

MOWAT RESEARCH #156 | OCTOBER 2017

Decent Work in the Green Economy

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Mowat Centre
ONTARIO'S VOICE ON PUBLIC POLICY



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About This Paper

In 2017, the Mowat Centre and Smart Prosperity Institute partnered with the intention of raising awareness and sparking discussion on decent work considerations in Ontario's green transition. As the province moves toward a greener economy, policymakers must consider the implications of the resulting changes on employment opportunities and particularly opportunities for decent work. Our research aims to explore this impact, identify where workers might be vulnerable to disruption, and consider where policy intervention may be beneficial.

This report is the product of a literature review on both green transition and labour market trends in Ontario, an applied economic and technological model of Ontario's cap and trade program, an analysis of policy relevant concepts, expert interviews and ongoing engagement of stakeholders within government, industry, labour and social justice circles. We hope that this research initiates a conversation between those advocating for decent work and those actively supporting a transition to the green economy, and increases the number of people working on the intersection of these issues.

Acknowledgements

The Mowat Centre and Smart Prosperity Institute thank the Atkinson Foundation whose generous support through the Atkinson Decent Work Fund made this project possible.

Thank you to those who dedicated their time to participate in the Decent Work in the Green Economy workshop and provide feedback on early drafts of this paper, as well as our external reviewers and those who participated in key informant interviews.

Thank you to Elaine Stam for her design work on this report. Munachi Victor-Nwosu assisted with researching and writing the case studies. Sunil Johal (Mowat Centre) and Michelle Brownlee (formerly Smart Prosperity Institute) provided project direction. Economic modelling was provided by EnviroEconomics and Navius Research. Any errors or omissions are the sole responsibility of the authors.

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Smart Prosperity Institute (formerly Sustainable Prosperity) is a national research network and policy think tank based at the University of Ottawa. We deliver world-class research and work with public and private partners – all to advance practical policies and market solutions for a stronger, cleaner economy.

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The Mowat Centre is an independent public policy think tank located at the School of Public Policy & Governance at the University of Toronto. The Mowat Centre is Ontario's non-partisan, evidence-based voice on public policy. It undertakes collaborative applied policy research, proposes innovative research-driven recommendations, and engages in public dialogue on Canada's most important national issues.

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©2017 ISBN 978-1-77259-057-9

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If the right policies are not put in place through the green transition, we will have missed a vital economic and environmental opportunity to draw upon the diverse skills and perspectives of all Ontarians to solve today's pressing challenges.

EXECUTIVE SUMMARY

Economies around the world are in transition as businesses, citizens and governments embrace new ways of generating growth that put less strain on the planet. For many economic sectors, the transition to a green economy means opportunity. For other sectors, the transition is potentially disruptive. Good government policy is necessary in both instances to ensure that the benefits of the green transition accrue to all, and that any negative impacts on sectors, communities and workers are effectively managed.

In Ontario, the transition to a low-polluting, resource-efficient economy is occurring at the same time as other disruptions: employment continues to shift away from goods-producing sectors and toward services and knowledge-intensive industries; rapid technological change is automating routine tasks, putting some traditional occupations at risk; work is becoming more precarious; and wages remain stagnant amid rising living costs. Further, the impacts of these changes are not distributed evenly across society, amplifying existing inequalities.

Initiating a conversation between those actively supporting the transition to a green economy and those advocating for decent work is indispensable. Communicating the economic and business opportunities that a green economy will bring to both industry and workers will be vital to ensure the success and momentum of the transition. The benefits must be shared, and any negative impacts associated with this transition need to be identified, mitigated and managed to ensure prosperity for all. Importantly, this conversation must address the need for equal opportunities among historically disadvantaged and equity-seeking groups who currently face barriers to accessing decent work. If the right policies are not put in place through the green transition, we will have missed a vital economic and environmental opportunity to draw upon the diverse skills and perspectives of all Ontarians to solve today's pressing challenges.

Ontario's green transition will be similar to those in other jurisdictions in that it will impact workers and reverberate throughout most sectors of the economy. Compared to business-as-usual, some sectors are expected to grow under a green transition (e.g. utilities – especially renewable energy – and waste management and remediation services); others may see lower growth (e.g. certain heavy industry sub-sectors such as petroleum refining and petrochemical production), and the skills demand and employment profiles of many others could be transformed (e.g. mining, manufacturing, forestry).

These sectoral changes will directly affect workers and their ability to access decent work. For example, most sectors that are expected to grow under a green transition tend to have higher wages than the provincial average and will likely see growth in jobs that require high levels of education and specialized skills (e.g. science and engineering, operations management, skilled trades). This raises important questions regarding access to post-secondary education, skills development and re-training.

It also raises questions about which workers will experience positive impacts, and which workers will experience negative impacts. Importantly, there are a number of marginalized communities that currently face inequities and barriers to accessing decent work in Ontario, which may be exacerbated by the green transition. For example, women and racialized communities appear to be underrepresented in the utilities sector – which is expected to see rapid growth in a green transition – and increased “credentialism” in green sectors may disadvantage newcomers to Canada who lack the necessary Canadian experience.

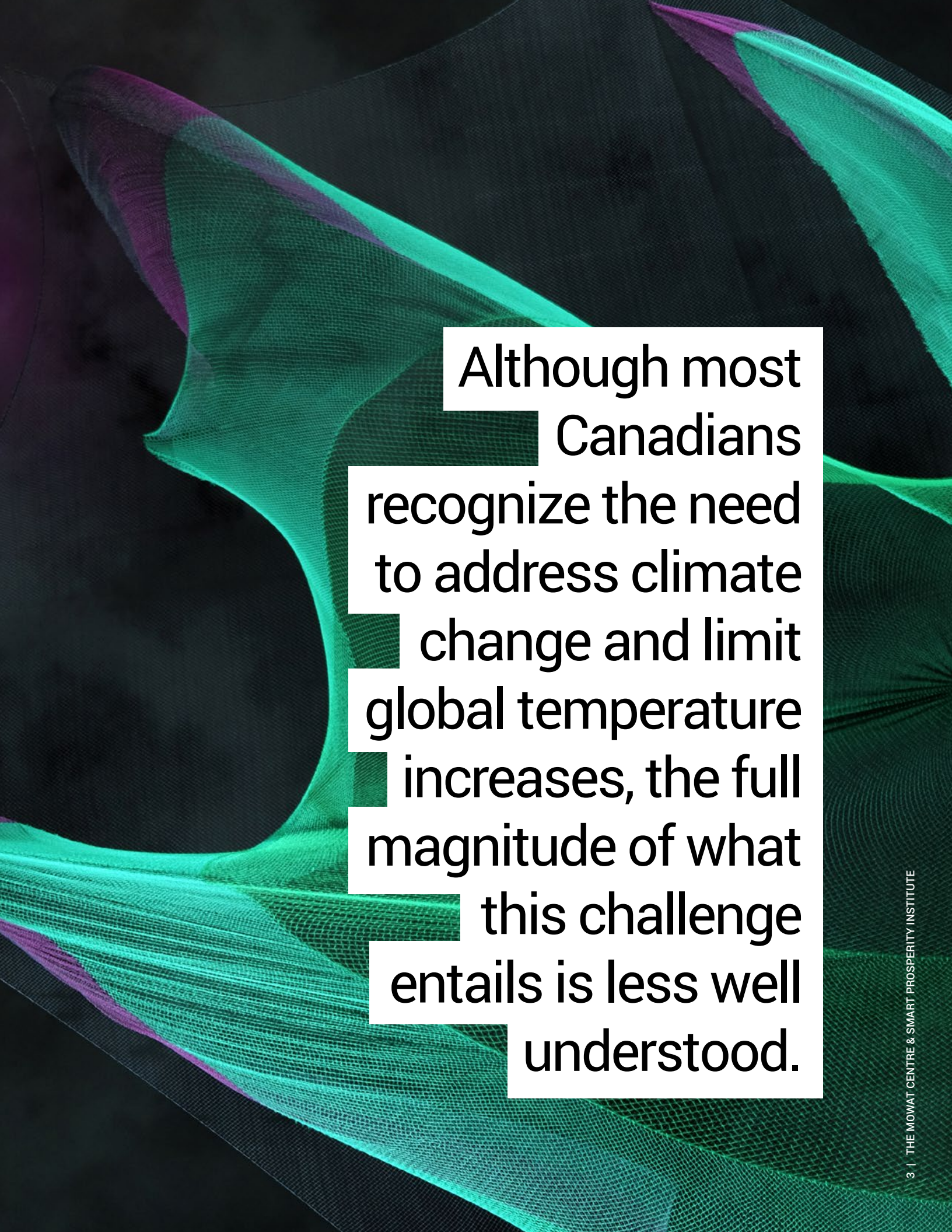
Public policy has a pivotal role in addressing the labour market impacts associated with the green transition, and many of the policies for ensuring decent work in the green economy are the same as those for promoting decent work in any economy. In particular, active labour market policies and strong social policies – such as Employment Insurance, affordable and accessible post-secondary education, access to lifelong training and skills upgrading – will be essential to support workers in the green transition.

However, the green transition also poses some unique challenges as the governments increase their policy ambition. Policymakers should consider their options in key areas such as explicitly assessing the impacts on workers

in green economy policy design, developing a comprehensive strategy to support workers in the transition to a green economy, tailoring workforce development measures, leveraging government procurement and spending power, rethinking broader social programs and striving for better data collection.

The transition to a green economy is happening irrespective of government direction. It is being driven by citizens and business and by global trends. In Ontario, the transition will have unique reverberations – both positive and negative – on economic sectors and the people who work in them. But the pace of the green transition worldwide cannot be fully predicted, posing a challenge to policymakers. Nevertheless, policymakers need to forecast and anticipate these impacts as best as they can, and ensure that policies and programs are in place that harness the full strength of Ontario’s diverse workforce to succeed in the green economy of the 21st century.

This report begins by defining the conversation and outlining the recent changes in Ontario’s green transition and broader economy, followed by a scan of sectoral impacts informed by a literature review on the impacts of environmental policy, as well as a modelling analysis of Ontario’s cap and trade program. The impacts on jobs and workers on the ground are explored, particularly for those already facing systemic barriers. Finally, the report highlights a number of policy options for supporting workers in Ontario’s transition to a green economy.



Although most Canadians recognize the need to address climate change and limit global temperature increases, the full magnitude of what this challenge entails is less well understood.



DEFINING THE CONVERSATION

What is decent work?

The concept of decent work can be a useful way to think about economic growth as defined by more than just jobs created, but also the quality of employment and working conditions. The International Labour Organization (ILO) identifies four strategic pillars of a decent work agenda: full and productive employment, rights at work, social protection and promotion of social dialogue.¹

Decent work includes opportunities that are productive and deliver a fair income and security in the workplace; social protection for families; better prospects for personal development and social integration; freedom for people to express their concerns, organize and participate in the decisions that affect their lives; and equality of opportunity and treatment.²

Decent work can also be understood as the flip-side of precarious work. Precarious work generally entails shifting risks and responsibilities away from the employer and onto the worker, resulting in more insecure and uncertain employment scenarios for individuals. Precarity tends to manifest itself in the form of temporary positions, unpredictable hours, lack of access to social protection and benefits, obstacles to collective bargaining and low pay.³ A decent work agenda aims to eliminate these challenges and improve the lives of workers.

1 International Labour Organization (2013). *Decent Work indicators: Guidelines for producers and users of statistical and legal framework indicators*. Retrieved from http://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/publication/wcms_229374.pdf.

2 International Labour Organization (nd). *The ILO's Decent Work Agenda*. Retrieved from <http://www.ilo.org/global/topics/decent-work/lang-en/index.htm>.

3 International Labour Organization (2011). *Policies and regulations to combat precarious employment*. Retrieved from http://www.ilo.org/wcmsp5/groups/public/---ed_dialogue/---actrav/documents/meetingdocument/wcms_164286.pdf.

What is the transition to a green economy?

The transition to a green economy refers to the shift in the global economy toward a model of less polluting and more resource-efficient growth. The historic 2015 Paris Agreement to limit global temperature increases to well below 2°C above pre-industrial levels, record levels of investment in clean technology (cleantech) and renewable energy, and widespread efforts to reduce pollution and environmental degradation reflect this new economic imperative to create growth while reducing strain on the planet.

In the green economy, there will also be a substantial shift toward greater resource productivity (including water and other commodities), in order to prevent their depletion.⁴ Further, green economies include finding productive uses for all types of waste or creating zero-waste systems, investing in clean infrastructure, moving to new models for urban form, better integrating and conserving nature and biodiversity in our communities, and reducing air, water and other pollutants.

Addressing climate change and other environmental pressures results not only in a cleaner environment – it also offers tremendous economic opportunity. Clean innovations and resource efficiency measures are expected to lead to trillions of dollars in savings and create new business opportunities. Estimates show that global improvements in resource and energy efficiency could generate savings of up to (USD) \$2.9 trillion by 2030.⁵ Similarly, cleantech firms will tap into a global market expected to surpass (CAD) \$2.5 trillion by 2022.⁶

This transition to a green economy brings significant change. Take climate change as an example: a recent International Energy Agency study illustrates how countries will need to deeply transform the ways they produce and use energy in order to meet the Paris Agreement targets. The study projects that by 2050, 95 per cent of global electricity generation must be low carbon, 70 per cent of new cars must be electric, all existing buildings must be retrofitted, and the CO₂ intensity of industry must be 80 per cent lower than today.⁷

In order to be consistent with the 2°C target, Canada must reduce its greenhouse gas (GHG) emissions by 80 per cent relative to 2005 levels by 2050.⁸ This will require significant actions to reduce emissions from all sectors of Canada's, and Ontario's, economies – from manufacturing goods using fewer resources, to changing how we build and power homes and buildings and communities, to radically altering how people and things move from one place to another.⁹

4 Woetzel, Jonathan et al. (2017). *Beyond the Supercycle: How Technology is Reshaping Resources*. McKinsey Global Institute. Retrieved from <http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/how-technology-is-reshaping-supply-and-demand-for-natural-resources>.

5 Dobbs, Richard et al. (2011). *Resource Revolution: Meeting the World's Energy, Materials, Food, and Water Needs*. McKinsey Global Institute, McKinsey Sustainability & Resource Productivity. Retrieved from http://www.mckinsey.com/insights/energy_resources_materials/mobilizing_for_a_resource_revolution.

6 Analytica Advisors (2016). *Canadian Clean Technology Industry Report: 2016*. Ottawa: Analytica Advisors.

7 OECD/IEA and IRENA (2017). *Perspectives for the energy transition – investment needs for a low-carbon energy system*. Paris and Abu Dhabi: OECD/IEA and IRENA. Retrieved from http://www.irena.org/DocumentDownloads/Publications/Perspectives_for_the_Energy_Transition_2017.pdf.

8 Government of Canada (2016). *Pan-Canadian Framework on Clean Growth and Climate Change*. Ottawa: Government of Canada. Retrieved from <https://www.canada.ca/content/dam/themes/environment/documents/weather1/20170125-en.pdf>.

9 Even with this bold action, Canadian citizens, business and governments will still have to adapt to a changing climate and invest in climate resiliency.

1 ONTARIO'S CHANGING ECONOMY

The green transition is occurring at a time when Ontario is already experiencing significant economic changes.

The shift from manufacturing to service provision is particularly noteworthy: Ontario lost over 300,000 manufacturing jobs between 2000 and 2011, driven by such factors as automation, globalization, exchange rates and low productivity.¹⁰ Similarly, the forestry sector has also seen employment fall from 115,000 jobs in 2004 to 58,000 jobs in 2015¹¹ as a result of competition from other jurisdictions and declining prices for forestry products.¹²

These declines have largely been offset by gains in knowledge-intensive industries such as professional, scientific and technical services, as well as healthcare and financial services.¹³ Between 1993 and 2013, employment shares in the goods-producing sector fell from 26.3 per cent to 20.6 per cent. During the same time period, private sector employment in services increased from 50.2 per cent to 55.0 per cent, and public sector employment in services from 23.5 per cent to 24.4 per cent.¹⁴

In total, many losses were offset through job creation in other industries, but the jobs that were lost were good ones. Both the manufacturing and

forestry sectors have traditionally been highly unionized and provided full-time, well-paying, stable career paths. For smaller communities, structural economic changes can be devastating – particularly for forestry operations in remote areas, where few alternatives exist nearby, those alternatives tend to be lower wage with fewer benefits, and education and training services are less accessible.¹⁵

Rapid technological change is playing an increasingly important role in these structural transformations.

Estimates in the US suggest that nearly 85 per cent of the decline in manufacturing employment is attributable to automation, rather than outsourcing or international trade.¹⁶ Technology is likely to continue reshaping the labour market in ways that we do not yet fully understand – while automation has typically disrupted industries

10 Mowat Centre (2014). *Ontario Made: Rethinking manufacturing in the 21st century. Summary Report*. Toronto: Mowat Centre. Retrieved from https://mowatcentre.ca/wp-content/uploads/publications/83_ontario_made_summary.pdf.

11 Natural Resources Canada (2016). Statistical data. Retrieved from <https://cfs.nrcan.gc.ca/statsprofile/employment/ca>.

12 Holmes, John (2013). "The Forestry Industry." *Climate@Work* (Carla Lipsig-Mummé, ed.), Halifax and Winnipeg: Fernwood Publishing.

13 Ontario Ministry of Finance (2014) "Ontario's Long Term Report on the Economy," *Chapter 3: The changing shape of Ontario's economy*. Retrieved from <http://www.fin.gov.on.ca/en/economy/ltr/2014/ch3.html>.

14 *Ibid.*

15 Holmes (2013), *op. cit.*

16 Coco, Frederica (2016). "Most manufacturing jobs lost to technology, not trade," *Financial Times*. December 2, 2016. Retrieved from <https://www.ft.com/content/dec677c0-b7e6-11e6-ba85-95d1533d9a62>.

in which machinery could “out-muscle” human labour, advances in artificial intelligence have revealed ways to “out-smart” human labour in unexpected fields such as law, finance and healthcare. It is estimated that somewhere between 9 and 42 per cent of existing jobs in Canada could be at risk of such technological disruption in the next 10 to 20 years.¹⁷

The nature of work itself has also changed dramatically, with an overall shift away from the Standard Employment Relationship (SER).

Traditionally, many Canadians were engaged in a form of work that was full time, permanent, salaried and unionized with employer-sponsored benefits and pensions available. More recently, employment has trended away from SER, toward work characterized by more uncertainty and instability such as part-time, temporary and contract positions. The rate of non-standard employment grew twice as fast as standard work from 1997 to 2015.¹⁸ Between 2015 and 2016, only 25 per cent of jobs created in the province were in full-time positions.¹⁹

Precarious jobs tend to be lower wage with few or no benefits – in 2015, the median hourly wage for workers engaged in an SER was \$24 compared to \$15 for non-standard workers.²⁰ The Ontario Changing Workplace Review found startling

differences in employment benefits for workers in SER vs. non-SER: 74 per cent vs. 23 per cent for medical insurance, 76 per cent vs. 23 per cent for dental insurance, 68 per cent vs. 18 per cent for life or disability insurance and 54 per cent vs. 17 per cent for employer pension plans.

Work is also significantly less likely to be unionized today than in the past. Unions have had a historically integral purpose of providing workers a voice and establishing decent wages and reasonable work hours, but Canada’s unionization rate has fallen from 37.6 per cent in 1981 to 28.8 per cent in 2014²¹ – due in large part to the shrinking of traditionally unionized private sector industries such as manufacturing, and to growth in service sector industries with lower rates of unionization.²²

Wages have remained alarmingly stagnant amid rapidly rising costs of living in Canada.

Historically, overall economic growth has occurred in tandem with wage growth; over the last 30 years, however, these two components of a healthy economy have diverged in a phenomenon described by economists as the Great Decoupling.²³ Despite economic growth, real wages have barely increased. For example, labour productivity grew by 25 per cent from 1997 to 2014, but the average hourly wage grew by only 12 per cent.²⁴

17 Lamb, Craig (2016). *The Talented Mr. Robot*. Toronto: Brookfield Institute. Retrieved from http://brookfieldinstitute.ca/wp-content/uploads/2016/08/TalentedMrRobot_BIIE-1.pdf; Arntz, Melanie, et al. (2016), “The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis,” OECD Social, Employment and Migration Working Papers, No. 189. Paris: OECD Publishing. Retrieved from <http://dx.doi.org/10.1787/5jlz9h56dvq7-en>.

18 Mitchell, Michael and Murray, John (2016). *Changing workplaces review: special advisors’ interim report*. Toronto: Ontario Ministry of Labour. Retrieved from https://www.labour.gov.on.ca/english/about/pdf/cwr_interim.pdf.

19 Statistics Canada (2017). Table 282-0087. *Labour Force Estimates (LFS) by sex and age group, seasonally adjusted*. Retrieved from <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=2820087&&pattern=&stByVal=1&p1=1&p2=31&tabMode=dataTable&csid=>


20 Mitchell, Michael and Murray, John (2016). *Op. cit.*

21 Statistics Canada (2017) “Unionization Rates Falling,” *The Daily*. Retrieved from <http://www.statcan.gc.ca/pub/11-630-x/11-630-x2015005-eng.htm>.

22 *Ibid.*

23 Brynjolfsson, Erik and McAfee, Andrew (2014). *The Second Machine Age: Work progress and prosperity in a time of brilliant technologies*. New York: WW Norton.

24 This estimate excludes the oil boom provinces of NL, AB and SK, which drove a minority of wages upward during this time period. See Canadian Centre for Policy Alternatives (2015). *Stagnant wages for workers for over 80 per cent of Canadian workers*. Errol Black Chair in Labour Issues. Retrieved from <https://www.policyalternatives.ca/sites/default/files/uploads/publications/Manitoba%20Office/2015/03/Stagnant%20wages.pdf>.



Inequality persists on a number of levels.

Most countries are seeing a persistent and growing gap between their highest and lowest earners. This is true for Canada and especially true for Ontario, which had the largest increase in income inequality among all provinces between 1981 and 2010.²⁵ This inequality continues to grow.²⁶

The impacts of these changes are not equally distributed across our society.

The negative effects of these changes are often disproportionately pronounced among disadvantaged communities that already face significant barriers to opportunity due to historic inequities. These communities – such as racialized Ontarians, Indigenous Peoples, women, newcomers and those with disabilities – are at risk of being left behind as the economy continues to change in ways that, if not properly addressed, may further disadvantage them.

²⁵ Statistics Canada (2017). *CANSIM Table 206-0033: Gini Coefficients of adjusted market, total and after-tax income, Canada and provinces*. Retrieved from <http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&p2=33&id=2060033>.

²⁶ Between 1981 and 2014, the Gini has grown from 0.368 to 0.429 for adjusted market income, 0.325 to 0.358 for total income, and 0.294 to 0.316 adjusted after-tax income. See Statistics Canada, *CANSIM Table 206-0033*.

2 ONTARIO'S GREEN TRANSITION

Ontario's businesses and citizens are taking important steps to accelerate the province's transition to a green economy, which is being amplified through provincial and federal government policies.

The Ontario government's decision to phase-out coal represents North America's single largest GHG reduction measure to date – helping to reduce emissions in the province by 17 per cent since 2007.²⁷ In 2017, the province introduced a cap and trade program that puts a price on GHG emissions. As part of the province's *Climate Change Action Plan*, revenues from cap and trade will be earmarked for a number of green projects aimed at helping households and businesses reduce their GHG emissions and adapt to climate change, such as retrofitting social housing infrastructure and supporting commuter cycling and electric vehicle charging infrastructure across the province.²⁸

The Government of Ontario has also shown leadership on other green efforts. Ontario was the first Canadian province to issue green bonds to finance low carbon projects such as public transit.²⁹ In 2016, it introduced the *Resource Recovery and Circular Economy Act*, along with 2017's *Strategy for a Waste-free Ontario*, which aims for a zero-waste Ontario and zero GHGs from the waste management and remediation services sector, while maximizing the transformation and recovery of materials.

In addition, Ontario businesses are already

moving toward greener business models and beginning to embrace the economic opportunities arising from the global green transition. Ontario leads all other Canadian provinces in clean energy investments,³⁰ with over \$5.3 billion in investment in 2015 alone.³¹ The province is also home to 289 cleantech companies – just over a third of all Canadian cleantech firms³² – and it is emerging as a hub of water technology innovation and energy storage innovation.³³

27 Harris, Melissa et al. (2015). *The End of Coal: Ontario's Coal Phase-out*. Winnipeg: Institute for Sustainable Development. Retrieved from <http://www.iisd.org/sites/default/files/publications/end-of-coal-ontario-coal-phase-out.pdf>.

28 Smart Prosperity Institute (2017). *Ontario 2017 Budget: Spending cap-and-trade revenues and other clean growth measures*. Retrieved from <http://institute.smartprosperity.ca/content/ontario-2017-budget>.

29 Ontario's three green bond offerings to date amount to \$2.05 billion. Smart Prosperity Institute (2017). *Ontario Issues its third – and largest – green bond*. Retrieved from <http://institute.smartprosperity.ca/content/ontario-issues-its-third-and-largest-green-bond>.

30 This includes large and small-scale hydro, wind, solar and biomass energy generation.

31 Clean Energy Canada (2016). *Tracking the Energy Revolution: A Pivotal Time for Clean Energy*. Vancouver: Clean Energy Canada. Retrieved from <http://cleanenergycanada.org/wp-content/uploads/2016/06/Tracking-Canada-June-2016.pdf>.

32 Analytica Advisors (2017). *Canadian Clean Technology Industry Report: 2017*. Ottawa: Analytica Advisors.

33 Clean Energy Canada (2016), *op. cit.*

Green Transition Terminology

Under green transitions, different sectors of Ontario's economy will see different impacts. For simplicity, we use four terms to categorize them:

Accelerated growth sectors will grow at a faster rate in the green economy than they would have otherwise. The utilities and waste management and remediation services sectors are most likely to enjoy accelerated growth under a green transition, and other sectors may include professional, scientific and technical services.

Altered sectors will see their growth rate remain more or less constant relative to what it would have been without the green transition, however their operations and work practices will change in response to shifting demand for low-polluting and resource-efficient products and services. Agriculture, forestry and construction are examples of these sectors – others may include mining and several manufacturing sub-sectors.

Emerging sectors refer to new sectors within the green economy. While entirely new sectors are unlikely to emerge in the immediate future, emerging *sub*-sectors will be found in both accelerated growth and altered sectors. Examples of these sub-sectors include energy technologies such as battery storage and solar photovoltaic (solar PV) within the utilities sector, and possibly low carbon vehicle manufacturing within the manufacturing sector.

Contracting sectors will see a significant decline in their growth rate relative to what would have been otherwise, as production costs rise and businesses substitute their inputs and consumers substitute their purchases for more environmentally-friendly alternatives. Examples of contracting sub-sectors in Ontario include certain heavy industry sub-sectors (which may include petroleum refining, iron and steel production, and lime production).

Extrapolating from these trends to understand how Ontario's economy will change under a green transition in the coming decades can be challenging for policymakers, especially since the pace of the green transition and its attendant disruption cannot be fully predicted. Nonetheless, there are sound reasons to believe that the changes facing Ontario and Canada in a green transition will be profound. For instance, the Government of Canada notes in *Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy* that, while "most Canadians recognize the need to address climate change and limit global temperature increases, the full magnitude of what this challenge entails is less well understood, requiring very deep emissions cuts from every sector by mid-century."³⁴

34 Environment and Climate Change Canada (2016). *Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy*. Ottawa: Environment and Climate Change Canada. Retrieved from http://unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf.

As a result of shifting consumer preferences, new market opportunities and strategic policy decisions, the green transition will incent firms in many of Ontario's economic sectors to alter their practices, and several sectors will also enjoy accelerated growth.³⁵ At the macroeconomic level, projected economic impacts of green transitions range from minor declines in economic growth rates to forecasts of accelerated economic growth.³⁶ The associated effects on overall employment can be difficult to predict, but studies estimate that green policies usually have no effect on net employment or lead to slight net employment increases.³⁷ This macro-level picture is important, but it does not provide insight into many of the changes that will be occurring across

35 Accelerated growth sectors and altered sectors were identified based on the commissioned modelling as well as a literature review (see Appendices A and C for discussion). The literature review complemented the modelling by identifying potential impacts of green transition policies and programs which were not captured in the model, such as the independent producer responsibility programme that will be rolled out Ontario's Resource Recovery and Circular Economy Act (2016). It also identified potential impacts from changing consumer preferences and supply chain trends.

36 See e.g. Bataille, Chris, Dave Sawyer and Noel Melton (2015). *Pathways to deep decarbonization in Canada*. Paris: Sustainable Development Solutions Network (SDSN); Institute for Sustainable Development and International Relations (IDDRI). Retrieved from http://deepdecarbonization.org/wp-content/uploads/2015/09/DDPP_CAN.pdf; Canada's Ecofiscal Commission (2016). *Choose wisely: options and trade-offs in recycling carbon pricing revenues*. Montreal: Canada's Ecofiscal Commission. Retrieved from <https://ecofiscal.ca/wp-content/uploads/2016/04/Ecofiscal-Commission-Choose-Wisely-Carbon-Pricing-Revenue-Recycling-Report-April-2016.pdf>. More optimistic growth perspectives can be found in Ellen MacArthur Foundation and McKinsey Centre for Business and Environment (2015). *Growth Within: A Circular Economy Vision For A Competitive Europe*. Cowes: Ellen MacArthur Foundation and McKinsey Centre for Business and Environment. https://www.ellenmacarthurfoundation.org/assets/downloads/publications/EllenMacArthurFoundation_Growth-Within_July15.pdf; OECD/IEA and IRENA (2017). *Perspectives for the energy transition – investment needs for a low-carbon energy system*. Paris and Abu Dhabi: OECD/IEA and IRENA. Retrieved from http://www.irena.org/DocumentDownloads/Publications/Perspectives_for_the_Energy_Transition_2017.pdf.

37 This is especially true of broad-based and flexible environmental policies such as carbon pricing – see OECD/IEA and IRENA (2017), *ibid.*; Yamakazi, Akio. 2017. "Jobs and climate policy: Evidence from British Columbia's revenue-neutral carbon tax." *Journal of Environmental Economics and Management*. 83: 197–216. See also Ellen MacArthur Foundation and McKinsey Centre for Business and Environment (2015), *op. cit.*; Herren, Hans. R., et al. (2012). *Green Jobs for a Revitalized Food and Agriculture Sector*. Rome: Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/fileadmin/user_upload/sustainability/pdf/FAO_green_jobs_paper_March_31.pdf.

and within sectors, which will have important ramifications for the world of work.

While it is difficult to know exactly how jobs in Ontario will be impacted, the modelling commissioned for this study shows that in Ontario, all major economic sectors such as manufacturing, services and heavy industry continue to grow in a green transition. The sectors that are most likely to see accelerated growth during the transition include utilities (especially renewable electricity); waste management and remediation services; and professional, scientific and technical services. Cleantech jobs may also grow as demand for innovative solutions that reduce environmental footprints rises, domestically and internationally. Other sectors such as manufacturing, mining, forestry, and agriculture may not see overall accelerated growth but may be altered in ways that will affect skills demand and employment profiles. Sectors with large greenhouse gas emissions footprints are at the greatest risk of contracting, including petrochemicals and petroleum refining, and lime production,³⁸ although many of these impacts can be mitigated through smart policy design. These economic and labour market impacts are summarized in Table 1.

See the Eliminated and Substituted Jobs subsection and Appendix A for more information.

38 These broad-scale sectoral trends are confirmed by the modelling commissioned for this report (but with less disaggregation by specific sub-sectors). Our discussion of potential contracting sectors draws from detailed modelling and analysis of impacts of carbon pricing policies in Ontario and Canada, e.g. Institute for Competitiveness and Prosperity (2016). *Toward a low carbon economy: The costs and benefits of cap-and-trade*. Toronto: Institute for Competitiveness and Prosperity. Retrieved from: https://www.competeprosper.ca/work/working_papers/toward-a-low-carbon_economy-the-costs-and-benefits-of-cap-and-trade; Sawyer, Dave (2013). *Carbon exposed or carbon advantaged? Thinking about competitiveness in carbon-constrained markets*. Ottawa: Smart Prosperity Institute (formerly Sustainable Prosperity). Retrieved from <http://www.sustainableprosperity.ca/sites/default/files/publications/files/Carbon%20Exposed%20or%20Carbon%20Advantaged.pdf>; Bataille, Sawyer and Melton (2015), *op. cit.*

Ontario's Cap and Trade Program: Smaller Carbon Footprint, Growing Economy

Economic and technological modelling can provide important insights for policymakers as they consider implementing environmental policies – such as carbon pricing – whose environmental and economic impacts cannot be estimated using historical data.³⁹ This report uses two models to illustrate the economic impacts of the early years of cap and trade – which is a major first step in the green transition – in order to help policymakers understand how these impacts might accelerate as governments and businesses increase their ambitions over time.

The model considers an **accelerated policy ambition** scenario, where Ontario's carbon price trajectory aligns with the social cost of carbon, and compares economic outcomes to a reference case of current policies. The carbon price trajectory under the accelerated policy ambition scenario approximates recent changes to California's cap and trade program – to which Ontario has linked in September 2017 – including a more rapidly rising floor price and a binding price ceiling for emissions allowances, among other changes⁴⁰ (see Appendix C for more information on current policies and the accelerated ambition scenario).

The modelling examines impacts in 2030 on Ontario's GDP, economic structure, and investments in low carbon technologies (LCTs) under current policies as well as the accelerated ambition policy scenario. The LCTs examined include industrial carbon capture and storage, low carbon and efficient industrial and manufacturing processes (including efficient motors and drives), low carbon buildings, efficient vehicles, and clean electricity sources including solar PV, biomass power, geothermal, hydroelectricity, nuclear power and biofuels (both for transportation and non-transportation).

The modelling only focuses on a small portion of climate change mitigation efforts, and does not track long-term deep decarbonization pathways or other aspects of the green transition. As such, it can be considered a much less ambitious case than what is needed to achieve GHG reductions consistent with the Paris Agreement, or any of Ontario's other green economy goals. The impacts will be much greater if Canada and Ontario embrace a transformational approach to the green transition via deeper GHG emissions reductions along with policies for enhancing natural capital and resource efficiency and for reducing congestion, air pollution and waste.

Modelling results

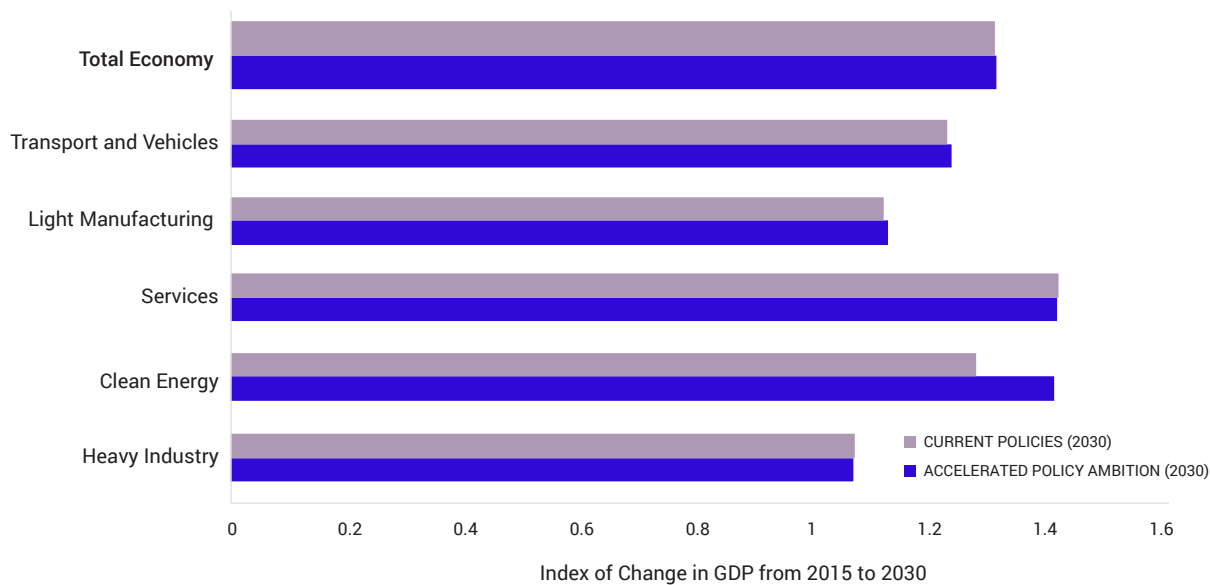
The accelerated ambition scenario leads to virtually identical growth outcomes in 2030 compared to current policies. Under both circumstances, Ontario's economy grows by approximately 32 per cent from 2015 levels (see Figure 1A), although the annual GDP growth rate from 2015-2030 is slightly lower (0.03 per cent decrease) in the accelerated policy ambition scenario.⁴¹ The impacts on Ontario's economic structure tell a similar story. In both cases, the services sector expands its share of GDP from 2015 levels while the transport and vehicles, heavy industry, and manufacturing sectors all make up slightly smaller shares of GDP in 2030 (see Figure 1B) – although all sectors will still grow in absolute terms relative to today. However, clean energy (biofuels and decarbonized electricity) makes up a slightly larger share of GDP under the accelerated ambition scenario, due to \$2.5 billion in additional LCT investments.

39 More information on the two models (R-GEEM and CIMS) is provided in Appendix C.

40 For a discussion in the Ontario context, see Lee-Andersen, Selina (2017). *Cap & Trade 2.0: California Fine Tunes and Extends Cap & Trade Program to 2030*. Canadian Energy Law Blog, August 9 2017. Retrieved from: <http://www.canadianenergylawblog.com/2017/08/09/cap-trade-2-0-california-fine-tunes-and-extends-cap-trade-program-to-2030/>.

41 Other analyses comparing GDP impacts in Ontario with and without carbon pricing have provided similar results – in both cases, well-designed carbon pricing schemes lead to modest impacts on GDP growth compared to the reference case. See Institute for Competitiveness and Prosperity (2016), *op. cit.*

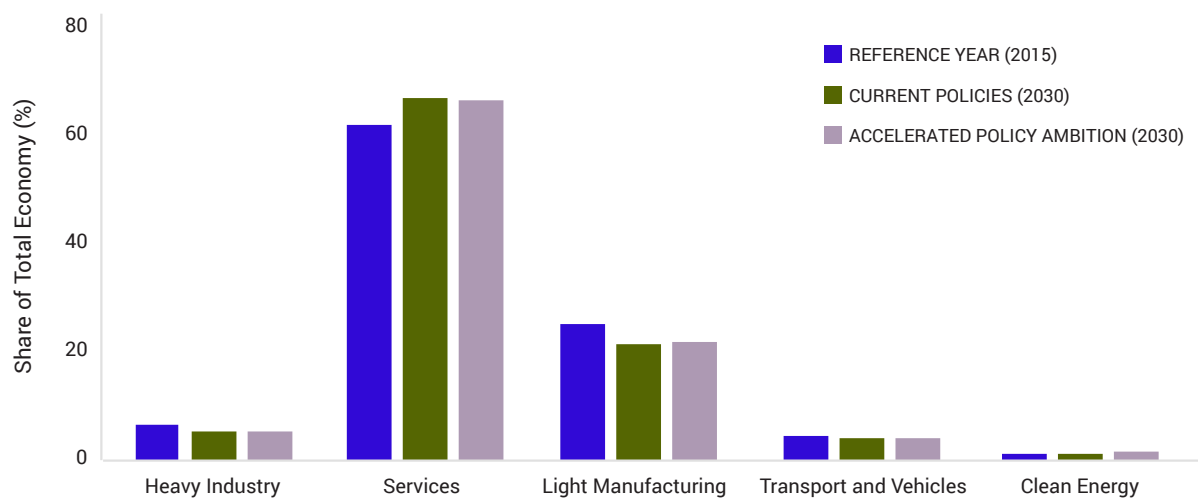
FIGURE 1A
Index of change in GDP in key economic sectors, 2015-2030 (2015=1)



Source: EnviroEconomics and Navius Research, 2017

The two bars illustrate potential growth by 2030 for each of Ontario’s major economic sectors under current policies and the accelerated policy ambition scenario, respectively (e.g., service sector GDP increases by 43 per cent under current policies relative to 2015, and by 42 per cent in the accelerated policy ambition scenario).

FIGURE 1B
Share of GDP in key economic sectors, 2015 to 2030



Source: EnviroEconomics and Navius Research, 2017

Left-hand bars shows each major sector’s share of Ontario GDP in 2015; while the middle and right-hand bars show their share of Ontario’s GDP in 2030 under current policies and the accelerated policy ambition scenario, respectively.

The modelling also projects that new annual investment in LCTs will climb to \$1 billion by 2030 under the accelerated policy ambition scenario, for a cumulative investment value of over \$7 billion for the years 2017-2030. This is in addition to the \$77 billion in LCT investments already made under current policies over the same time period. In terms of employment impacts, Canada-wide modelling suggests that aligning the federal carbon pricing schedule to the social cost of carbon would lead to \$453 billion in total LCT investments from 2015-2030, which would double the number of jobs associated with these technologies, rising from 100,000 in 2015 to approximately 200,000 in 2030.⁴²

Ontario's LCT investments fall primarily in four areas:



Efficient vehicles

consist of low carbon passenger and freight vehicles, including plug-in hybrid electric vehicles, pure electric vehicles and vehicles offering substantial emission reductions compared to the current fleet. These are estimated to comprise over half of all new LCT investments at \$3.7 billion.



Clean electricity technologies

together capture 34 per cent of new LCT investment (\$2.5 billion in total). Wind generation leads among new LCT investments, while solar and nuclear closely compete for second place, whereas hydro ranks fourth-place in new clean electricity investments.⁴²



Efficient buildings

enjoy the third-largest share of new LCT investment at 12 per cent of new investment (\$854 million).



Efficient industrial processes and biofuels

receive much smaller shares of new LCT investment (<2 per cent each).

⁴² Sawyer, Dave, Seton Stiebert, Noel Melton and Chris Bataille (forthcoming). *Green Growth Opportunities for Canada: Low Carbon Investment on the Road to 2030*. Ottawa: Smart Prosperity Institute.

⁴³ When these additional electricity LCT investments under the accelerated policy ambition scenario are combined with electricity LCT investments under current policies, wind and solar clearly receive the largest shares of total electricity LCT investment (approximately one third each), while hydro and nuclear each capture approximately one sixth of total electricity LCT investment.

The increased LCT investments (relative to current policies) under the accelerated policy ambition scenario are visualized in Figure 1C, while total LCT investments (combining current policies and accelerated policy ambition) are visualized in Figure 1D, respectively.

FIGURE 1C
Additional investment (\$millions) by LCT under the accelerated policy ambition scenario (APA), 2017 to 2030

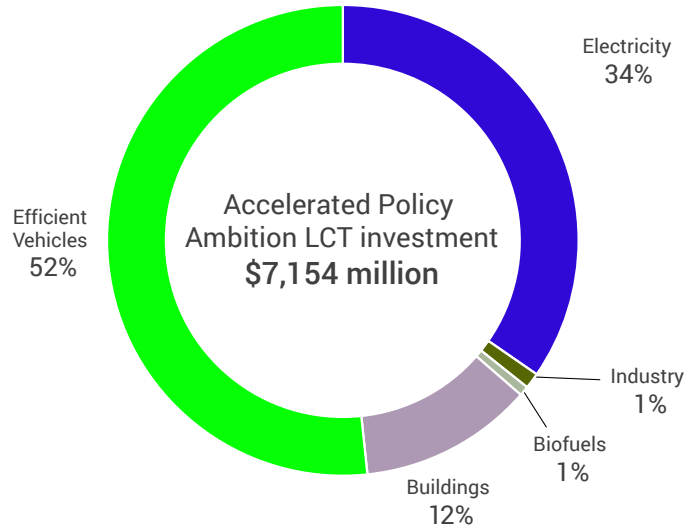
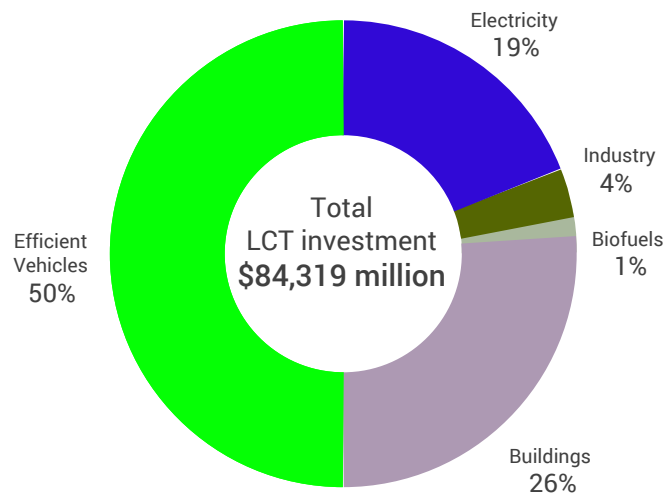


FIGURE 1D
Total investment (\$millions) by LCT across current policies and the accelerated ambition scenario, 2017 to 2030



Source: EnviroEconomics and Navius Research, 2017

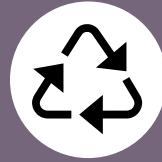
While it is not possible to quantify precisely how the LCT investments will flow into each economic sector, a mapping of LCTs to their corresponding industry codes suggests that most of these investments will flow to the manufacturing and construction sectors, as well as the technical and professional advisory services sector and utilities sector. Thus, although manufacturing makes up a smaller share of overall GDP under the accelerated ambition scenario, it will still grow in absolute terms, and some of this growth will be driven by LCT investment. Overall, the modelling results for this modest new development in Ontario and California’s linked cap and trade policy are consistent with the other available studies on the sectoral impact of green transitions in Ontario and Canada. The minor projected impacts on economic growth from the newly announced changes to the cap and trade program also show that Ontario is on a solid track for further climate action and green growth.

Green Transition Trends



Utilities

Over \$16 billion in clean electricity investments (wind, solar photovoltaic, hydroelectricity, nuclear) from 2017-2030



Waste management and remediation services

Increasing Ontario's waste diversion rate could boost GDP by \$1.5 billion and **employ 13,000 more people** in waste management and remediation services and related sectors



Cleantech

Ontario cleantech firms tap into a global cleantech market worth up to CAD \$2.5 trillion by 2022



Construction

Ontario's Climate Change Action Plan could **employ up to 33,000 construction workers** from 2016-2020 through its \$1.91 billion-\$2.73 billion investment in building retrofits



Manufacturing

\$46 billion of **investments** in efficient manufacturing and low carbon vehicle production from 2017-2030



Mining

Ontario has an opportunity to **supply the growing global demand** for clean technology through its numerous copper, lead, zinc and nickel mining and mineral processing facilities



Forestry

New forestry opportunities could emerge as a supplier of wood bioproducts and building materials, and through forest carbon offsets



Agriculture

Potential opportunities in payments for **environmental services, carbon offsets and bioenergy production**

TABLE 1
Green Transition Impacts at a Glance

Green transition trend	Relevant economic sector(s) ⁴⁵	Economic and business opportunities	Likely impact on jobs ⁴⁶	Main (new) skills requirements ⁴⁷
Increased electrification and a shift toward renewable electricity (RE)	Utilities, construction, possibly manufacturing	Growing RE supply creates opportunities for operating, installing and possibly manufacturing of RE technologies (including smart grid and controls)	Increased employment (job creation ⁴⁸ and job transformation ⁴⁹)	Advanced skills in trades, engineering and operations management (e.g. design and installation of RE technologies)
Movement toward low carbon buildings	Construction	Constructing low carbon buildings and retrofitting existing buildings may increase demand for construction workers, skilled contractors and technical services	Unclear employment trend/ potential modest employment increase (job creation, transformation)	Advanced skills in trades, engineering and operations management (e.g. resource-efficient design and audits)
Shift to low carbon vehicles, efficient manufacturing and industrial processes	Manufacturing	Changing policy and consumer preferences increase demand for low carbon vehicles and zero-waste products. More efficient industrial processes are increasingly rewarded	Potential employment decline in emissions-intensive, trade-exposed sectors (job elimination); unclear employment trend in other manufacturing sectors (job transformation and substitution ⁵⁰)	Advanced skills in trades, engineering, operations management and monitoring (e.g. new technologies in wood product processing, fuel efficiency, recycling, and in vehicle design maintenance and recycling)
Shift to more environmentally-friendly and resource-efficient commodity production	Mining, quarrying, oil and gas	Mining and recycling of key minerals increases as part of a green transition Shifting preference for commodities extracted and produced with a lower environmental footprint	Unclear employment trend (job transformation and substitution)	Advanced skills in engineering, operations management and monitoring (e.g. resource efficiency, pollution control)
	Forestry	Increased opportunities for sustainable wood products, forest carbon sequestration, etc. Conserving and valuing nature increases spending within the nature conservation sub-sector	Unclear employment trend/ potential employment increase (job creation, transformation and substitution)	Advanced skills in science, engineering, and operations management (e.g. forest planning, wildlife management)
	Agriculture	Increased opportunities for biodiversity conservation, payments for ecosystem services, carbon offsets from soil and livestock management, etc.	Unclear employment trend (job creation, transformation and substitution)	Advanced skills in science, engineering and operations management (e.g. new farming practices, crop diversification)
Increased waste diversion and resource recovery	Waste management and remediation services	Greater opportunities for waste diversion, methane capture, waste to energy, etc.	Increased employment (job creation, transformation and substitution)	Advanced skills in engineering, operations management (e.g. re-training from waste disposal to waste diversion among low-skill employees, increase in engineering skills at the highest skill levels)
Increased market opportunities for cleantech	Cross-cutting, including all sectors	All sectors likely impacted; the cleantech "sector" may grow through increased demand for greener, more resource-efficient goods and services	Potential increased employment (job creation, job transformation)	Advanced skills in operations management, science, engineering, and monitoring

44 Relevant economic sectors were identified through a literature review as well as a mapping of low carbon technologies to economic sectors. See Appendix A for more information.

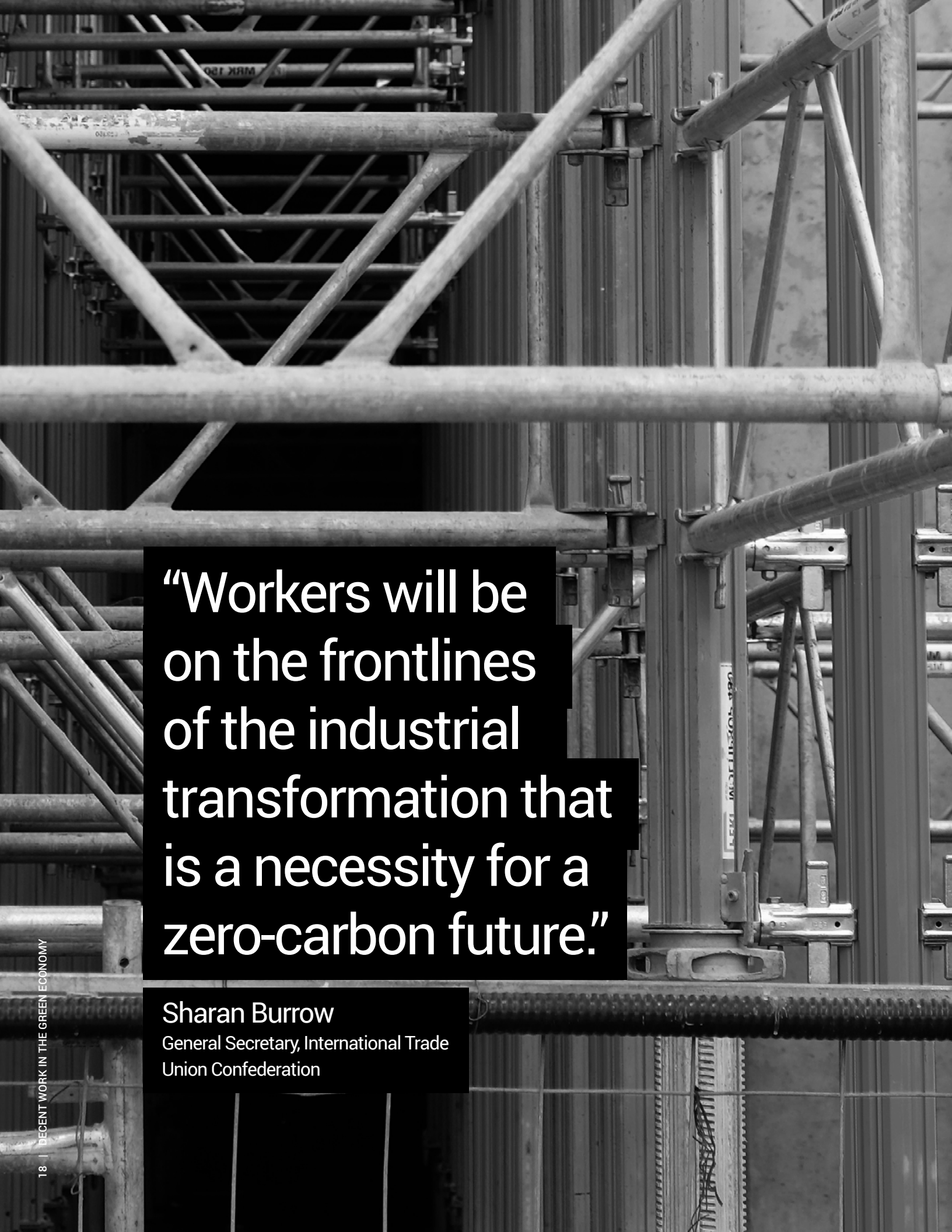
45 Overall employment trends are estimated based on a literature review (see the Appendix A for more information), and the main labour market impacts are identified in parentheses using the ILO typology of labour market shifts (see page 19).

46 Skills requirements under a green transition were adapted from Vona, Marin, Davide Consoli and David Popp (2015). *Green Skills. Nota di Lavoro 72.2015*. Milan: Fondazione Eni Enrico Mattei. Retrieved from <http://www.jstor.org/stable/resrep01190>; Strietska-Illina, Olga, Christine Hofmann, Mercedes Durán Haro and Shinyoung Jeon. (2011). *Skills For Green Jobs: A Global View*. Geneva: International Labour Organization. Retrieved from http://www.ilo.org/global/publications/books/WCMS_159585/lang--en/index.htm. It was also based on the mapping of low carbon technologies to economic sectors. Based on our literature review, we identified five broad skill requirements: skilled trades, science, engineering, operations management, and monitoring.

47 Job creation understood as the creation of new occupations related to novel greener products, services, and infrastructure. See section on Impacts on Jobs and Workers for a more detailed discussion on labour market shifts.

48 Job transformation understood as the transformation of business operations and skills required of workers in existing sectors. See section on Impacts on Jobs and Workers for a more detailed discussion on labour market shifts.

49 Job substitution is understood as existing jobs that will be substituted as a result of the adoption of resource-efficient and low carbon technologies. See section on Impacts on Jobs and Workers for a more detailed discussion on labour market shifts.



“Workers will be on the frontlines of the industrial transformation that is a necessity for a zero-carbon future.”

Sharan Burrow
General Secretary, International Trade Union Confederation

3 IMPACTS ON JOBS AND WORKERS

While it is difficult to predict the precise impacts of the green transition on the world of work, there is little doubt that the shift to a green economy will have important implications for many workers. The International Labour Organization has identified four major labour market shifts that will occur in the transition to a green economy:

- 1] **Job creation** resulting from new occupations related to novel greener products, services, and infrastructure;⁵¹
- 2] **Job elimination** from carbon-intensive energy sources and industrial processes and related service sectors;
- 3] **Job substitution** to more resource-efficient and low carbon technologies; and,
- 4] **Job transformation** as the green transition transforms business operations and skills required of workers in existing sectors.⁵²

It is important to note that these four labour market shifts serve as a conceptual frame to better understand the ways in which the green transition will impact employment. These four shifts refer to how occupations or job descriptions will be impacted, including the creation of entirely new occupations, and they do not necessarily refer to net job increases or decreases. For instance, an altered sector like mining may not see any net employment increases under a green transition, but this transition will nevertheless lead to the creation of new occupations requiring specific skillsets (“job creation”), such as engineers specializing in mine methane capture. At the same time, other mining sector occupations might be transformed as the sector adopts greener practices (e.g., mining workers using less water during mining operations).

50 In this report, ‘job creation’ refers to the creation of new types of occupations or job descriptions requiring specialized or ‘niche’ skillsets. It does not necessarily refer to net employment increases.

51 International Labour Organization (2016). *A just transition to climate-resilient economies and societies: Issues and perspectives for the world of work*. Geneva: International Labour Organization. Retrieved from http://www.ilo.org/wcmsp5/groups/public/--ed_emp/--gjp/documents/publication/wcms_536552.pdf.

Job Quality in Accelerated Growth and Altered Growth Sectors

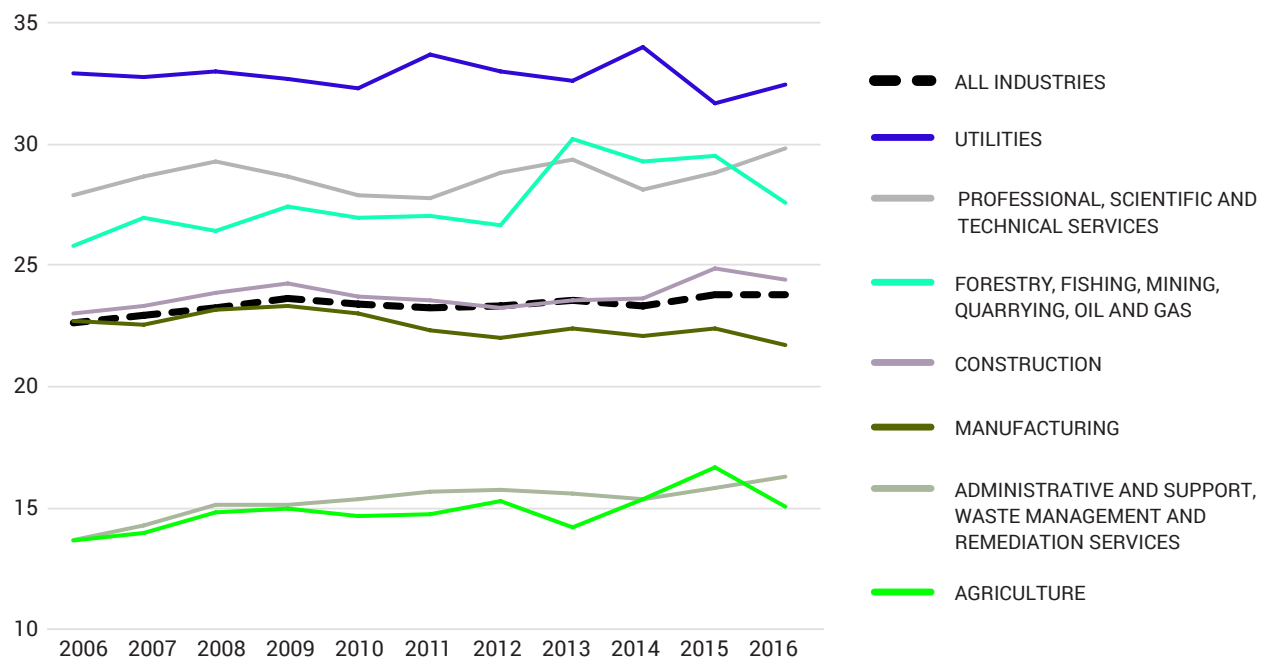
For the purposes of this report, we have identified seven sectors that are likely to see the most accelerated growth or be altered in significant ways in the coming years: utilities; forestry, mining, quarrying, fishing, oil and gas; construction; manufacturing; waste management and remediation services; agriculture; and professional, scientific and technical services. Several of these sectors are likely to see significant employment increases in a green transition, including utilities and waste management and remediation services. Cleantech jobs may also grow, which are found in the professional, scientific and technical services sector, as well as other economic sectors.

Looking at existing occupations, job quality and employment demographics within these sectors can provide some insight into what they might look like in the future, especially in the near-term. It also helps point out those communities that are currently underrepresented and may risk losing out on decent work opportunities in the green economy.

WAGES AND INCOME

Average hourly wages across most sectors projected to experience accelerated growth and alteration are higher than the Ontario average hourly wage for core-aged workers, currently at \$28.32 (see Figure

FIGURE 2
Average hourly wages of core-aged workers (25-54) in select sector (Ontario), inflation-adjusted \$2016



Source: Statistics Canada. CANSIM Table 282-0072 and table 281-0030. Authors' calculations

52 Calculations were made using CANSIM tables to look at Labour Force Survey estimates by North American Industry Classification System (NAICS) at the 2-digit level. Since data at the 3-digit NAICS code level were not publicly available for the waste management and remediation services sector (NAICS 562), data from the Survey of Employment, Payrolls and Hours for the Administrative, support, waste management and remediation services (NAICS 56) sector were used as a surrogate.

53 Within this section of the report, Administrative, support, waste management and remediation services sector (NAICS 56) has been shortened to Waste management and remediation services. All mention of waste management and remediation services refers to NAICS code 56 (rather than NAICS 562), unless noted otherwise.

2). This is particularly true for average wages in utilities; professional, scientific and technical services; and forestry, mining, quarrying, fishing, oil and gas whose 2016 average hourly wages were \$38.68, \$35.59 and \$32.84, respectively. On the other hand, wages in agriculture and manufacturing are lower than the Ontario average, at \$17.91 and \$25.88, respectively.⁵⁴

After adjusting for inflation, average hourly wages across most of these seven sectors have slightly increased over the past 10 years. Utilities and manufacturing are the only sectors whose wages have slightly decreased in that same period.

PERMANENCE AND FULL-TIME EMPLOYMENT

Most of the jobs in growth and altered sectors are full-time and permanent positions, although the construction, agriculture, and waste management and remediation sectors had the lowest rates of permanent job positions.^{55 56}

54 While the above figure estimates wages for administrative, support, waste management and remediation services (NAICS 56) at \$19.44 (lower than the Ontario average), this aggregates wage data for two separate sectors (NAICS 561 and 562) and may understate wages for waste management and remediation services (NAICS 562 – unfortunately publicly accessible data for this sector are suppressed by Statistics Canada due to poor data reliability). For instance, a study on the economic impacts of Ontario's Blue Box program used data from Statistics Canada and Waste Management Ontario to estimate annual wages of approximately CAD (2007) \$52,000/year (or \$60,000 in adjusted 2016 dollars) for jobs in recycling and waste disposal, approximately 22 per cent higher than average provincial wages at the study's date of publication. See AECOM (2009). *The Economic Benefits of Recycling in Ontario – Final Report to the Ministry of Environment and Climate Change*. Toronto: Ontario Ministry of the Environment and Climate Change. Retrieved from <https://archive.org/details/theeconomicbenef00snsn21841>. While this estimate is not strictly comparable with the data in the above figure, it does suggest that wages in the waste management and remediation services sector may be higher than indicated in the above figure.

55 More disaggregated data are needed to fully understand permanence of jobs in the waste management and remediation services sector (see footnote 54).

56 Statistics Canada (2017). *CANSIM Table 282-0008 Labour force survey estimates (LFS), by North American Industry Classification System (NAICS), sex and age group, annual (persons x 1,000)*. Retrieved from <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=2820008>; Statistics Canada (2017). *CANSIM Table 282-0080 Labour force survey estimates (LFS), employees by job permanency, North American Industry Classification System (NAICS), sex and age group, annual (persons x 1,000)*. Retrieved from <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=2820080>.

UNIONIZATION RATES

The utilities sector has the highest rate of unionization at 66 per cent of all employees. However, in line with the declining unionization trend across Canada, coverage has decreased by 5.7 per cent over the past 10 years.⁵⁷ For the remaining sectors, only a third or less of all employees are unionized. The construction sector is the only sector to have increased coverage – and only slightly – over the past several years.

NON-WAGE BENEFITS

In terms of non-wage benefits (e.g., employer pensions, prescription and dental coverage and life insurance), certain accelerated growth or altered sectors rank well in terms of non-wage benefits. Pension coverage, including defined benefit and defined contribution/hybrid plans, are the highest in the agriculture, mining and utilities sectors.^{58 59}

Thus, jobs in sectors projected to experience accelerated growth or alteration tend to be permanent and full time, and have higher wages than the provincial average. However, these trends could change over the longer term due to deep decarbonization efforts and other technological disruptions such as automation, which could make profound changes to Ontario's economic structure.

57 Statistics Canada (2017). *CANSIM Table 282-0078 Labour force survey estimates (LFS), employees by union coverage, North American Industry Classification System (NAICS), sex and age group, annual (persons x 1,000)*. Retrieved from <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=2820078>.

58 Marie Drolet and René Morissette (2014). *Insights on Canadian Society: New facts on pension coverage in Canada*. Ottawa: Statistics Canada. Retrieved from <http://www.statcan.gc.ca/pub/75-006-x/2014001/article/14120-eng.htm>.

59 Although this report presents most data for mining and forestry as one sector, for pension coverage rates, only data on mining are available.

Skills Requirements for New and Transformed Jobs

The green transition will require a dynamic and highly skilled labour force, with proficiency in technical skills such as STEM (science, technology, engineering and mathematics), operations management, as well as skilled trades.⁶⁰ Jobs classified as “green” tend to require more advanced skills than “brown” jobs (i.e. employment in an economy that is more heavily reliant on fossil fuels). Environmental regulations also increase demand for science, engineering, operations management and monitoring skills in key sectors such as construction, utilities and manufacturing.⁶¹ Many of the jobs requiring these skills are also characterized by relatively low routine task intensity, suggesting that they will be largely resilient to automation.⁶²

On the other hand, workers in transformed jobs with fewer opportunities for formal education or on the job training may struggle with skills obsolescence and the associated challenges of re-skilling for the green economy. For example, a shift to greater use of electric cars could reduce demand for automotive mechanics or require

them to re-skill substantially. Much of their current skillset relates to fixing and maintaining internal combustion engines, whereas different skills will be required for maintaining electric vehicle systems.⁶³ These re-skilling challenges are also particularly relevant for the manufacturing, agriculture, forestry, and waste and remediation services sectors.

Failure to provide employees with appropriate skills and training to meet the needs of a green transition could lead to risks of skills shortages or poor quality products and services in emerging sub-sectors,⁶⁴ emphasizing the importance of education and skills training through the green transition. This includes building the skills of students and recent graduates, training new employees from the outset, and also re-training existing employees to meet new skills demands. It is important to note however, that such re-training efforts may be difficult given potentially steep learning curves for low-skilled workers attempting to “skill up” to new fields.⁶⁵

60 Peel Halton Workforce Development Group, Toronto Workforce Innovation Group and Workforce Planning Board (2011). *Greening the Economy: Transitioning to New Careers*. Mississauga and Toronto: Peel Halton Workforce Development Group, Toronto Workforce Innovation Group and Workforce Planning Board. Retrieved from <http://www.peelhaltonworkforce.com/sites/default/files/Greening%20the%20Economy%20-%20Transitioning%20to%20New%20Careers.pdf>; Evergreen and ECO Canada (2012). *The Green Jobs Map: Supplementary Ontario Report*. Toronto and Ottawa: Evergreen and ECO Canada; Baruah, Bipasha and Crystal Gaudet (2015). “Creating and Optimizing Employment Opportunities for Women in the Clean Energy Sector in Canada.” *Social Sciences and Humanities Research Council Knowledge Synthesis report*. London: Western University. Retrieved from http://publish.uwo.ca/~bbaruah/pdf/Baruah_KSG_Final%20Report_May%202016.pdf; Calvert, John. (2015) “Construction and Climate Change: Overcoming Roadblocks to Achieving Green Workforce Competencies.” *Work in a warming world* (Carla Lipsig-Mummé and Stephen McBride, eds.), Montreal and Kingston: McGill-Queen’s University Press; Strietska-Illina, et al. (2011), *op. cit.*; Vona, Consoli and Popp (2015), *op. cit.*

61 More stringent environmental regulations are associated with a modest increase in demand for each of these skills, although science and organizational management skills showed the greatest increase in demand. See Vona, Consoli and Popp (2015), *op. cit.*
62 *Ibid.*

63 Hamilton, James (2011). “Careers in Electric Vehicles.” *September 2011 – Report 4*. United States Bureau of Labour Statistics. Retrieved from https://www.bls.gov/green/electric_vehicles/.

64 Calvert (2015), *op. cit.*; O’Grady, John. The Impact of Climate Change on Employment and Skills Requirements in the Construction Industry. *What do we know? What do we need to know? The state of research on work, employment and climate change in Canada*. Toronto: Work in a Warming World Research Programme (York University). Retrieved from: <http://warming.apps01.yorku.ca/wp-content/uploads/what-do-we-know-ogrady-chapter.pdf>

65 International Labour Organization (2016), *op. cit.*; The Economist (January 12 2017) “Retraining low-skilled workers: Systems for continuous reskilling threaten to buttress inequality” Retrieved from <https://www.economist.com/news/special-report/21714175-systems-continuous-reskilling-threaten-buttress-inequality-retraining-low-skilled>.

Eliminated and Substituted Jobs

In sectors that are at risk of contracting during a green transition, jobs may be eliminated as a result of economic activity shifting away from environmentally harmful energy sources and production processes, as well as shifts in consumer preferences for different green products and services.

As the economy decarbonizes at the national level, over the next several decades, the sectors and jobs at greatest risk of contraction and elimination are in coal mining and coal-fired electricity generation,⁶⁶ and possibly unconventional oil production such as Canada's oil sands.⁶⁷ The implications of these changes will largely be felt in jurisdictions such as Alberta and Saskatchewan, which highlights the need for targeted measures in areas where these sub-sectors are regionally concentrated.⁶⁸ At the same time, Ontario is not immune to similar dynamics: the province's phase-out of coal-fired electricity in 2014 had significant implications for the workers employed at these stations, and currently over 1,100 Ontario businesses directly supply

goods and services to the oil sands.⁶⁹ There is also a modest but manageable risk of negative employment impacts in Ontario's emissions-intensive and trade-exposed sectors, such as petroleum refining and petrochemicals production (see Appendix A on Sectoral Impacts).

Other examples of potential negative impacts from the green transition may be less obvious. For example, new public transportation infrastructure may reduce demand for bus ridership leading to layoffs among bus drivers, as will be the case with OC Transpo's construction of light rail transit in Ottawa.⁷⁰ Similarly, while green measures such as energy and water efficiency and conservation may save on costs, increase business productivity and improve consumer choice, they may also unintentionally increase worker precarity. For instance, many hotels now offer eco-friendly options such as opting out of daily laundry services. This can result in a reduction in hours worked (per worker) for employees engaged in laundry cleaning, many of whom are from historically disadvantaged and equity-seeking groups.⁷¹

66 Although these sectoral contractions are partially the result of policy decisions, such as carbon pricing and federal and provincial phase outs of coal-fired electricity generation, much of coal's decline is the result of competition with low cost natural gas (and, to a lesser extent, renewables). See Houser, Trevor, Jason Bordoff, and Peter Marsters. (2017). *Can coal make a comeback?* New York: Columbia Center on Global Energy Policy and School of International and Public Affairs. Retrieved from: <http://energypolicy.columbia.edu/sites/default/files/energy/Center%20on%20Global%20Energy%20Policy%20Can%20Coal%20Make%20a%20Comeback%20April%202017.pdf>.

67 However, Bataille, Sawyer and Melton (2016), *op. cit.* note that the world oil price will primarily determine the viability of Canada's oil and gas sector in a decarbonized future (e.g. by 2050), rather than domestic climate change policy *per se*. See also Bošković, Branko and Andrew Leach (2017). "Leave It in the Ground? Incorporating the Social Cost of Carbon into Oil Sands Development." *University of Alberta School of Business Research Paper No. 2920341*. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2920341.

68 Shaffer, Marvin (2017). "Just Transition in the Phase-Out of Coal." *SFU School of Public Policy Commentary Paper 2017.1*. Retrieved from <https://www.sfu.ca/content/dam/sfu/mpp/Working-PaperSeries/CommentaryCoalPhaseOutShaffer2017.pdf>.

69 Canadian Association of Petroleum Producers (2017). *Ontario's manufacturing sector is an important supplier for Canada's oil sands industry*. Retrieved from <http://www.capp.ca/canadian-oil-and-natural-gas/industry-across-canada/ontario>.

70 E.g. Chianello, Joanne (2016). "OC Transpo to shed 500-600 positions after LRT starts rolling in 2018." *CBC News*. July 11, 2016. Retrieved from <http://www.cbc.ca/news/canada/ottawa/oc-transpo-cut-hundreds-jobs-2018-1.3674447>.

71 Teelucksingh, Cheryl and Laura Zeglen (2016). "Building Toronto: Achieving Social Inclusion in Toronto's Emerging Green Economy." *Green Prosperity Papers, June 2016*. Toronto: Metcalf Foundation. Retrieved from <http://metcalfoundation.com/stories/publications/building-toronto/>.

Historically Disadvantaged and Equity-Seeking Groups

A number of marginalized communities already face barriers to accessing decent work. There is some evidence that the green transition could have disproportionately negative impacts on these communities in the absence of proactive measures. Table 2 briefly outlines some of the pressures that these groups might face under a green transition (for further discussion around these pressures, see Appendix B).

TABLE 2
Historically Disadvantaged and Equity-seeking Groups in the Green Transition

Identified Group	Current Inequities	Pressures Under Green Transition
Racialized populations	Despite higher levels of labour market participation, racialized Canadians earn 81.4 cents for every dollar earned by a non-racialized Canadian, and are more likely to be engaged in work that is insecure, temporary and low paying. ⁷²	Both racialized men and women are overrepresented in waste management and remediation services. While this sector is expected to see accelerated growth, its wages may be lower than the provincial average and often characterized by precarity. Racialized women in particular are seemingly underrepresented in utilities, one of the sectors that is expected to grow and benefit the most under a green transition. ⁷³
Indigenous Peoples (including First Nations, Inuit and Métis)	Indigenous Peoples face lower rates of employment (63 per cent compared to 76 per cent of the non-Indigenous population), ⁷⁴ and lower annual earnings (\$22,546 compared to \$30,696 for non-Indigenous people). ⁷⁵ Indigenous people currently face significant barriers and challenges along the education-to-employment continuum. ⁷⁶	Some impacted sectors (utilities, construction, possibly agriculture and natural resource sectors such as forestry and mining) employ many Indigenous Peoples, although this group is underrepresented in higher paying growth sectors (e.g. professional, scientific and technical services). ⁷⁷ Challenges along the education-to-employment continuum faced by Indigenous Peoples may be exacerbated for jobs that require higher education levels and training (e.g. cleantech).

72 Block, Sheila; Grace-Edward Galabuzi; Weiss, Alexandra (2014). *The Color-coded labour market by the numbers*. Toronto: the Wellesley Institute. Retrieved from <http://www.wellesleyinstitute.com/wp-content/uploads/2014/09/The-Colour-Coded-Labour-Market-By-The-Numbers.pdf>.

73 *Ibid*. Intersectionality becomes an important consideration here. An individual can represent multiple identities based on such traits as gender, ethnicity, race, sexuality, religion, age, disability, etc. – all of which can intersect and generate an entirely different experience of discrimination and barriers to opportunity.

74 Statistics Canada (2016). *Aboriginal Peoples: Fact Sheet for Ontario*. Ottawa: Statistics Canada. Retrieved from <http://www.statcan.gc.ca/pub/89-656-x/89-656-x2016007-eng.htm>.

75 National Aboriginal Economic Development Board (2015). *The Aboriginal Economic Progress Report*. Retrieved from <http://www.naedb-cndea.com/reports/NAEDB-progress-report-june-2015.pdf>.

76 Ontario Federation of Indian Friendship Centres (2013). *Urban Aboriginal Labour Force and Training Strategic Framework: Identifying Our Potential*. Retrieved from <http://www.ofifc.org/sites/default/files/docs/2013-04-17%20Labour%20Force%20and%20Training%20Strategy%20-%20FINAL.pdf>.

77 Statistics Canada (2017). *Aboriginal People Living Off-Reserve and the Labour Market: Estimates from the Labour Force Survey, 2007-2015*. Retrieved from <http://www.statcan.gc.ca/pub/71-588-x/71-588-x2017001-eng.pdf>.

<p>Women</p>	<p>There continues to be a gender wage gap in Ontario: a qualified working woman – with the same socio-economic and demographic characteristics as a man – receives on average \$7,200 less than her male counterpart each year.⁷⁸</p>	<p>Women are significantly underrepresented in utilities, a key accelerated growth sector (representing 25 per cent of all employees). Women also experience lower wages and unionization rates in all accelerated growth sectors, earning on average 38 cents per every dollar earned by a man.⁷⁹</p>
<p>Newcomers to Canada</p>	<p>Newcomers to Canada identify a number of barriers to accessing the labour market, such as difficulties regarding language and communication, credential recognition, arbitrary requirements for “Canadian experience” and outright discrimination.⁸⁰</p>	<p>Credentialism – which may become more prevalent in the green economy – could particularly disadvantage newcomers to Canada.</p> <p>International credentials may not be recognized in the labour market, leaving many immigrants in lower-skill and lower-paid jobs for which they are overqualified, especially those who have arrived recently with less time to re-skill.⁸¹</p>
<p>Workers with disabilities</p>	<p>Accessible services and inclusive workplaces are still not a reality for disabled Ontarians: Canadians with a disability are half as likely to complete a university degree, more likely to settle for part-time over full-time employment, and have lower annual incomes than adults without a disability.⁸²</p>	<p>Workers with a disability are much less likely to be involved in some accelerated growth sectors such as professional, scientific and technical services, but experience equal participation in others such as utilities.⁸³</p> <p>Both men and women with severe disabilities tend to be concentrated in lower paying sectors that are less likely to see accelerated growth (e.g. retail trade, accommodation and food services).</p>
<p>Rural Ontarians</p>	<p>As a result of remoteness and distance to many services (e.g. education), rural Ontarians tend to have lower average levels of education than their urban counterparts. There is evidence to believe that education levels actually decrease as the distance from a population centre increases.⁸⁴ Full-time earnings of a rural worker are 68 per cent of the equivalent earnings of an urban worker.⁸⁵</p>	<p>Jobs in forestry, fishing, mining, quarrying and oil and gas – which are expected to be significantly altered – tend to be concentrated in rural areas. For example, 91 per cent of underground mine services and support workers are employed in the northern regions. This can disproportionately impact smaller communities in the face of disruption.</p> <p>Many growth sectors under a green transition are also likely to require advanced skill levels, which may further disadvantage workers in remote communities, who often have fewer nearby opportunities for education and re-training.</p>

78 Ministry of Labour (2016). *Final Report and Recommendations of the Gender Wage Gap Strategy Steering Committee*. Retrieved from https://files.ontario.ca/7198_mol_gwg_finalreport_eng_wa_08f_v2_1.pdf.

79 Authors' calculation from Statistics Canada (2017). *CANSIM Table 282-0072 Labour force survey estimates (LFS), wages of employees by type of work, North American Industry Classification System (NAICS), sex and age group, annual (current dollars)*. Retrieved from: <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=2820072>.

80 Ontario Human Rights Commission (2013). *Policy on Removing the “Canadian Experience” Barrier*. Retrieved from <http://www.ohrc.on.ca/en/policy-removing-%E2%80%9CCanadian-experience%E2%80%9D-barrier>.

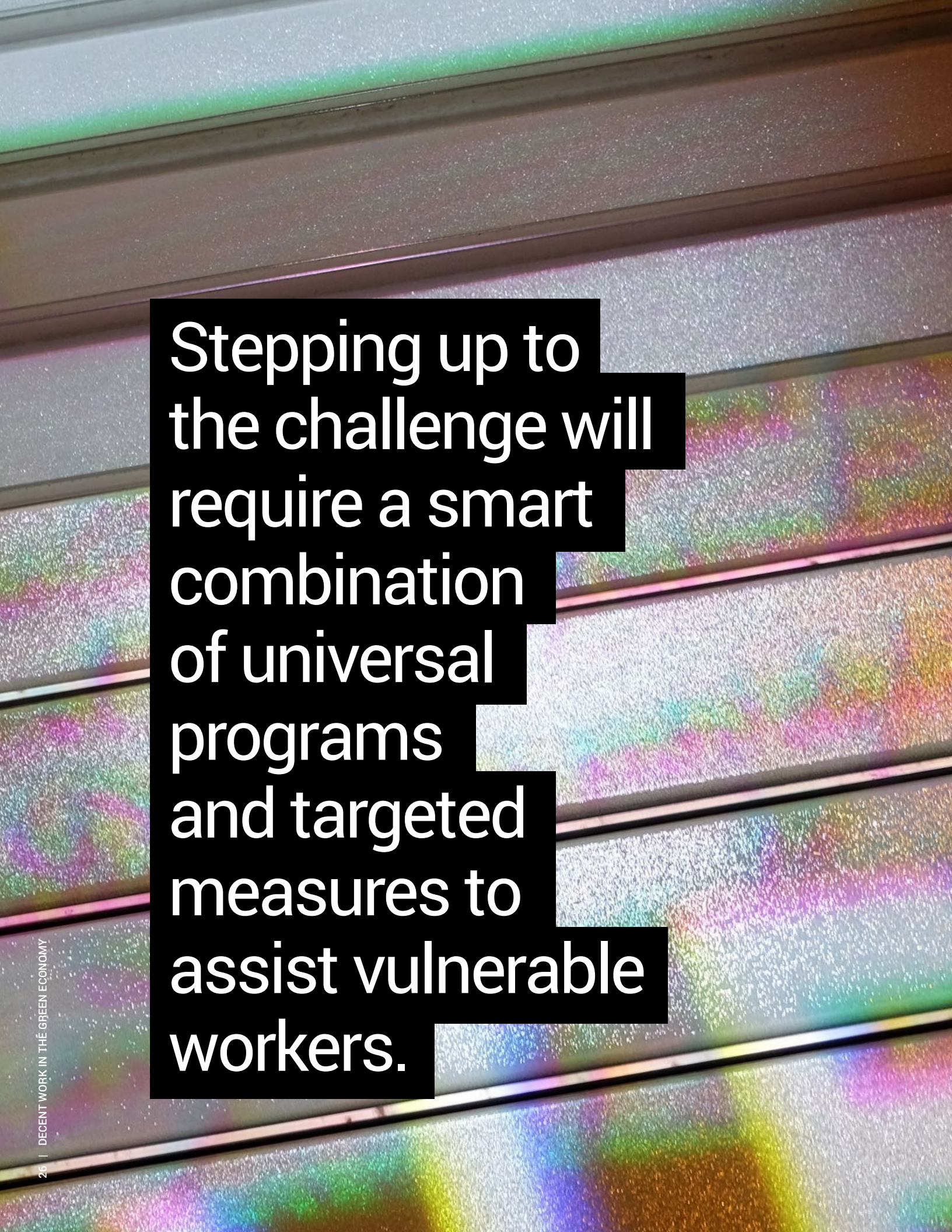
81 Teelucksingh and Zeglen (2016), *op. cit.*

82 Government of Canada (2015). *Persons with disabilities continue to be marginalized in Canadian society*. CHRC Canadian Human Rights Commission. Retrieved from <https://www.chrc-ccdp.ca/eng/content/persons-disabilities-continue-be-marginalized-canadian-society-chrc>.

83 *Ibid.*

84 Strengthening Rural Canada. *Challenges*. Retrieved from <http://strengtheningruralcanada.ca/challenges/>.

85 *Ibid.*



Stepping up to the challenge will require a smart combination of universal programs and targeted measures to assist vulnerable workers.

4 MOVING FORWARD: POLICIES AND PRACTICES

Given the changes that the green transition will bring, policymakers will need to be agile, adaptive and ready to respond to pressures on an evolving workforce and technological landscape that cannot be fully predicted in advance. The unpredictable pace of the green transition, in addition to diverse barriers faced by historically marginalized groups, means that stepping up to the challenge will require a smart combination of universal programs and targeted measures to assist vulnerable workers.

Everyone has a role in this transition. All levels of government will need to work together to ensure that no Ontarian is left behind and that decent work is available to all. Furthermore, governments will require collaboration with other key actors, such as employers, unions and non-profit organizations. Most importantly, workers and job seekers should be involved in ongoing dialogue at all stages of this transition to ensure that their concerns are heard and understood.

To make the most of Ontario's transition to a green economy, governments should work together to develop a comprehensive "Just Transition Strategy" that addresses decent work considerations at all stages.

Policymakers should consider incorporating the following key components into this strategy:

1] Build worker considerations into green transition policies and programs

A key starting point in developing a Just Transition Strategy should be to consider the implications on workers in the design stage of policies and programs intended to transition the province to a green economy. While policymakers do make efforts to identify economy-wide or sectoral employment impacts of environmental policies, much more could be done to assess employment effects and the broader consequences on job security and permanence, non-wage benefits, skills requirements and

other challenges in finding new employment for displaced workers. By putting programs into place and approaching decent work as an afterthought, policymakers are forced to remedy any unintentional negative impacts at a later point – which can be costly, inefficient and damaging to workers. Programs and policies should rather be designed through multiple lenses, including decent work, to address these concerns at the outset. When incorporating worker considerations into green transition policies, policymakers can learn from and build on success stories like the Solar City program in Halifax (see Case Study 1) by explicitly considering local supply chains and analyzing local employment impacts.

CASE STUDY 1

Halifax Regional Municipality's Solar City Program Lights the Way

The Halifax Regional Municipality (HRM) rolled out its Solar City program in 2013, enabling residential homeowners to access solar water heating installation for their properties. The program provides eligible residents with a free home feasibility assessment, which also includes complementary advice on water conservation measures. The program is financially sustainable, since the solar water heaters are financed through property assessed clean energy (PACE) loans⁸⁶ and repaid through local improvement charges (LIC) to the property.⁸⁷

The program is providing significant financial benefits to residents along with environmental and economic benefits for the broader community. Residents are expected to reap around \$14.4 million in energy savings (or \$20,600 per home) over 25 years, while the cost of water savings over that same time period could be as high as \$1.69 million.⁸⁸ The program is also expected to reduce GHG emissions by 10,500 metric tonnes over its lifetime, and to lower mercury, nitrogen oxide and sulphur dioxide emissions from heating oil and coal-fired electricity plants.⁸⁹

Solar City's impact was nationally recognized in 2015 when it received the Federation of Canadian Municipalities' Sustainable Communities Award.⁹⁰ After a two-year pilot, the program was extended for an additional three years, expanding its technology offerings beyond solar water heating to include solar PV panels and solar hot air.⁹¹

The program is also providing tangible benefits for the local economy, having created around 30 installation jobs and three manufacturing jobs for the residents of HRM, with annual wages of approximately \$50,000 and \$58,000 respectively.⁹² The program also employs a project manager at the HRM earning \$60,000 annually.⁹³ The extended program is expected to create around 52 installation jobs and five manufacturing jobs at comparable wages.⁹⁴

An economic impact analysis of the first phase of the program noted that approximately 80 per cent of the materials used to manufacture the solar water heaters are imported, meaning that there the program has significant potential for fostering additional local employment and economic development. The study recommended a market analysis to examine the feasibility of establishing local manufacturing facilities for supplying a greater share of manufacturing materials for the solar water heaters.⁹⁵ This could be complemented by an analysis of skills requirements for expanding manufacturing (if economically viable) under the program.

The program's success has also inspired other Nova Scotia communities – such as Shelburne, Berwick, Bridgewater and Guysborough – to replicate Halifax's bright idea.

86 Federation of Canadian Municipalities. *2015 Energy Program: Halifax Regional Municipality, Nova Scotia*. <https://fcm.ca/home/awards/sustainable-communities-awards/past-winners/2015-winners/2015-energy-program.htm>. Property Assessed Clean Energy (PACE) loans enable municipalities and local Governments to finance upfront investments in renewable energy and energy efficiency, which are then repaid by the property over several years. See Office of Energy Efficiency and Renewable Energy (nd). *Property Assessed Clean Energy Programs (PACE)*. Retrieved from <https://energy.gov/eere/slsc/property-assessed-clean-energy-programs>.

87 Local improvement charges are municipally administered property taxes which are an additional annual charge to participants' property tax bill. See (City of) Halifax. (2017). *Property owner guide*. Retrieved from <https://www.halifax.ca/home-property/solar-projects/about-solar-city-halifax>; Brownlee, Michelle (2013). *Financing Residential Energy Savings: Assessing Key Features of Residential Energy Retrofit Financing Programs*. Ottawa: Smart Prosperity Institute (formerly Sustainable Prosperity). Retrieved from <http://institute.smartprosperity.ca/library/publications/financing-residential-energy-savings>.

88 Federation of Canadian Municipalities (2015), *op. cit.*

89 *Ibid.*

90 *Ibid.*

91 *Ibid.*

92 Raymond, Mark and Emma McGuire (2016). *Economic Impact Analysis of Solar City 2.0*. Technical report (unpublished). Halifax.

93 Personal communication with Kevin Boutilier, Solar City Program Officer, Halifax Municipal Government (September 29 2017).

94 *Ibid.*

95 *Ibid.*

2] Consider the green transition in broader social supports

Just as the worker experience should be considered in programs that facilitate a green transition, the green transition's anticipated impacts should be considered in the development of programs and policies that are aimed to support workers more broadly.

Social programs should ensure a minimum floor of security for Ontarians as they move between jobs, re-train for their current job or even return to school. Increasing the universality of programs such as pharmacare coverage, affordable childcare and affordable housing can help alleviate the financial pressures and stresses associated with precarious work and job churn, and help ease the transition to the green economy.⁹⁶ For example, increasing the number of affordable childcare options could encourage female participation in emerging sectors such as renewable energy, where a lack of access has been identified as a barrier to female participation in the sector.⁹⁷

Other existing programs aimed at benefitting workers should be re-examined in the context of the green transition, such as Employment Insurance (EI). Currently, the bulk of funds transferred from the federal to provincial and territorial governments for training purposes is linked to EI payments, although a rapidly decreasing number of Ontarians are eligible for EI.⁹⁸ A number of people who are likely to experience temporary unemployment during a green transition may not be eligible, and therefore excluded from important re-skilling and re-training opportunities.

96 Johal, Sunil and Thirgood, Jordann (2016). *Working Without a Net*. Toronto: Mowat Centre. Retrieved from <https://mowatcentre.ca/working-without-a-net/>.

97 Baruah and Godet (2015), *op cit*.

98 Johal and Thirgood (2016), *op cit*.

Similarly, the federally-administered Canada Job Grant program provides grants directly to employers carrying out training for both current and prospective employees. While the program has faced criticism in the past, such demand-driven programs could be useful for employers who foresee the required skillsets of their workforce shifting.⁹⁹ However, when pursuing demand-driven labour market policies, governments should ensure that other options are accessible to the unemployed population as well.¹⁰⁰

The Government of Ontario has recently proposed amendments to employment and labour relations legislation through Bill 148: *Fair Workplaces, Better Jobs Act, 2017*, as a means of improving work conditions in the province. Over the longer term, more transformative social policy measures could be considered as well, such as generously increasing the working income tax benefit, introducing a basic income guarantee or replicating approaches such as Denmark's "flexicurity" model, which strikes a unique balance of flexible hiring and firing, active labour market policy and generous income supports.¹⁰¹

99 Government of Canada. *Canada Job Grant | ESDC*. Accessed 29 September 2017. Retrieved from <https://www.canada.ca/en/employment-social-development/programs/job-grant.html>.

100 Goss Gilroy Inc. (2016). *Canada Job Grant Year 2 Review. Pan-Canadian Report – Final Draft*. Regina: Forum of Labour Market Ministers. Retrieved from <http://www.flmm-fmmt.ca/CMFiles/CJG%20Year%20Two%20Review%20Final%20Report%20EN.pdf>.

101 International Labour Organization (2008). *Flexicurity for decent work: A labour market policy approach*. Retrieved from http://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_093856/lang-en/index.htm.

3] Focus efforts on workforce development

An emphasis on education, training and skills development should be present given the likely changes in skills demands through the green transition. The education system has an important role to play in ensuring that curricula are relevant and adequately prepare youth for the labour market they are about to enter. Modernizing school curriculum and establishing partnerships between secondary and post-secondary education institutions and employers will be a key driver in equipping graduates with appropriate skills for the workforce. This includes apprenticeships and other experiential learning programs that are common among many trades that are most likely to be impacted by the green transition.

For those already participating in the labour market, green skills gaps might develop in some sectors and re-training will be an important piece of the puzzle. The green transition is likely to transform many existing jobs rather than eliminate them entirely (e.g. new building skills and retrofit knowledge skills in the construction sector). In these cases, the most appropriate strategy may be to build the skillsets of existing workers in these sectors through re-training initiatives that reflect an evolving workforce, rather than resorting to layoffs. Employers and unions have many of the necessary insights to lead such efforts.¹⁰²

However, it is important to consider that solely focusing on re-training the existing workforce may perpetuate issues of inequity and lack of diversity in some sectors. Therefore, efforts to improve diversity and inclusion in growth sectors would be valuable, such as incorporating diversity goals and explicit targets in workforce

development initiatives.¹⁰³ Some jurisdictions can offer insight, such as the United Kingdom Transport Infrastructure Skills Strategy (see Case Study 2).

The Government of Ontario has recently announced details pertaining to its commitment to support training for low carbon building skills, highlighting sector-focused partnerships funded by carbon pricing proceeds.¹⁰⁴ The province may have the opportunity to further engage in such projects through the prospective FutureSkills Lab recommended by the Advisory Council on Economic Growth and the Forum of Labour Market Ministers and recently elaborated on in the 2017 federal budget. Pending further announcements and the development of an appropriate governance model, the Lab would provide an opportunity for Ontario to participate in co-financed pilots that would help prepare the workforce for the future.¹⁰⁵ The proposed organization is meant to bring together provincial and territorial governments, the private sector and post-secondary institutions to identify skills for the future and explore new innovative approaches to skills development.¹⁰⁶

103 Teelucksingh and Zeglen (2016), *op. cit.*

104 Government of Ontario (August 10, 2017) "Ontario helping skilled workers train for green jobs" https://news.ontario.ca/maesd/en/2017/08/ontario-helping-skilled-workers-train-for-green-jobs.html?utm_source=ondemand&utm_medium=email&utm_campaign=p.

105 Parkin, Andrew; Hartmann, Erich; Morden, Michael (2017). *How to build a skills lab: A new model for institutional governance in Canada*. Toronto: Mowat Centre. Retrieved from <https://mowatcentre.ca/how-to-build-a-skills-lab/>.

106 Government of Canada. Budget 2017. Chapter 1: "Skills, Innovation and Middle-class jobs." Ottawa: Government of Canada. Retrieved from <http://www.budget.gc.ca/2017/docs/plan/chap-01-en.html>, Advisory Council on Economic Growth (February 6 2017) "Building a highly skilled and resilient Canadian workforce through the Future Skills Lab." Retrieved from <http://www.budget.gc.ca/aceg-ccce/pdf/skills-competences-eng.pdf>.

102 O'Grady (2010), *op. cit.*



CASE STUDY 2

Diversity is a Strength in the UK Transport Infrastructure Skills Strategy

Developing comprehensive sector-level strategies to modernize skills training and improve diversity and inclusion in green jobs would be incredibly valuable. Research shows that the transition to a green economy may exacerbate inequalities as there tends to be an underrepresentation of marginalized communities in a number of emerging and accelerated growth sectors (see Appendix B).

In modernizing Britain's approach to skills development in the transport infrastructure sector (e.g. rail and road), the UK Department for Transport took a comprehensive approach in its Transport Infrastructure Skills Strategy (2016). The strategy outlines objectives for the sector, such as:

- » Improving diversity and inclusion by setting a target to provide 20 per cent of all engineering and technical apprenticeships to women by 2020 and to achieve parity with the working population by 2030. Also, to better represent the communities they serve, also aim to increase the number of racialized apprenticeship candidates to 20 per cent by 2020;
- » Bringing employers together through the Strategic Transport Apprenticeship Taskforce to address skills challenges, develop new apprenticeship standards, establish training facilities and play an "ambassadorial" role in promoting the sector as exciting career opportunity;
- » Establishing Centres of Excellence through national transport colleges to ensure that skills training and education institutions are working to address the skills gaps forecasted by the Taskforce.

A number of such recommendations in the strategy could be useful when applied to other sectors that may be impacted by a green transition.

CASE STUDY 3

The POWER of Collaboration in the Appalachian Region

As Ontario and Canada transition to a green economy, we can look to other jurisdictions for important lessons on how to support communities impacted by contracting sectors. For example, as a result of the changing economics of energy production in the United States, the coal industry has seen significant job losses in concentrated areas. Around 85 per cent of these losses occurred in the Appalachian region, which lost a total of 33,500 jobs between 2011 and 2016.¹⁰⁷

The Appalachian Regional Commission (ARC) – an agency representing a collaboration between all three levels of government – supports regional economic development within the 13 states of the Appalachian area.¹⁰⁸ Since 2016, ARC has provided \$92 million through the Partnerships for Opportunity and Workforce and Economic Revitalization (POWER). Through the program, implementation and technical assistance grants are awarded to projects that support coal-impacted communities throughout the region.

ARC participates in the program alongside the US Economic Development Administration and eight other agencies to fund programs such as the Bevill State Community College POWER 2016 Initiative in Alabama and many others. This particular project will result in a new Rapid Training Centre that will serve as a regional training and job placement hub to transition workers into growing regional industries such as welding, commercial trucking, rigging, hydraulics/pneumatics, healthcare and print reading.¹⁰⁹

These projects show the importance of partnerships and collaboration between public, private and non-profit sectors to assist with transitions.

107 Appalachian Regional Commission (2017). "Addressing economic challenges in Appalachia's coal-impacted communities." Washington: Appalachian Regional Commission. Retrieved from https://www.arc.gov/images/grantsandfunding/POWER2017/Graphics/Maps_CoalEmployment_POWERCounties_June2017.pdf.

108 Appalachian Regional Commission. *About ARC*. Retrieved from <https://www.arc.gov/about/index.asp>.

109 Appalachian Regional Commission (2017). "POWER Award Summaries by State." Retrieved from <https://www.arc.gov/images/grantsandfunding/POWER2017/ARCPowerAwardSummariesbyState6-14-2017.pdf>.

4] Address gaps through a dedicated Just Transition Fund

A key feature of a Just Transition Strategy would be distributing funds to support individuals, industries and communities to assist those who are negatively impacted by a green transition. These targeted measures could be financed in part through revenue generated from green transition policies (e.g., carbon pricing proceeds). Funds could be transferred to communities facing disproportionate job loss, to universities or colleges to prepare the workforce through specialized programming, to social enterprise or service providers to carry out re-training programs, to directly impacted companies to invest in their employees, or on an individual basis to those in transition (much like EI payments).

There is a compelling precedent for this type of programming in the United States, for example, to provide support to communities impacted by the economic decline of coal production across the Appalachian region (see Case Study 3). Similar discussions on a just transition for workers in the coal mining and electricity generation sub-sectors are also underway in Alberta.¹¹⁰ However, such lessons could be applied to a number of other sectors which might see significant change in the upcoming years.

110 See for example the October 2016 "Just Transition and Good Green Jobs for Alberta" conference, convened by environmental NGOs and labour groups in Edmonton (retrieved from <http://bluegreencanada.ca/alberta>), as well as Shaffer (2017), *op. cit.*

5] Leverage public procurement and spending power

The public sector spends billions of dollars each year on goods and services: in 2015, the provincial and local governments in Ontario spent more than \$49 billion combined.¹¹¹ These enormous expenditures can be leveraged to pursue both green transition and decent work agendas, for example, by undertaking projects to lower emissions while simultaneously providing opportunities for decent work. Both federal and provincial governments have committed to significant investment in procurement and infrastructure projects to facilitate a green transition in the upcoming years, which could include stipulations as to how these investments can provide additional benefits to disadvantaged communities.

There are a number of promising initiatives in North America that channel public funds into projects specifically mandated to benefit local communities through legal or aspirational agreements. These agreements, such as the Community Benefits Framework Agreement in Toronto (see Case Study 4), can specify decent work conditions for contractors who submit bids to undertake various projects. These could be used in a number of areas to which the government has voiced commitment, such as:

» Infrastructure

The province has committed to \$190 billion in new infrastructure investments, including low carbon infrastructure (e.g. light rail transit and water and wastewater infrastructure) from 2014-2026.¹¹²

111 Statistics Canada (2017). CANSIM Table 385-0042 – Canadian government finance statistics (CGFS), statement of operations and balance sheet for consolidated governments, annual (dollars). Retrieved from <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=3850042&&pattern=&stByVal=1&p1=1&p2=31&abMode=dataTable&csid=>

112 Government of Ontario (2017). *2017 Ontario Budget: A Stronger, Healthier Ontario*. Toronto: Queens Printer for Ontario. Retrieved from <https://www.fin.gov.on.ca/en/budget/ontariobudgets/2017/>.

» Social housing

Ontario's 2017 budget pledged an additional \$85 million for social housing retrofits in 2017-2018.¹¹³

» Residential and public buildings

The province has also committed \$100 million from its Green Investment Fund toward residential retrofits, including for low-income Ontarians, as well as \$200 million toward energy efficiency and renewable energy investments for schools.¹¹⁴

» Indigenous communities

A portion of the Green Ontario Fund¹¹⁵ proceeds have been earmarked for low carbon programs in Indigenous communities.¹¹⁶ Government support for renewable energy and energy efficiency programs in Indigenous communities can lower these communities' energy costs, and provide decent work opportunities for local community members implementing the program (see the Dokis First Nation example in Case Study 5).

By strategically leveraging public procurement and spending power, governments at various levels can pursue initiatives with social, economic and environmental benefits.

113 The Government had already committed to invest \$92 million from its Green Investment Fund into social housing retrofits. Ontario's Green Investment Fund is a 'down payment' (financed from general Government revenues before cap and trade revenues come in) on the climate change mitigation and adaptation actions outlined in the Government's Climate Change Action Plan. Government of Ontario (2016). *Green Investment Fund*. Retrieved from <https://www.ontario.ca/page/green-investment-fund>.

114 Government of Ontario (Budget 2017), *op. cit.*

115 "The Green Ontario Fund is a not-for-profit provincial agency that invests proceeds from Ontario's carbon market into climate actions that help people and businesses reduce greenhouse gas emissions and use cleaner technology to power their homes and workplaces." See Green Ontario Fund (2017). *About us*. Retrieved from <https://www.greenon.ca/>.

116 Government of Ontario (Budget 2017), *op. cit.*

CASE STUDY 4

All on Board: Eglinton Crosstown Light Rail Transit Community Benefits Framework

In 2014, Metrolinx, Project Co. and the Toronto Community Benefits Network (TCBN) – a coalition of grass root organizations, social enterprises, labour and workforce development organizations – signed a Community Benefits Framework (CBF) for the Eglinton Crosstown Light Rail Transit system. While the primary purpose of the \$5.3 billion, 19.5 km project is to ease passenger commuting within Toronto and decrease GHG emissions from passenger transportation, the TCBN is using its collective voice to ensure that local communities also benefit from the economic and employment opportunities created by the project.¹¹⁷

While the CBF is non-binding, signatories have agreed to develop policies and strategies to create employment, training, and apprenticeship opportunities for racialized and historically disadvantaged Torontonians residing near the project (including women and new Canadians), many of whom are struggling with poverty and unemployment.¹¹⁸ A corollary declaration to the CBF specifies that 10 per cent of the construction trade work hours necessary for the execution of the project should be dedicated to residents of disadvantaged communities.¹¹⁹ The framework has the potential to create over 300 jobs for local residents over the project's lifetime.¹²⁰ Thus far, 19 apprentices from equity-seeking communities have been hired under the apprenticeship stream, 11 of which were from the TCBN network.¹²¹

The CBF also aims to provide employment opportunities for equity-seeking communities in professional, administrative and technical occupations (many of which are traditionally staffed by women).¹²² Approximately 600 people have been hired for these positions to date, with 92 of them being from the targeted communities, including 28 of them coming directly from the TCBN network.¹²³ Furthermore, the CBF commits to procuring project resources and services from local suppliers and businesses. Thus far, local businesses have supplied \$2.4 million dollars' worth of goods and services to the project and over \$55,000 worth of services have been procured from social enterprises.¹²⁴

This initiative could help guide the efforts of other community groups as well as federal, provincial and municipal governments as they consider and design their own CBFs or similar community benefits agreements (CBAs). The TCBN has shared some key lessons from the project to date, noting that although CBFs will vary according to communities' differing circumstances, there are three measures that community advocates can take to increase the likelihood of success:¹²⁵

- » focus on setting binding, rather than aspirational, employment targets from the very beginning – project informants noted that while aspirational targets are important, it is preferable to hold parties accountable to firm and quantifiable targets;
- » ensure that the targets are ambitious but reasonable, based on sound research and consultation with all stakeholders involved, and develop a roadmap for how they can be achieved; and
- » have the community on board with the community advocates' vision, since they will serve as their “backbone” of support throughout the negotiation period.

117 United Way Toronto and York Region / Ontario Labour Market Partnership (2015). *On Track to Opportunities: Linking Transit Development to Community Employment and Training Project*. Toronto: United Way Toronto and York Region. Retrieved from <https://www.unitedwaytyr.com/file/what-we-do---research-reports-document-upload-part/OLMP-Final-Report.pdf>.

118 *Ibid.*

119 Metrolinx (2016). “Declaration re. Apprentices on the Eglinton Crosstown LRT Project” The Eglinton Crosstown Light Rail Transit Project. Signed November 8, 2016. Retrieved from http://www.thecrosstown.ca/sites/default/files/crosstown_apprenticeship_declaration_signed.pdf.

120 Mojtehdzadeh, Sara (2016). “Community Benefits program on track to create hundreds of local jobs.” *TheStar.Com*. December 7 2016. Retrieved from <https://www.thestar.com/news/gta/2016/12/07/community-benefits-program-on-track-to-create-hundreds-of-local-jobs.html>.

121 Personal communication with Rosemarie Powell, TCBN Coordinator (August 11 2016).

122 Crosslinx Transit Solutions (February 2016) “Community Benefits and Liaison Plan for Eglinton Crosstown LRT Project.” Retrieved from http://www.thecrosstown.ca/sites/default/files/cts_-_community_benefits_and_liason_plan_rev_01_-_february_26_2016_.pdf.

123 Personal Communication with Rosemarie Powell, *op. cit.*

124 *Ibid.*

125 *Ibid.*

6] Strive for better, more granular and more frequent data collection.

Consistently measuring, tracking and forecasting employment, GDP, and output in the green economy by sector and region would provide policymakers with a better understanding of growth opportunities, job security and wages. Complementary surveys and analyses could highlight skills requirements needed for job seekers to succeed in various green professions.¹²⁶ Statistics Canada has recently committed to better measuring and tracking Canada's cleantech sector, which is an important step in the right direction.¹²⁷ However, there is potential to go further still by tracking a broader suite of green economy sectors, similar to the now-defunct Green Jobs initiative from the U.S. Bureau of Labour Statistics.¹²⁸

126 In particular, analysing skills needs across various economic sectors at an intermediate level of resolution would be useful, since many assessments of skills requirements for green jobs are either very broad (e.g. Vona et al. (2015), *op. cit.*) or very detailed and sector-specific. A promising starting point would be to analyze green occupations in terms of the 35 skills categories used in the United States Department of Labour's O*net database, in order to identify those that are most prevalent across green occupations. See O*net resource centre (2017). *The Green Economy*. Retrieved from <https://www.onetcenter.org/green.html?p=2>.

127 Statistics Canada (2016). *Corporate Business Plan, Statistics Canada 2016/2017 to 2018/2019*. Ottawa: Statistics Canada. Retrieved from <http://www.statcan.gc.ca/eng/about/bp>.

128 This survey measures both green technology production and manufacturing, as well the adoption of technologies and practices to lower the environmental impact of 'brown economy' products. See United States Bureau of Labour Statistics (nd). *Measuring Green Jobs*. <https://www.bls.gov/green/>.

CASE STUDY 5

Dokis First Nation Hydroelectric Project: Building and Skilling Up Indigenous Communities

to boost economic prospects for local residents – clean energy is also providing opportunity to Indigenous communities like the Dokis First Nation (DFN), whose territory straddles the districts of Parry Sound, Sudbury and Nipissing. Through a partnership with Hydromega, DFN jointly developed the Okikendawt hydroelectric project, a run-of-river station drawing power from the French River. In addition to having a 40 per cent share in the station,¹²⁹ the DFN developed a community impact benefit agreement with Hydromega for the project. This agreement obliged the contractor to prioritize qualified personnel from DFN for the construction and operating phases of the project.¹³⁰ The project is reducing GHG emissions from the electricity sector, providing employment and skills for community members, as well as economic development for members of the DFN.

Over 35 community members from DFN were employed in a number of occupations during the construction phase of the project, including skilled tradespeople, journeypersons, caterers and transportation services.¹³¹ Construction of the dam was completed in 2015, and it currently is operated by two employees, one of whom is a member of the DFN. The community aspires to train another engineer from the DFN to operate the station within five years, so that it can be wholly staffed by members of DFN.¹³² Other workers have used the skills and experience gained during the construction phase to find employment in other regions.

129 Ireland, Nicole (2016). "First Nations see economic future in Canada's growing clean energy industry." CBC News, November 5 2016. Retrieved from <http://www.cbc.ca/news/indigenous/first-nations-pursue-canada-clean-energy-economy-1.3829405>.

130 Personal communication with Christopher Henderson, Lumos Energy (August 21 2017).

131 *Ibid.*

132 *Ibid.*

Green sectors and their associated occupations should be explicitly linked to the North American Industry Classification System (NAICS) and National Occupation Classification System (NOCS), in order to maximize comparability within and across jurisdictions.

It is also essential that governments collect data on participation from disadvantaged communities in these green economy sectors and occupations, in order to effectively design and evaluate policies for increasing their participation rates and improving outcomes. Given that granular data on various green economy sectors are currently unavailable (for reasons mentioned above), policymakers and researchers should in the meantime consider tracking disadvantaged group participation in those economic sectors (NAICS codes) and occupations (NOCS codes) which are known to contain a relatively high proportion of 'green' sub-sectors and occupations. Promising candidates include renewable energy, waste management and remediation services,¹³³ construction and building retrofits, as well as professional, scientific and technical services.

However, detailed provincial data on sector-by-sector demographics are rarely published or made easily accessible, in part due to data reliability and confidentiality concerns – this is likely to be the case for the recently announced cleantech data. While Statistics Canada's Research Data Centres are currently the most promising avenue for acquiring these demographic data on labour force participation, Statistics Canada may want to consider additional options for making these data more accessible to analysts while respecting confidentiality concerns (e.g.

133 Improved information on wages, benefits, and job permanence in the waste management and remediation services sector is especially important in light of the fact that it is one of the sectors that is most likely to see accelerated growth in a green transition, and due to the apparent overrepresentation of racialized Ontarians in the sector (see Impacts on Jobs and Workers section for discussion).

by including 2016 Census data in its Real Time Remote Access service).¹³⁴ Social scientists also have an important role to play by complementing these national and provincial-level surveys with more targeted (e.g. regional or industry-specific) surveys and case studies documenting participation from historically disadvantaged and equity-seeking groups in green sectors, as well as job quality and workers' experiences in a green transition.¹³⁵

Better information on the linkages between environmental policies and overall economy-wide employment outcomes is also necessary. Many of the studies estimating employment impacts of green economy policies use methodologies based on input-output tables, which have a number of limitations. Complementary studies using more robust approaches would be helpful, such as partial equilibrium or computable general equilibrium modelling of employment outcomes¹³⁶ as well as econometric estimations of employment effects once these green economy policies have been implemented.¹³⁷

134 Statistics Canada (2017). *Surveys and Metadata*. Retrieved from <http://www.statcan.gc.ca/eng/rtra/surv>.

135 These complementary surveys will be especially important for researchers attempting to undertake intersectional analyses of worker impacts under a green transition, since attempting to cross-tabulate multiple demographic variables in national survey datasets increases the likelihood of triggering Statistics Canada's data suppression algorithms, due to risks associated with data reliability (small sample size) or confidentiality (higher risk of obtaining identifying information from the data).

136 Ideally, these modelling studies should take into account real world labour market dynamics, such as labour search costs, but this is rarely the case. For discussion, see Jared C. Carbone and Nicholas Rivers (2014). "Climate policy and competitiveness: policy guidance and quantitative evidence." *Colorado School of Mines, Division of Economics and Business Working Paper 2014-05*. Retrieved from http://inside.mines.edu/~jcarbone/carbone_rivers_competitiveness_9a.pdf.


137 See e.g. Yamakazi (2017), *op. cit.*

7] Engagement and dialogue

Establishing mechanisms for regular dialogue and consultation with various groups will be integral to a Just Transition Strategy. No effort to ensure decent work in the green economy will be successful without meaningfully engaging workers who are directly impacted by the transition, to understand where and how they might need support. Just as important will be the ongoing engagement with employers and industry to understand the changing employment landscape, and how workers can best prepare for it.

Bringing it all together

A multi-pronged Just Transition Strategy can help navigate some of the potentially far-reaching impacts of the green transition. Considering the worker implications of green transition policies and engaging in dialogue with workers can help identify employment opportunities and minimize negative impacts from the outset, while incorporating green transition considerations into labour market and training support policies helps reinforce these measures by providing workers with the support they need to succeed. A Just Transition Fund can help make up for any remaining shortfalls in worker support, and governments can use their infrastructure and procurement dollars to create additional opportunities for decent green work. Finally, these measures need to be supported by timely and comprehensive data, in order to ensure that the opportunities created by the green transition are equitable and inclusive, and that no Ontarian is left behind.



“We are the first generation that can end poverty and the last generation that can take steps to avoid the worst impacts of climate change.”

Ban Ki Moon

8th Secretary General of the United Nations

5 CONCLUSION

Ontario must make its green transition a triple win – one that offers social, economic and environmental opportunities across the province. There is evidence to believe that this transition will greatly benefit the economy and the environment, and is likely to have overall positive impacts on the employment landscape. But the individual worker experience cannot be ignored amid these broader changes. As governments, businesses and citizens change their preferences and practices, sectoral changes will restructure the economy in ways that directly affects workers on the ground. These impacts will become all the more pronounced if and when the global pace of the green transition accelerates. Questions around job quality, skills and educational requirements, displaced workers and barriers faced by marginalized communities must be taken seriously during this transition.

Public policy will be a key driver in ensuring that this transition is just and equitable. By developing a comprehensive strategy that combines broad supports and targeted measures for vulnerable populations, governments can proactively approach these upcoming changes in a way that can reap the benefits, mitigate the negative impacts and provide support where gaps emerge.

Everyone has a role to play in this transition. Governments, employers, workers, unions and non-profit organizations alike must remember that if we fail to ensure that the green transition is just and inclusive, we will have missed a vital opportunity to address today's most pressing challenges. But if we design policies and programs that facilitate this transition with decent work in mind, they have the potential to benefit all Ontarians.

APPENDICES

APPENDIX A Sectoral Impacts

The green transition will likely have profound implications for many key sectors of Canada's economy. As the Government of Canada notes in Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy, "although most Canadians recognize the need to address climate change and limit global temperature increases, the full magnitude of what this challenge entails is less well understood, requiring very deep emissions cuts from every sector by mid-century."¹³⁸

As this transformation unfolds, there will be opportunities for many economic sectors to increase their competitiveness through greater efficiency and to tap into the growing global market for green goods and services. A survey of the existing knowledge base indicates which economic activities are most likely to see change. These activities, how they may change and the resulting impact on jobs are described below.¹³⁹ Given the ongoing and related discussions surrounding the labour market implications of workforce automation, we also briefly discuss how employment trends under a green transition might interact with trends in automation.

Utilities: Renewable electricity generation will likely grow due to increased demand from the electrification of heating and transportation. For instance, a recent study estimates that decarbonizing Canada's electricity sector by 2025 would lead to significant new wind capacity development in Ontario (>14,000 MW).¹⁴⁰ Other studies estimate that Canada will likely need to double or triple its electricity supply (with renewables making up a significant share of generating capacity) in order to reduce its GHG emissions to levels consistent with the Paris Agreement.¹⁴¹ The Deep Decarbonization Pathways Canada report also estimates that Canada's electricity sector GDP will increase by approximately 500 per cent in 2050 under a green transition, compared to a 20 per cent increase under business-as-usual.¹⁴²

138 Environment and Climate Change Canada (2016). *Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy*. http://unfccc.int/files/focus/long-term_strategies/application/pdf/canadas_mid-century_long-term_strategy.pdf.

139 The employment figures mentioned in this section should be understood as highlighting broad-scale trends in the types of green jobs and related skills that will be in demand under a green transition. While some of them might lead to net employment growth within a sector (drawing from the unemployed labour force or from other sectors), many of these jobs will represent shifts within the same economic sector as workers re-skill and existing occupations transform. For example, much of the existing pool of construction workers may also be the ones constructing efficient buildings and retrofitting existing ones. Similarly, if green economy policies increase costs and lower output across the economy, then net employment growth within green sectors will not necessarily increase economy-wide employment. It should also be kept in mind that some of these jobs will be temporary. For more information on a specific figure, please see the referenced source. General useful reading on this topic includes: Bohringer, Christoph, Nicholas J. River, Thomas F. Rutherford, and Randall Wigle. (2012). "Green Jobs and Renewable Electricity Policies: Employment Impacts of Ontario's Feed-in Tariff." *The B.E. Journal of Economic Analysis & Policy* 12. 7; Lambert, Rosebud Jasmine and Patrícia Pereira Silva (2012). "The challenges of determining the employment effects of renewable energy." *Renewable and Sustainable Energy Reviews*. 16: 4667–4674. Retrieved from <http://www.sciencedirect.com/science/article/pii/S1364032112002572>.; Earley, Sinead and Warren Mabee (2011). "The Impact of Bioenergy and Biofuel Policies on Employment in Canada." *Presented at the Work in a Warming World (W3) Researchers' Workshop: "Greening Work in a Chilly Climate," Toronto, Canada, November 2011*. Retrieved from http://warming.apps01.yorku.ca/wp-content/uploads/WP_2011-09_Earley_Mabee_Impact-of-BioenergyBiofuel-on-Employment.pdf.

140 See Dolter, Brett and Nic Rivers (2017). *The Cost of Decarbonizing the Canadian Electricity System*. Ottawa: Institute of Environment Working Paper. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2907924.

141 See Bataille, Sawyer and Melton (2015), *op. cit.*; Trottier Energy Futures Project (2016). *Canada's Challenge and opportunity: transformations for major reduction in GHG emissions*. Ottawa: Canadian Academy of Engineering and the David Suzuki Foundation. Retrieved from https://www.cae-acg.ca/wp-content/uploads/2013/04/3_TAFP_Final-Report_160425.pdf.

142 Bataille, Sawyer and Melton (2015), *op. cit.*

Renewable electricity – particularly solar and wind – is likely to account for a significant share of LCT employment opportunities in Ontario’s green transition, since manufacturing, installing and operating renewable energy technologies is usually labour-intensive.¹⁴³ For instance, Alberta’s 2030 target for 5,000 MW of installed renewable electricity capacity (wind and solar) is expected to create 900-2500 full-time equivalent jobs per year.¹⁴⁴ Ontario’s currently installed wind and solar electricity capacity is just shy of 4,600 MW,¹⁴⁵ and will continue to grow over time. While data specific to the renewable energy sub-sector are not available, occupations within the utilities sector as a whole are at relatively low risk of automation.¹⁴⁶

Construction and building renovations: Decarbonizing the building construction and renovations sector will have important economic and employment ramifications. Opportunities for greening the sector may include more environmentally-friendly building materials (e.g. multi-storey wood structures), and improved energy and water efficiency. One recent study estimated that increasing Canada’s carbon price in \$10/year increments from \$10/tonne in 2018 to \$80/tonne in 2025 would increase Canada-wide output from the construction sector by approximately \$10 million, which may lead to a correspondingly modest increase in GDP and employment for the sector in Ontario.¹⁴⁷

Another study estimated that the \$1.91 billion to \$2.73 billion allocated toward building retrofits in Ontario’s Climate Change Action Plan could lead to approximately 24,500-32,900 person-years of employment in these activities over five years.¹⁴⁸ While jobs in the construction sector as a whole are at moderate risk of automation,¹⁴⁹ the risk may be less pronounced for building renovators, where most of the short and medium-term employment opportunities will be found under a green transition.¹⁵⁰

143 Wei, Max, Shana Patadia and Daniel M. Kammen (2010). "Putting renewables and energy efficiency to work: How many jobs can the clean energy industry generate in the US?" *Energy Policy* 38: 919–931. Retrieved from <http://www.sciencedirect.com/science/article/pii/S0301421509007915>; Lambert and Silva (2012), *op. cit.*

144 Jeyakumar, Binu (2016). *Job Growth in Clean Energy: Employment in Alberta's emerging renewables and energy efficiency sectors*. Calgary: The Pembina Institute. Retrieved from <https://www.pembina.org/reports/job-growth-in-clean-energy.pdf>.

145 Independent Electricity System Operator (2017). "Ontario's Supply Mix." *Independent Electricity System Operator*. Retrieved from <http://www.ieso.ca/learn/ontario-supply-mix/ontario-energy-capacity>.

146 Oschinski, Matthias and Wyonch, Rosalie (2017). *Future Shock? The Impact of Automation on Canada's Labour Market*. C.D. Howe Institute Commentary No. 472. Toronto: C.D. Howe Institute. Retrieved from <https://www.cdhowe.org/public-policy-research/future-shock-impact-automation-canadas-labour-market>.

147 Coad, Len, Robyn Gibbard, Alicia Macdonald, and Matthew Stewart (2017). *The Cost of a Cleaner Future: Examining the Economic Impacts of Reducing GHG Emissions*. Ottawa: Conference Board of Canada. Retrieved from <http://www.conferenceboard.ca/e-library/abstract.aspx?did=9021>.

148 Environmental Defence, Blue Green Canada and Clean Economy Alliance (2017). *Building an Ontario green jobs strategy: ensuring the climate change action plan creates good jobs where they are needed most*. Toronto: Environmental Defence, Blue Green Canada and Clean Economy Alliance. Retrieved from http://environmentaldefence.ca/wp-content/uploads/2017/04/EDEF_GreenJobsPrimer-WebRes-FINAL-FINAL.pdf.

149 Oschinski and Wyonch (2017), *op. cit.*

150 Calvert (2015) notes that low carbon building construction and renovations require flexibility, judgment and creativity amongst skilled tradespeople – all competencies which Autor (2015) notes are difficult to automate. (Autor also notes that in the automotive sector, windshield manufacturing has been automated much more easily than windshield replacement. The latter might be considered analogous to building renovations). See Calvert, John. (2015) "Construction and Climate Change: Overcoming Roadblocks to Achieving Green Workforce Competencies." *Work in a warming world* (Carla Lipsig-Mummé and Stephen McBride, eds.), Montreal and Kingston: McGill-Queen's University Press; Autor, David. (2015). "Why Are There Still So Many Jobs? The History and Future of Workplace Automation." *Journal of Economic Perspectives* 29,3: 3-30.

Manufacturing: Lowering the overall environmental footprint of the manufacturing sector will require a number of green practices that can save costs and capture new markets. These may include increasing material and energy efficiency,¹⁵¹ fuel switching,¹⁵² product life extension (e.g. modular electronics that allows for parts to be easily replaced), increasing the use of bio-based products¹⁵³ and recyclable materials, and creating fully compostable or biodegradable products.¹⁵⁴ Of course, these changes will take place within a broader shift for the sector in which increasing automation of assembly line manufacturing will likely lead to decreasing employment.¹⁵⁵

Low carbon vehicles (automobile manufacturing) and transportation:

Decarbonizing the transportation sector presents an enormous environmental and economic opportunity. Zero and low GHG-emitting automobiles (e.g. electric, hydrogen, bioenergy, and ultra-efficient internal combustion engines) make up a rapidly growing share of the vehicle market, which will be captured by smart and forward-looking businesses.¹⁵⁶ As was mentioned previously, the International Energy Agency Estimates that 70 per cent of all new cars will need to be electric by 2050 in order to stabilize global temperatures at or below the 2°C target.¹⁵⁷ Other opportunities for greening the sector include switching from trucking to rail freight, ridesharing, as well as substituting public transit for personal automobile use.¹⁵⁸ While the low carbon technology investment modelling suggests that vehicle manufacturers hold many (if not most) of the economic opportunities associated with decarbonizing transportation,¹⁵⁹ the development of technologies such as ridesharing suggest that there may also be niche opportunities within the transportation sector itself. On the other hand, many of jobs in the transportation and warehousing sector are susceptible to automation,¹⁶⁰ and this trend is likely to persist under a green transition.

151 McKinsey Global Institute (2017). *op. cit.*

152 Smart Prosperity Initiative (2017). *Fabricating metals the carbon neutral way*. Smart Prosperity Initiative. Retrieved from <http://www.smartprosperity.ca/stories/metal>

153 Forest Products Association of Canada. (nd). *Bio-economy*. Retrieved from <http://www.fpac.ca/advocacy/bio-economy/>.

154 Lacy, Peter, Justine Keeble, Robert McNamara, et al. (2014). *Circular advantage: innovative business models and technologies to create value in a world without limits to growth*. Dublin: Accenture. Retrieved from https://www.accenture.com/t20150523T053139__w_/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Strategy_6/Accenture-Circular-Advantage-Innovative-Business-Models-Technologies-Value-Growth.pdf#zoom=50; National Zero Waste Council (2015). *Circular economy case study: enviro image solutions*. Vancouver: National Zero Waste Council. Retrieved from <http://www.nzwc.ca/focus/circular-economy/case-studies/casestudies/enviroimage.pdf>.

155 Oschinski, Matthias and Rosalie Wyonch (2017), *op. cit.*

156 It was estimated that in the first half of 2016, electric vehicle sales grew approximately ten times faster than conventional vehicle sales. See Electric Vehicle World Sales Database. (2016). "Global Plug-in Vehicle Sales for 2016 H1." *Electric Vehicle World Sales Database*. Retrieved from <http://www.ev-volumes.com/news/global-plug-in-vehicle-sales-h1-2016/>.

157 OECD/IEA and IRENA (2017), *op. cit.*

158 Environment and Climate Change Canada (2016), *op. cit.*; Fulton, Lew, Jacob Mason, Dominique Meroux (2017). *Three Revolutions in Urban Transportation*. Davis: Institute for Transportation and Development Policy. Retrieved from <https://www.itdp.org/wp-content/uploads/2017/04/ITDP-3R-Report-FINAL.pdf>.

159 US Department of Energy (2015). *New Analysis Center Releases First Report, Evaluates Opportunities in Electric Vehicle Battery Market*. Retrieved from <https://energy.gov/eere/articles/new-analysis-center-releases-first-report-evaluates-opportunities-electric-vehicle> and Hamilton, Tyler (2015). "Is Ontario destined to become a relic of the auto industry?" *Corporate Knights*. August 12, 2015. Retrieved from <http://www.corporateknights.com/channels/transportation/ontario-destined-become-relic-auto-industry-14393680/>.

160 Oschinski and Wyonch (2017), *op. cit.*

Natural resources: There will also be opportunities for greening Ontario's established natural resource sectors, including mining, forestry and agriculture.

- » **Mining opportunities** may include greater energy and water efficiency, electrifying the vehicle fleet and substituting renewable energy for diesel,¹⁶¹ mine methane capture and destruction,¹⁶² better protection of biodiversity and state of the art remediation practices. Ontario also has the opportunity to supply several important minerals that many fast-growing clean technologies (such as solar PV panels and advanced batteries) depend on such as copper, lead, zinc and nickel, as it has nearly two dozen mines, processing facilities and advanced exploration projects underway for these minerals.¹⁶³ Further, some estimates see demand for rare earth elements (REEs) – another key input for clean technologies – rising by as much as 2,600 per cent by 2025.¹⁶⁴ Ontario currently has one advanced REE project in operation¹⁶⁵ and analysts and policymakers should explore the potential for future growth in this area. However, given the ongoing automation in the mining sector, the employment impacts arising from a green transition are unclear.¹⁶⁶
- » **Forestry opportunities** may include creating carbon offsets by sequestering emissions,¹⁶⁷ better protecting biodiversity and reducing emissions throughout the forestry supply chain.¹⁶⁸ The sector may also enjoy growth as a supplier of wood bioproducts for the manufacturing sector, and as a supplier of environmentally-friendly building materials for the construction sector.¹⁶⁹ Some of these green practices may require specialized skills and may be labour-intensive, which implies increased employment.¹⁷⁰ However, forestry sector occupations are also at moderate risk of automation,¹⁷¹ and thus it is not clear to which extent green forestry occupations defy this trend.
- » **Agriculture sector opportunities** could result from rewards for more sustainable farming practices such as biodiversity conservation on farmlands, carbon offsets through activities such as soil carbon sequestration in croplands and pastures,¹⁷² as well as using marginal agricultural land and agricultural residues for bioenergy production.¹⁷³ Although some studies have shown that 'green' agricultural

161 Smith, Michael (2013). *Assessing climate change risks and opportunities for investors: mining and minerals processing sector*. Canberra: Australian National University and Investor Group on Climate Change. Retrieved from https://igcc.org.au/wp-content/uploads/2016/04/mining_assessing-climate_change_risks_for_investors.pdf; Nyquvest. Tyler (2016). "Goldcorp ditches diesel to electrify Borden mine." *Business Vancouver*. Dec 12, 2016. Retrieved from <https://www.biv.com/article/2016/12/goldcorp-ditches-diesel-electrify-borden-mine>.

162 Climate Action Reserve (2016). *Adapting Offset Protocols for Ontario, Québec, and Other Jurisdictions*. Climate Action Reserve. <http://www.climateactionreserve.org/adapting-offset-protocols-for-ontario-quebec-and-other-jurisdictions-2/>

163 Clean Energy Canada (2017). *Mining for Clean Energy: How the global rise of solar power will drive demand for Canadian metals and minerals*. Vancouver: Clean Energy Canada. Retrieved from <http://cleanenergycanada.org/wp-content/uploads/2017/06/MiningCleanEnergy2017.pdf>; Natural Resources Canada (2017). *Information Bulletin: Enabling Clean Energy Applications with Canadian Minerals and Metals*. Retrieved from <http://www.nrcan.gc.ca/mining-materials/publications/19447>.

164 Standing Committee on Natural Resources (2014). *The Rare Earth Elements Industry in Canada – Summary of Evidence*. June 2014, 41st Parliament, Second Session. Retrieved from http://www.pelemountain.com/pdfs/standing_committee_on_natural_resources_full_report.pdf.

165 Natural Resources Canada (2017), *op. cit.*

166 Oschinski and Rosalie Wyonch (2017), *op. cit.*

167 Climate Action Reserve (2016), *op. cit.*

168 Mabee, Warren (2013). "Circular Economies and Canada's Forest Sector." *Presented at the Work in a Warming World (W3) Researchers' Workshop: "Greening Work in a Chilly Climate,"* Toronto, Canada, November, 2011. Retrieved from http://warming.apps01.yorku.ca/wp-content/uploads/WP_2011-08_Mabee_Circular-Economies.pdf; Holmes (2013), *op. cit.*

169 Forest Products Association of Canada (nd), *op. cit.*

170 *Ibid.*

171 Oschinski and Wyonch (2017), *op. cit.*

172 Climate Action Reserve (2016), *op. cit.*

173 Mabee, Warren A., et al. (2006). "Canadian Biomass Reserves for Biorefining." *Applied Biochemistry and Biotechnology* 22: 129-132.

Retrieved from https://link.springer.com/chapter/10.1007%2F978-1-59745-268-7_3?LI=true#page-1.

practices are likely to increase employment within the sector,¹⁷⁴ it should be kept in mind that agriculture is also among the economic sectors most likely to become automated over the coming years.¹⁷⁵ As such, the overall impacts of the green transition on agricultural employment are unclear.

Nature conservation: If fully embraced, a green transition will also offer increased opportunities for nature conservation through a mix of public expenditures and private incentives. To give an example from the public sector, nature conservation in federal and provincial parks in Ontario provides approximately 5,700 full-time equivalent jobs.¹⁷⁶ The green transition will further bolster these trends and create good-paying conservation jobs – many of which are highly skilled and hence resilient to automation. This will be especially important in rural and remote communities which may have few alternative employment opportunities.

Waste management and remediation services: Ontario's new *Resource Recovery and Circular Economy Act* requires brand holders for several important product areas (e.g. printed paper and packaging materials and used tires) to recover a growing proportion of their products at end of life. This will create incentives for a number of greener practices within the sector, including increasing recycling and recovering products and packaging for numerous types of goods, and supplying carbon offsets within Ontario's cap and trade system.¹⁷⁷ The Act also has significant ramifications for employment and the economy, since every tonne of waste diversion is estimated to create 60 per cent more GDP and 40 per cent more jobs than waste disposal.¹⁷⁸

Studies have also estimated that increasing Ontario's waste diversion rate to 60 per cent from the current 23 per cent could create up to 13,000 new jobs in the sector and increase GDP of the waste management and remediation services sector by up to \$1.5 billion.¹⁷⁹ Given that Ontario's waste management and remediation services sector currently produces around \$2.5 billion in GDP, this corresponds to a 60 per cent increase in GDP for the sector. However, automation may be feasible for about 40 per cent of the occupations in the administrative and support, waste management and remediation services sector, which may dampen these employment trends somewhat.¹⁸⁰

Cleantech: Ontario has the opportunity to tap into a global cleantech market worth more than (CAD) \$2.5 trillion by 2022.¹⁸¹ This would increase cleantech employment as demand for innovative solutions that reduce environmental footprints rises, domestically and internationally.

174 Herren, Hans. R., et al. (2012), *op. cit.*

175 Oschinski and Wyonch (2017), *op. cit.*

176 The Outspan Group Inc. (2011). *The Economic Impact of Canada's National, Provincial & Territorial Parks in 2009*. Peterborough: Canadian Parks Council. Retrieved from http://www.parks-parcs.ca/english/pdf/econ_impact_2009_part1.pdf.

177 GHD Limited (2016). *Cap-and-Trade Research for Ontario's Waste Management Sector*. Brampton: Ontario Waste Management Association. Retrieved from <http://www.owma.org/Publications/OWMAReporstandPolicies/tabid/180/ctl/DisplayAttachment/mid/624/AnnotationId/fd7d05b9-151d-e611-83d9-00155d607900/ShowOpenSaveDlg/1/Default.aspx>; Climate Action Reserve (2016), *op. cit.*

178 Ontario Ministry of Environment and Climate Change. (2017). *Strategy for a Waste Free Ontario: Building the Circular Economy*. Toronto: Queens Printer for Ontario. Retrieved from https://files.ontario.ca/finalstrategywastefreeont_eng_aoda1_final-s.pdf.

179 Gill, Vijay and James Knowles. (2014). *Opportunities for Ontario's waste: Economic impacts of waste diversion in North America*. Ottawa: Conference Board of Canada. Retrieved from <http://www.conferenceboard.ca/e-library/abstract.aspx?did=6233>.

180 Lamb (2016), *op. cit.*

181 Analytica Advisors (2016), *op. cit.*

Professional, scientific and technical services: This sector also has considerable growth potential under a green transition, with one recent study estimating that increasing Canada's carbon price by \$10/tonne each year from 2018 through 2025 would increase the Canada-wide output for professional, scientific and technical services by almost \$350 million.¹⁸²

There are also a number of sectors that may face challenges during Ontario's green transition. These challenges could result from the possible negative competitiveness effects of various environmental policies, technological developments and changes in consumer preferences.

This issue is best examined in the context of carbon pricing, such as Ontario's cap and trade system. The concern is that carbon pricing will increase costs for businesses, which might lead to changes in production or employment as businesses decide to produce less, or close up shop and move elsewhere. Research has shown that this is a legitimate concern, though only for the small fraction of the economy that is export-oriented and has a high GHG emissions intensity (referred to as emissions-intensive trade-exposed sectors). Fortunately, this concern has led policymakers and others to identify these vulnerable sectors and design policies to ensure that they are able to manage the transition to a green economy.¹⁸³

In the case of Ontario, competitiveness risks from climate change policy are largely concentrated in heavy industry sub-sectors such as petrochemicals and petroleum refining, iron and steel production, as well as lime production.¹⁸⁴ Ontario has designed its cap and trade program to provide short-term support to these sectors as they make a successful transition away from emissions-intensive production. Further, analysis shows that the majority of Ontario's economy consists of low carbon sectors, so it will be less vulnerable to these pressures than other jurisdictions. Under a carbon price of \$30-40/tonne – which is in line with the carbon pricing schedule leading up to 2022 under the Pan-Canadian Framework on Clean Growth and Climate Change – only 1 to 2 per cent (or less) of Ontario's total GDP is highly vulnerable to these threats.¹⁸⁵ However, even with these support measures in place, it is likely that some of these sub-sectors will have a somewhat lower growth rate relative to business-as-usual.¹⁸⁶ Generally, a fully-fledged green transition would also reduce local air pollution¹⁸⁷ (e.g. sulphur dioxide).¹⁸⁸ The policies for achieving this, such as emissions pricing and regulations, have competitiveness

182 Coad, Len et al. (2017), *op. cit.*

183 Strategies include subsidizing clean technology adoption, tax cuts, and various forms of targeted carbon pricing exemptions and rebates (such as allocating free emissions permits). See Canada's Ecofiscal Commission (2016), *op. cit.*; Institute for Competitiveness and Prosperity (2016), *op. cit.*

184 Sawyer (2013), *op. cit.*; Canada's Ecofiscal Commission (2015). *Provincial carbon pricing and competitiveness pressures*. Montreal: Canada's Ecofiscal Commission.

185 Sawyer (2013), *op. cit.*; Canada's Ecofiscal Commissions (2015), *op. cit.* Even if Ontario increases its carbon pricing ambition to \$120/tonne, representing a deep cut in emissions and a bolder step towards a green transition, Canada's Ecofiscal Commission estimates that only 5 per cent (or less) of Ontario's GDP will be vulnerable to competitiveness pressures.

186 See ICP (2016), *op. cit.*

187 Government of Canada (2016). *Pan-Canadian Framework on Clean growth and Climate Change*. Ottawa: Government of Canada. Retrieved from <https://www.canada.ca/content/dam/themes/environment/documents/weather1/20170125-en.pdf>.

188 Ontario has already made great strides in this area through its combination of cap and trade programs for nitrogen oxides and sulphur dioxide (O. Reg. 397/01 and O. Reg. 194/05), its vehicle emissions regulations, and the phase-out of coal-fired electricity, so this prescription may be more relevant to other Canadian jurisdictions. See Ontario Ministry of Environment and Climate Change (2017). *Air Quality in Ontario: 2015 report*. Toronto: Queen's Printer for Ontario. Retrieved from https://files.ontario.ca/books/7396_moecc_airquality2017report_wa_14f.pdf.

considerations and solutions that are similar to carbon pricing.¹⁸⁹ On the other hand however, the competitiveness impacts of other environmental policies (e.g. waste diversion targets) are not as well-understood and deserve further study and consideration.¹⁹⁰ Changing consumer preferences (e.g. demand for zero-waste products, electric vehicles, living closer to the urban core or with easy access to transit) will also have important ramifications for sectoral changes under a green transition, which may result in employment impacts for different sub-sectors and job types.

189 Sterner, Thomas and Lena Höglund (2000). "Output-Based Refunding of Emission Payments: Theory, Distribution of Costs, and International Experience." *Resources for the Future Discussion Paper 00-29*. Retrieved from <http://www.rff.org/files/sharepoint/WorkImages/Download/RFF-DP-00-29.pdf>.

190 Much of the research on the effects of environmental regulations on economic or business competitiveness have focused on regulations targeting carbon dioxide or local air pollutant emissions. See e.g. Ambec, Stefan, Mark A. Cohen, Stewart Elgie and Paul Lanoie (2013). "The Porter Hypothesis at 20: Can Environmental Regulation Enhance Innovation and Competitiveness?" *Review of Environmental Economics and Policy* 7(1): 2-22. Retrieved from <https://academic.oup.com/reep/article/7/1/2/1578611/The-Porter-Hypothesis-at-20-Can-Environmental>.

APPENDIX B

Impacts on Historically Disadvantaged and Equity-Seeking Groups

A number of marginalized communities continue to face inequities in Ontario and experience barriers to accessing decent work. There is also reason to believe that a green transition could have disproportionately negative impacts on these groups if proactive measures are not taken. The following groups must be carefully considered as the province pursues a green transition:

Racialized Populations

Studies have found that despite higher levels of labour market participation, racialized Canadians (i.e. those identifying as non-Caucasian in race or non-white in colour) earn 81.4 cents to every dollar earned by a non-racialized Canadian, and are more likely to be engaged in work that is insecure, temporary and low paying.¹⁹¹

In Ontario, both racialized men and women appear to be overrepresented in administrative and support, waste management and remediation services – an industry grouping that is characterized by precarious, insecure and low paid work.¹⁹² Furthermore, Table 3 suggests that racialized women may be significantly underrepresented in the utilities sector, which is expected to see the most growth from a green transition as illustrated in Table 3. Such an example highlights why intersectionality is an important consideration. An individual can represent multiple identities based on gender, ethnicity, race, sexuality, religion, age, disability, and many others – all of which can intersect and generate an entirely different experience of discrimination and barriers to opportunity.¹⁹³

191 Block, Galabuzi, and Weiss, Alexandra. (2014) *op. cit.* This particular study uses 2006 Census data on the visible minority group to which the respondent belongs. The Employment Equity Act defines visible minorities as persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour.

192 Block, Galabuzi, and Weiss, Alexandra. (2014) *op. cit.* However, see footnote 55 for a discussion of how working conditions in the waste management and remediation services sector may be better than the data from Statistics Canada suggest, due to the way in which sectors are aggregated when Statistics Canada reports on wage data for the administrative and support, waste management and remediation services sector.

193 Hankivsky, Olena. *Intersectionality 101*. Vancouver: Simon Fraser University. Retrieved from https://www.sfu.ca/iirp/documents/resources/101_Final.pdf.

TABLE 3

Racialized and Non-Racialized Labour Force by Sector, Ontario 2011

Sector	Racialized		Non-Racialized	
	Men	Women	Men	Women
All sectors	12.5%	11.8%	39.2%	36.5%
Utilities	10.5%	4.7%	64.3%	20.5%
Construction	11.4%	1.6%	76.9%	10%
Manufacturing	18.9%	10%	51.9%	19.3%
Professional Scientific and technical services	15.9%	11.3%	39.2%	33.6%
Agriculture, forestry, fishing and hunting	4.1%	2.9%	61.6%	31.4%
Mining, quarrying and oil and gas extraction	5.5%	2.3%	80%	12.2%
Administrative and support, waste management and remediation services	15.2%	13.2%	40.5%	31.1%

Source: Sheila Block, Grace-Edward Galabuzi, Alexandra Weiss. 2014. *The Colour Coded Labour Market by the Numbers: A National Household Survey Analysis*. Toronto: Wellesley Institute.

NOTE: Any sector that has a racialized labour force share above 12.5 per cent for men and 11.8 per cent for women shows a potential overrepresentation¹⁹⁴.

Indigenous Peoples

In Ontario, the employment rate of the Indigenous Peoples population (including First Nations, Inuit and Métis) was 63.4 per cent in 2011, compared to 75.5 per cent of the non-Indigenous Peoples population.¹⁹⁵ Earnings are also significantly lower – the median income for Indigenous Peoples was \$22,546 in 2010, compared to \$30,696 for non-Indigenous Peoples.¹⁹⁶ Much of this can be tied to deeply unequal access to education for both on- and off-reserve Indigenous individuals: while 52.3 per cent of Indigenous youth receive some form of post-secondary education, over 65 per cent of their non-Indigenous counterparts do.¹⁹⁷

While some sectors that are expected to grow in a transition to a green economy, such as utilities, do employ many Indigenous people, they remain significantly underrepresented in other growth sectors such as professional, scientific and technical services.¹⁹⁸ Many Indigenous individuals are also employed in sectors which are likely to see significant skills shifts in a green transition, including construction and natural resource sectors such as forestry and mining. These changes could be problematic, since Indigenous Peoples face significant barriers and challenges along the education-to-employment continuum in ways that are very different to the non-Indigenous population.¹⁹⁹ This may exacerbate challenges in finding employment in the green economy, where many jobs require higher

194 These figures need to be interpreted with a certain amount of caution however, as the authors note that “the summary statistics made available by Statistics Canada do not have sufficient detail to allow for significance testing these variables.” Block, Galabuzi, and Weiss, Alexandra. (2014) *op. cit.*

195 Statistics Canada (March 14, 2016) “Aboriginal Peoples: Fact Sheet for Ontario.” Retrieved from <http://www.statcan.gc.ca/pub/89-656-x/8-9-656-x2016007-eng.htm>.

196 The National Aboriginal Economic Development Board (2015). *The Aboriginal Economic Progress Report*. Retrieved from <http://www.naedb-cndea.com/reports/NAEDB-progress-report-june-2015.pdf>

197 Statistics Canada (March 14, 2016), *op. cit.*

198 Statistics Canada. (2017), *op. cit.*

199 Ontario Federation of Indian Friendship Centres (January 2013), “Urban Aboriginal labour force and strategic framework: Identifying our Potential.” Retrieved from <http://www.ofifc.org/sites/default/files/docs/2013-04-17%20Labour%20Force%20and%20Training%20Strategy%20-%20FINAL.pdf>.

education levels and training. Indirect barriers and systemic forces such as these should be addressed in crafting a decent work agenda in the green economy.

Women

There continues to be a gender wage gap in Ontario. A qualified working woman – with the same socio-economic and demographic characteristics as a man – receives on average \$7,200 less each year. For all working Ontario women in the aggregate, this amounts to approximately \$18 billion of foregone income per year, representing 2.5 per cent of provincial GDP.²⁰⁰

A number of concerns have been raised about the gendered employment impacts of green transition policies, since the majority of jobs generated by renewable energy and building retrofit programs are typically performed by men.²⁰¹ Similarly, only 1 in 4 workers in the Ontario utilities sector is a woman. Furthermore, the unionization rate and wages for women are also consistently lower across all the observed sectors – making, on average, 83 cents per every dollar earned by a man.²⁰²

This reflects a broader trend of underrepresentation of women employed in STEM fields and skilled trades.²⁰³ A number of factors might explain these trends, including: biased perceptions (by both male and females) of female competence in technical occupations;²⁰⁴ societal expectations that females should be primary caregivers (making it more difficult for women to attain work-life balance);²⁰⁵ as well as slight differences in choice of university major (which may be due to differences in socialization or considerations based on comparative advantage).²⁰⁶ There is also some evidence that certain skilled tradesmen see their skills and accomplishments as an important part of their masculine self-identity, which sometimes causes hostility toward female participation in the skilled trades.²⁰⁷

Newcomers to Canada

Despite Canada's reliance on immigration for its economic well-being, newcomers to Canada identify a number of barriers to accessing the labour market, such as difficulties regarding language and communication, credential recognition, arbitrary requirements for "Canadian experience" and outright discrimination.²⁰⁸

200 Ministry of Labour (Ontario) (2016). *Final Report and Recommendations of the Gender Wage Gap Strategy Steering Committee*. Retrieved from: https://files.ontario.ca/7198_mol_gwg_finalreport_eng_wa_08f_v2_1.pdf.

201 McFarland, Joan (2015). "Are there jobs for women in green job creation?" *Women and Environments International Magazine* 94/95, 22-25. Retrieved from http://www.uwo.ca/womens/pdf/faculty_info/Baruah_WE2015.pdf.

202 Authors' calculation from Statistics Canada (2017). *CANSIM Table 282-0072 Labour force survey estimates (LFS), wages of employees by type of work, North American Industry Classification System (NAICS), sex and age group, annual (current dollars)*. Retrieved from: <http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=2820072>.

203 Baruah and Godet (2015), *op cit*.

204 *Ibid*.

205 *Ibid*.

206 In this example, comparative advantage refers to the hypothesis that women specialize in majors where they perform exceptionally well (relative to all of their courses taken across different disciplines), even if they perform very well on measures of STEM readiness in absolute terms (e.g. grades in STEM-related courses). Recent analyses of data from the Ontario Ministry of Education and the Ontario University Applications Centre suggest that such a dynamic might be at work, since "students with higher grades in STEM related courses are more likely to enter STEM, holding constant their overall top 6 grades, whereas students with higher overall grades are less likely to enter STEM, holding constant their top 3 math/science grades" (Card and Payne 2017). The authors also find that students in the former group are more likely to be male, whereas students in the latter group are more likely to be female. Based on these trends, the authors conclude in favour of the comparative advantage interpretation. See Card, David and A. Abigail Payne (2017). "High school choices and the gender gap in STEM." *National Bureau of Economic Research Working Paper 23769*. Retrieved from: <http://www.nber.org/papers/w23769>.

207 See the discussion of Marcia Braundy's *Women, Men and Tools: Bridging the Divide* in McFarland, Joan. (2013). "The Gender Impact of Green Job Creation." *Work in a Warming World Working Paper # 2013-03*. Retrieved from http://warming.apps01.yorku.ca/wp-content/uploads/WP_2013_03_McFarland_Gender-Impact-of-Green-Job-Creation.pdf.

208 Ontario Human Rights Commission (February 2013) "Policy on Removing the 'Canadian Experience' Barrier." Retrieved from <http://www.ohrc.on.ca/en/policy-removing-%E2%80%9Ccanadian-experience%E2%80%9D-barrier>.

Credentialism may be of particular concern to newcomers seeking work in the green economy as research has documented a high premium placed upon credentials within green businesses.²⁰⁹ Credentialism – the trend toward increasing requirements for formal designations, education and training – has extended into traditionally entry level jobs and is likely to become increasingly prevalent in the green economy. This will particularly disadvantage newcomer Canadians, since their international credentials may not be recognized in the Canadian labour market. As a result, recent immigrants may resort to lower-skill and lower-paid jobs for which they are overqualified.²¹⁰

Workers with Disabilities

Accessible services and inclusive workplaces are still not a reality for disabled Ontarians. According to a 2012 report from the Canadian Human Rights Commission, Canadians with a disability are half as likely to complete a university degree, more likely to settle for part-time over full-time employment, and have lower annual incomes than adults without a disability.²¹¹

Workers with a disability are much less likely to be involved in some promising green sectors such as professional, scientific and technical services, but around equal to their counterparts in others such as utilities.²¹² Both men and women with severe disabilities tend to be concentrated in economic sectors such as sales, retail trade and accommodation and food services. These jobs are often lower paying, which is reflected in vastly different earnings profiles as well: for example, a man with a university degree with a disability

209 Teelucksingh and Zeglen (2016), *op. cit.*

210 *Ibid.*

211 Government of Canada (December 2015) "Persons with disabilities continue to be marginalized in Canadian society: CHRC." *Canadian Human Rights Commission*. Retrieved from <http://news.gc.ca/web/article-en.do?nid=1023019>.

212 *Ibid.*

made around \$69,200 a year in 2011, compared to \$92,700 for a university-educated male without a disability.²¹³

Rural Ontarians

Residents of rural Ontario also face significant barriers to opportunity. The remoteness of these areas often causes difficulty accessing healthcare and other government services, education, training and skills development opportunities as well as decent work. As a result, rural Ontarians tend to have below average levels of education than their urban counterparts, with years of schooling decreasing in proportion to the distance from population centres.²¹⁴ Moreover, full-time earnings of a rural worker are also only 67.8 per cent of the equivalent earnings of an urban worker.²¹⁵

Oftentimes, there are simply fewer job opportunities in rural areas. This becomes a further concern if occupations in a region are concentrated in a particular economic sector. For example, jobs in forestry, fishing, mining, quarrying, oil and gas, are likely to change considerably and are often highly concentrated in the north: over 88 per cent of the province's underground production and development miners, and 91 per cent of underground mine service and support workers are employed in the northern regions.²¹⁶ If and when these industries face disruption, communities may feel disproportionate impacts as a result of regional concentration. These impacts will be

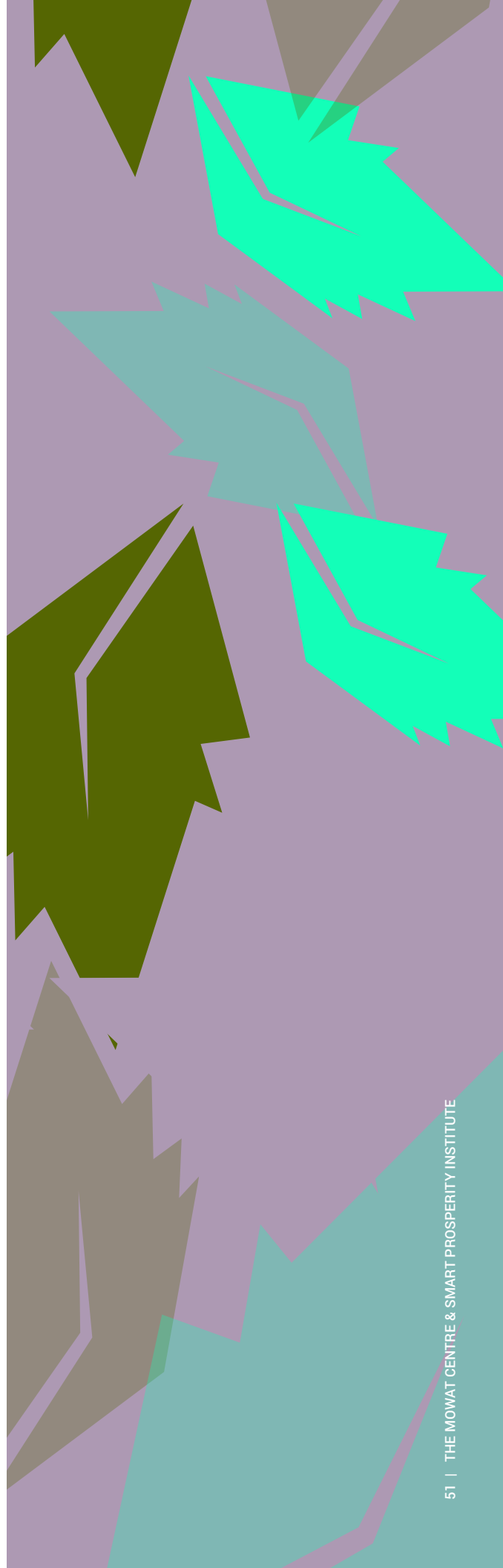
213 Martin Turcotte (December 3, 2014) "Persons with disabilities and employment." Statistics Canada, *Insights on Canadian Society*. Retrieved from <http://www.statcan.gc.ca/pub/75-006-x/2014001/article/14115-eng.pdf>.

214 Strengthening Rural Canada. *Challenges. op. cit.*

215 *Ibid.*

216 Government of Ontario. *Ontario's Labour Market Profiles: Underground production and development miners*. Retrieved from https://www.app.tcu.gov.on.ca/eng/labourmarket/ojf/profile.asp?NOC_CD=8231; Government of Ontario. *Ontario's Labour Market Profiles: Underground mine service and support workers*. Retrieved from https://www.app.tcu.gov.on.ca/eng/labourmarket/ojf/profile.asp?NOC_CD=8411.

compounded if their remoteness makes it difficult to pursue further education, training or skills development for new job opportunities. Ontario's industrial heartland in the southwest region – specifically around London, Windsor and Sarnia – have already experienced such a regional decline in the manufacturing sector. This exemplifies the need for targeted supports to rural Ontarians.



Appendix C: Modelling

Scenario Modelling Parameters²¹⁷

Caveat: The databases and analysis used in this report are unrelated to the analysis completed by EnviroEconomics and Navius Research to support Ontario's Ministry of Environment and Climate Change in designing Ontario's cap and trade program.

The modelling and analysis examines the early stages of Ontario's green transition by outlining how developments in Ontario's cap and trade program will affect Ontario's economic structure and technological investments. The modelling includes a **current policies** reference case which extrapolates from federal and Ontario climate change policies implemented prior to September 2015 and those announced in the lead-up to the Paris Climate Conference, including Ontario's cap and trade policy and municipal solid waste regulations.²¹⁸ Under current policies, the cap and trade program is modelled using previous price forecasts for the Western Climate Initiative, with prices at CAD \$18/tonne in 2017 and rising to \$59/tonne (nominal) by 2030.

The **accelerated policy ambition** scenario builds on these policies by modelling a slightly more ambitious carbon pricing schedule aligned with the social cost of carbon,²¹⁹ moving from \$31/tonne in 2017 to \$81/tonne in 2030. This approximates some recent developments to California's cap and trade program²²⁰ (to which Ontario linked in September 2017).²²¹ Under both current policies and the accelerated policy ambition scenario, purchasing emissions permits from California closes the gap between Ontario's domestic GHG emissions reductions and Ontario's 2030 mitigation target, and carbon pricing revenues are offset with tax cuts to labour and capital.

The models do not incorporate the additional regulations and expenditures announced in Ontario's Climate Change Action Plan or the Pan-Canadian Framework, nor do they incorporate other environmental policies in Ontario. While the analysis indicates the likely direction of change in Ontario's economy, a fully-fledged green transition would further accelerate these trends.

217 The descriptions of the GEEM and CIMS models are adapted from Sawyer, Dave, Jotham Peters and Seton Stiebert (2015). *Impact Modelling and Analysis of Ontario's Cap and Trade Program*. Ottawa: EnviroEconomics, Navius Research and Dillon Consulting. Retrieved from <https://drive.google.com/file/d/0B9FT5KrVwYmwZHV2M1RZbnZmUGM/view>.

218 Current policies are taken from Sawyer, Dave and Chris Bataille (2016). *Canadian Carbon Pricing Pathways: The Economic and Emission Outcomes of Leading Policies*. Ottawa: Canadians for Clean Prosperity. Retrieved from <https://drive.google.com/file/d/0B9FT5KrVwYmwY3A2RlpaTDMON2M/view>.

219 As estimated by Environment and Climate Change Canada (2016). *Technical Update to Environment and Climate Change Canada's Social Cost of Greenhouse Gas Estimates*. Ottawa: Environment and Climate Change Canada. Retrieved from <http://ec.gc.ca/cc/default.asp?lang=En&n=BE705779-1>.

220 Several elements of California's recently passed California AB-398 legislation will increase the stringency of the cap and trade program, including a rising floor price and ceiling price for emissions permits, as well as limitations on the number of offsets which large final emitters are allowed to purchase. While the rate of increase for floor and ceiling prices for emission permits is still to be determined, AB 398 requires that the California Air Resources Board take into account the social cost of carbon when setting the ceiling price. The accelerated policy ambition scenario can be considered a potential scenario where prices for emissions permits hit the price ceiling by 2030. For a discussion of the recent changes to Ontario's legislation in the Ontario context, see Lee-Andersen, Selina (2017). *Cap & Trade 2.0: California Fine Tunes and Extends Cap & Trade Program to 2030*. Canadian Energy Law Blog, August 9th 2017. Retrieved from: <http://www.canadianenergylawblog.com/2017/08/09/cap-trade-2-0-california-fine-tunes-and-extends-cap-trade-program-to-2030/>.

221 Government of Ontario (2017). *Québec, Ontario and California Join Forces to Fight Climate Change*, 27 September 2017, retrieved from <https://news.ontario.ca/opo/en/2017/9/quebec-ontario-and-california-join-forces-to-fight-climate-change.html>.

The Models

Two models are used to derive these findings. **The Regional General Equilibrium Emissions Model (R-GEEM)** is a computable general equilibrium model of Canada and the United States, which simulates how the economy evolves under different economic conditions. It explicitly represents Canadian households and Canada's major economic sectors. As the model steps through time, it adjusts prices to ensure that markets clear for all commodities and inputs. A policy leading to a contraction in one sector will have an economy-wide impact, as labour and capital are reallocated throughout the economy.

The CIMS model is an integrated technology-economic model which provides a technology-explicit view of GHG abatement potentials and costs. A total of 11 LCTs are tracked in CIMS, including industrial carbon capture and storage, low carbon and efficient industrial and manufacturing processes, low carbon buildings, low carbon vehicles, as well as solar PV, wind power, biomass power, geothermal, hydroelectricity, nuclear power and biofuels. Capital and operational and management costs for each LCT are explicitly linked to specific economic sectors (i.e. NAICS codes).

