling' through 'stackable credentials' that reduce duplication.
- 2) What do you consider to be your key college strengths in program and skill development related to education for sustainable development, environmental sustainability, climate change, adaptation and mitigation and transitioning to an integrated green economy?

Describe briefly, and consider college capacity to adapt these programs and initiatives to an international context of TVET.

- 3) Given the transition from focussing on green technical skills in discrete program areas (such as renewable energy), to the prospect of 'every job a green job'; what are some of the most effective and transferable strategies for transforming curriculum and integrating green technical skills and skills for sustainability across all programs, at your college?
- 4) Many colleges have adapted academic and operational policies as well as mission and values statements to reflect institutional commitment to the greening of operations and learning for sustainability. Identify and briefly describe the <u>one</u> strategy which produced the greatest effect in furthering sustainability goals, and changing college culture. Consider how this 'whole of institution' approach could be transferable to other contexts.

In answering the questions, a web link, and/or contact information for follow-up, would be helpful.

APPENDIX D. GREEN SKILLS TYPOLOGY FOR TECHNICAL AND TECHNOLOGY-BASED TVET

This skills typology was originally developed by the author; the original version applied specifically to Ontario colleges, but is broadly applicable to TVET in general. (Knibb, 2015)

Skill types	Description and application to the work place
Specialist	These skills most commonly apply to what are sometimes called 'deep'
technical skills	green jobs. They may be:
	 Job specific, or distinct to an emergent, occupational area 'New', but more commonly are adapted from existing occupational areas, or represent a fusion of existing, but often very different skills for a new application (e.g. installation of roof-top PV panels) Few in number, relative to other skills categories Focused on the production of goods and services Time-sensitive, (requiring rapid development), or time-limited, (e.g. installation of a particular product that may have a limited shelf-life) Some may be positioned at the granular level, requiring only 'surface learning' (such as the capacity to follow, accurately, manufacturer's instructions for installation). Others may be complex requiring site assessment and design skills. Examples: photo-voltaic systems design; installation of photo-voltaic
	panels, decommissioning of wind turbines.
Broad-based technical skills	 These skills apply to a broad range of technical/technology programs. Includes new(er) or modified green, (or environmental), skills common across multiple jobs, occupational areas, industries, or sectors and/or program 'families' (programs within the same cluster, possibly at different levels of learning). Several models for these have been developed at a jurisdictional level (e.g. UK's <i>Skills for a Low Carbon and Resource Efficient Economy</i>). Identification of these skills might help promote greater consistency of approach, as well as commonalities across education/training programs. Once identified, these skills can be adapted to different workplace contexts. Examples: life cycle assessment; impact minimization processes; reporting for sustainability; carbon accounting; energy conservation; waste reduction and management.
Transitioning skills	 Represent the adaptation of existing vocational skills to include more sustainable practices and processes. Most common skills types for 'light' green jobs where a percentage of the work may need to adapt to new practices. Modifications may be incremental

	 Represents a large skill cluster of particular significance in re-
	positioning <u>all</u> academic programs around change in work
	processes.
	Examples:
	 Business (green procurement; stakeholder engagement);
	 Construction (materials selection; building decommissioning
	and materials reuse; appropriate disposal);
	 Culinary arts (selection and use of energy efficient appliances;
	waste reduction; sourcing of local food).
Skills for sustainability (transversal skills)	 Future-oriented skills for sustainability, (e.g. thinking, process and change agent skills; 'habits of mind'), that can help build desirable graduate attributes such as resilience and adaptability in an unpredictable and changing work world and climate. Considered to be key skills for the 21st Century workplace and 'career capital'. They 'prepare people to cope with, manage and shape social, economic and ecological conditions characterized by change, uncertainty, risk and complexity' (Sterling, 2012, 9). They complement, and can be integrated into, existing frameworks for generic skills, essential employability skills, or so-called 'soft' skills. Do not require frequent up-dating. May be challenging to teach to, and assess. Must be embedded in curriculum not taught 'stand-alone.' Require 'deep' learning. Examples: systems thinking, capacity to solve complex problems, civic responsibility, accountability for the consequences of one's actions, ethical/moral decision-making, the capacity to work in
	intergenerational, culturally diverse environments.