

Green Opportunities

Occupations in the Wind Industry

March 2010



Niagara Workforce
Planning Board

Our Vision is Working

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Niagara Workforce Planning Board recognizes potential limitations of report content and is committed to ongoing research to enhance local labour market planning in Niagara.

Introduction

In 2009, Niagara Workforce Planning Board (NWPB) released **The Niagara Labour Market Plan 2009-2013... A Vision in Action** a workforce development plan which identifies strategies designed to strengthen Niagara's economic base and promote regional prosperity for businesses, communities and residents. The Niagara Labour Market Plan is grounded in an extensive consultative process that reached across multiple sectors and stakeholders. The plan is built on community input, knowledge, intelligence and statistical evidence that validate each strategic priority and proposed action. This plan promotes a common, innovative labour market strategy to develop a skilled, knowledgeable and resilient talent pool for a competitive leading edge economy in Niagara.

Two broad challenge areas were identified and are the basis for the actions documented in the plan. One of the two challenges identified in this report states *"Niagara needs a qualified, competitive workforce with workers who can transition across existing and emerging economic sectors, industries and occupations in order for the region to be competitive in a global, knowledge based economy"*.

One of the actions designed to address this challenge was to examine and profile occupations in the wind industry. This green energy sub-sector was chosen due to the extensive research and economic development activity ongoing across Niagara as the region explores opportunities related to growth of a local wind power industry.

Part One

Brief Industrial Background

The green energy sector has experienced significant growth in recent years, with wind power playing a major role in that growth. Wind energy is one of the fastest growing sources of electricity in the world and it has become an important component of the global energy marketplace.

The growth of wind power creates employment opportunities both for existing skilled workers and our future workforce. Over 400,000 people are now directly and indirectly employed in this industry around the world, and the number is expected to rise into the millions in the near future.¹ In the United States, new wind projects completed in 2008 created 35,000 new jobs, bringing total employment in the wind sector to 85,000.²

In Canada, wind power is estimated to have grown by at least 30% annually in the last five years.³ Wind energy projects with signed power purchase agreements are projected to result in more than 5,000 megawatts (MW) of electricity in the five year period beyond 2009.

The Canadian Wind Energy Association (CanWEA) released a strategic plan in 2008 entitled *Wind Vision 2025 – Powering Canada's Future*, that lays out a growth plan for the wind energy industry. The report predicts that this industry could create over 52,000 high quality full-time jobs, and even more if Canada develops a much stronger domestic wind energy supply chain.

With over 38% of total installed capacity in 2008 and 22 wind farm operations, Ontario is Canada's leading province in wind power. Seven wind farms are under construction in Ontario with total installed capacity of 689.9 MW. The Ontario Power Authority has set a target of 4,600 MW of wind energy by 2020.⁴

In 2009 the Ontario government introduced the Green Energy Act, launching a series of bold measures to bring the Act to life. These milestone new regulations will create 50,000 direct and indirect jobs in the green energy sector over the next three years. In addition, the provincial government created North America's most progressive procurement program in the form of the Feed-in Tariff Program (FIT) further contributing to the promotion of employment in the province. The FIT establishes domestic content regulations stipulating that developers are required to have a certain percentage of their project costs come from Ontario goods and labour by the time commercial operations commence. For the wind industry, these requirements are currently set at 25% and will rise to 50% by 2012. Green energy legislation provides Ontario a competitive advantage in the North American wind industry. The FIT has attracted extraordinary interest in Ontario from developers, investors and manufacturers from around the world. International investment in wind power development is growing and has targeted Ontario locations for growth and new development in this emerging energy sector.⁵

Indeed, international wind industry suppliers are looking to establish projects in Ontario. The Government of Ontario signed a \$7-billion deal on January 21, 2010 with a consortium led by the Samsung Corporation and the Korea Electric Power Corporation (KEPCO). This is the biggest green energy business transaction ever made in Canada; it is predicted to triple Ontario's renewable energy generation and lead to new manufacturing facilities being constructed in the province.⁶

1 Global Wind Energy Council. (2008). Global Wind Report.

2 American Wind Energy Association. (2009). Windpower Outlook.

3 Niagara Economic Development Corporation. (2009). Economic Development Opportunities for Niagara: Emerging Clusters for the Future.

4 Global Wind Energy Council. (2008). Global Wind Report.

5 <http://news.ontario.ca>, Sep. 24, 2009

6 The Globe and Mail, Jan 21, 2010

There are a number of factors that make the Niagara region an especially desirable location for the wind power industry. The established industrial base, history in power generation, location within a world-class multi-modal transportation corridor and geographic situation in one of North America's strongest wind pattern areas (through the Great Lakes region) provide Niagara region with key advantages in becoming a leader in wind energy manufacturing. Wind turbine manufacturers looking to partner with local parts suppliers or assemblers, or looking to establish new facilities in the region, have ready access to markets in central Canada and the Northeastern U.S.⁷

There are already a number of successful construction and wind power development companies that are active in or near Niagara, including Rankin Renewable Power Inc., the Trillium Power Wind Corporation, and Power Canada Inc., to name a few. These business firms, among others, are actively engaged or seeking to engage in the wind energy industry. In addition, Niagara region has many other businesses that have the potential to be involved in the wind industry supply chain.⁸

Locally, more and more corporations, business associations, research facilities and government departments are becoming involved in activity related to this industry. These stakeholders are working as a "virtual team", communicating and sharing intelligence on opportunities in the wind industry. Niagara is becoming a hub of activity in relation to this emerging industry.

The Niagara Industrial Association (NIA) - a member driven manufacturing association - is working closely with a consortium of offshore wind developers to establish a local supply chain for manufacturing and assembling components for offshore wind turbines. The NIA represents approximately 90 Niagara-based manufacturers and has taken a lead role in examining opportunities in the wind industry. The NIA's wind power sub-committee is conducting a feasibility study (expected completion in Summer 2010) to examine the possibility of Niagara becoming a renewable energy "centre of excellence". The NIA has recently joined Trillium Power's TaiWind Consortium to establish facilities to make and assemble turbine equipment to supply future offshore wind power projects in the Great Lakes area.

Other Niagara region projects include opportunities for local companies to learn more about the role they can play in the wind industry. A workshop focused on emerging business opportunities in the large wind turbine supply chain for manufacturers, engineers and service providers was organized by Niagara Economic Development Corporation (NEDC) in June 2009. Additionally, in response to increasing interest among local manufacturers in learning how they can become stakeholders in this exciting new industry, the annual Niagara Industrial Buyer Seller Tradeshow for 2010 included a focus on "Wind Supply Chain Opportunities" with industry-specific presentations and workshops.

NEDC has initiated research on opportunities in the wind industry and published several conclusive market reports, including *Economic Development Opportunities for Niagara: Emerging Clusters for the Future (2009)*, and *Opportunities for Niagara Region Manufacturers and Service Providers in the Wind Energy Industry (2009)*. The research has revealed what many local manufacturers, business and municipal leaders already suspected; Niagara has the capacity to take a leadership role in supplying parts for wind turbines.

7 Niagara Economic Development Corporation. (2009). *Economic Development Opportunities for Niagara: Emerging Clusters for the Future*.

8 Niagara Economic Development Corporation. (2009). *Economic Development Opportunities for Niagara: Emerging Clusters for the Future*.

Part Two

Employment Research

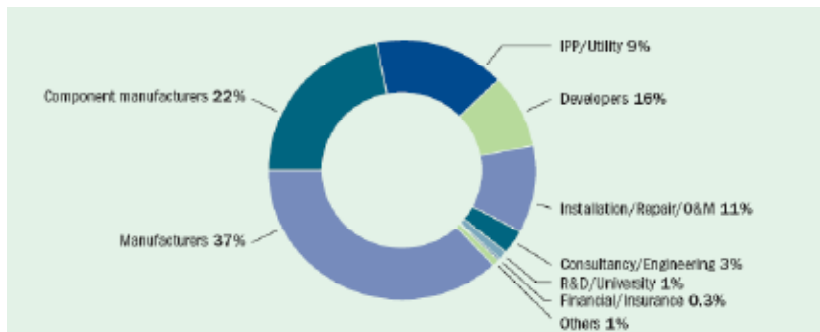
1. Employment Structure

With the projected growth of the wind industry within the green energy sector, it is inevitable that industry-specific employment opportunities will be created through various stages of wind power development.

The supply chain for the life cycle of a grid-connected wind farm consists of three major phases: project development, wind farm construction, and power generation. In each of these phases, direct and indirect jobs result. The term “direct jobs” relates to employment within wind turbine manufacturing companies and manufacturers, whose main activity is the supply of wind turbine components; it also includes wind energy project developers, utilities/IPPs (independent power producers) selling electricity from wind energy, major research and development (R&D), engineering and specialized wind energy services. Any other company producing intermediates or components, providing services or sporadically working in wind-related activities is deemed to provide indirect employment.⁹

Wind energy is a fairly new industry in Canada, but it is well established in the European market. According to the employment structure research completed by the European Wind Energy Association (EWEA), wind turbine and component manufacturers are responsible for the greatest share of direct employment (59%).¹⁰ These results are consistent with what has been found by other studies (Asociación Empresarial Eólica, AEE (2008b); Federal Ministry of the Environment in Germany, BMU, 2006).

Figure.1 Direct Employment by Type of Company



Source: European Wind Energy Association. (2009). *Wind at Work*.

EWEA’s analysis concludes that 15.1 jobs are created in the European Union for each new MW installed. In addition, 0.4 jobs are created per MW of total installed capacity in operations and maintenance and other activities related to existing installations.¹¹

“Wind energy represents a significant opportunity to create new green jobs in Canada’s manufacturing sector,” said CanWEA President Robert Hornung. “It is estimated that between now and 2020 more than 2 million jobs will be created in the global wind energy sector, many of them in manufacturing and export.”¹²

9 European Wind Energy Association. (2009). *Wind at Work*.

10 European Wind Energy Association. (2009). *Wind at Work*.

11 European Wind Energy Association. (2009). *Wind energy - the facts*.

12 CanWEA . (December 12, 2009). CanWEA Sees Opportunity In The Wind Energy Industry’s Response To Ontario’s Feed-in Tariff Program Launch Period.

The Canadian industry is poised to capitalize on our knowledge, skills and ingenuity to sustain tens of thousands of new “green collar” manufacturing and service jobs supplying wind power operations in Canada and around the world.¹³

Industry Canada forecasts that 13,000 jobs will be created in the wind sector by 2012.¹⁴ The Canadian employment opportunities identified below are based on the forecasted installations of wind turbines reaching the same national content as leading countries:

Installation cost (initial investment):	\$2.4 million / MW
Manufacturing & installation of WTG:	10.5 person years / MW
Operation & maintenance/repair:	0.33 job / MW installed
Export:	1 job / \$150,000 revenue

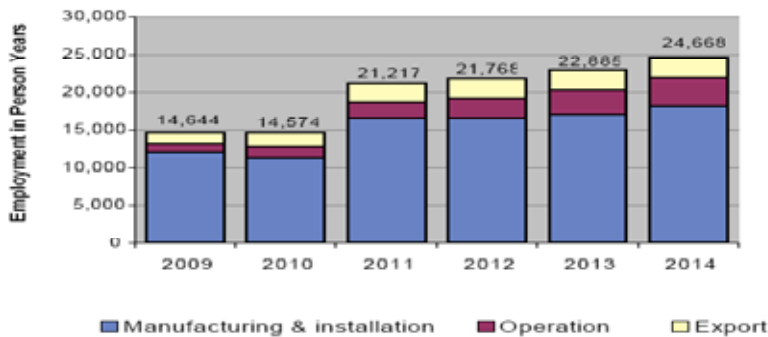
Table.1 Capacity Installation Forecast for Canada

	2009	2010	2011	2012	2013	2014
MW/Year	1,150	1,079	1,585	1,587	1,635	1,735
MW – Cumulative	3,520	4,599	6,184	7,771	9,406	11,141

Source: Niagara Economic Development Corporation. (2009). *Opportunities for Niagara Region Manufacturers and Service Providers in the Wind Energy Industry*.

Figure.2 Forecast of Employment in Wind Energy for Canada

FORECAST OF EMPLOYMENT FROM WIND ENERGY



Source: Niagara Economic Development Corporation. (2009). *Opportunities for Niagara Region Manufacturers and Service Providers in the Wind Energy Industry*.

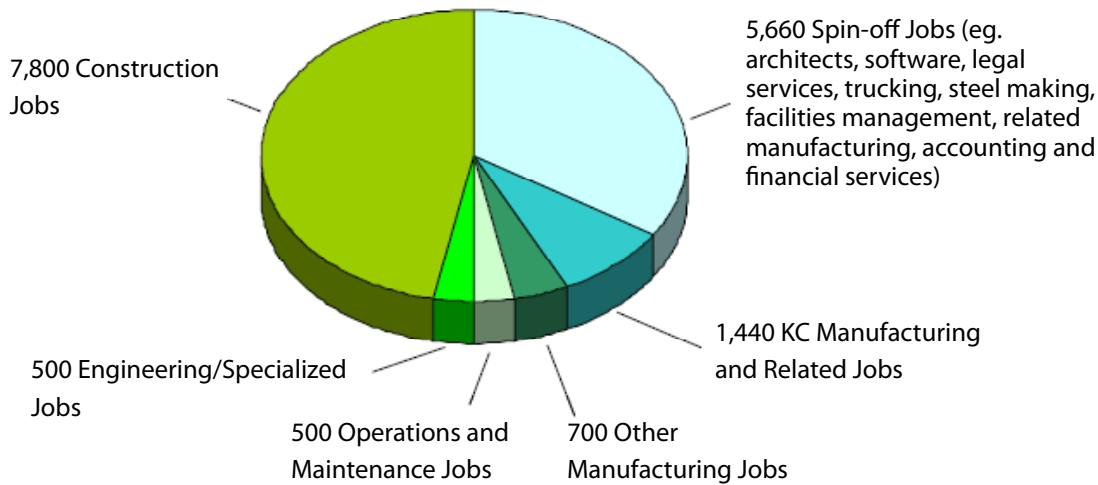
The green energy deal between the Government of Ontario and the Korean consortium is projected to create over 16,000 jobs (including solar and wind) in the province’s manufacturing infrastructure over six years. Jobs will be created during construction, installation and operation as well as in the manufacturing plants. In addition, indirect jobs in areas such as finance, consulting, and services will be created.

13 CanWEA. *Wind Vision 2025*.

14 Niagara Work Force Planning Board. (2009). *Niagara’s Labour Market in Transition*.

Figure.3 Green Jobs for Ontario

More than 16,000 jobs over six years



Source: Ontario Ministry of Energy and Infrastructure. (Jan 21, 2010). Korean Green Energy Investment Agreement.

2. Employment Opportunities in Niagara Region

A typical wind turbine is made up of about 8,000 separate parts – from electronics to heavy metal components – and Niagara region is well positioned to play an important role in wind turbine manufacturing.

There are already a number of successful businesses currently active or initiating wind industry projects in and near Niagara region, including DMI, Niagara Region, Erie Shores Wind Farm, and Niagara Wind Power Inc.¹⁵

The chart below presents a summary of the number of self-identified businesses - by industry - related to the wind power sector in Niagara region. Because the wind industry is still so new to the area, there are very few operations solely devoted to wind industry-specific manufacturing. The current challenge lies in identifying manufacturers who have both the capacity and the ability to fulfill the stringent requirements of wind industry developers that will allow them to participate in the supply chain. Manufacturers must have a highly skilled and available workforce in addition to the requisite machinery, equipment, quality control and customer relations.

Table.2 Businesses in Niagara Region in Industries Related to the Wind Power Sector

NAICS	Business activity	Number of companies	Average number of employees
2211	Electric power generation, transmission and distribution	7	47
325	Chemical manufacturing		
326	Plastics and rubber products manufacturing		
327	Non-metallic mineral product manufacturing		
331	Primary metal manufacturing	26	66
3321	Forging and stamping	16	41
3323	Architectural and structural metals manufacturing	46	31
3325	Hardware manufacturing	5	49
3326	Spring and wire product manufacturing		
3327	Machine shops; turned product; screw, nut, and bolt manufacturing	42	22
3328	Coating, engraving, heat treating, and allied activities	21	17
3329	Other fabricated metal product manufacturing	36	51
3311	Agriculture, construction, and mining machinery manufacturing	1	34
3336	Engine, turbine, and power transmission equipment manufacturing	7	89
3353	Electrical equipment manufacturing	8	56
3359	Other electrical equipment and component manufacturing	3	39
3363	Motor vehicle parts manufacturing	14	285
3364	Aerospace product and parts manufacturing	6	69
3366	Ship and boat building	5	49
237130	Windmill construction	1	250
Total		244	75

* The number of companies per industry do not add up to total number of companies in the cluster because some companies have activities in more than one NAICS¹⁶ code.

Source: Niagara Economic Development Corporation. (2009) *Economic Development Opportunities fo Niagara: Emerging Clusters for the Future*.

The Niagara Development Corridor (a consortium of six local municipalities whose goal is to attract investment and achieve growth in the manufacturing and supplier industries) identified key industries in the advanced manufacturing sector in Niagara through the Advanced Materials Manufacturing Cluster (AMMC) initiative in 2007. The key industries identified in the AMMC include several that directly apply to wind industry component manufacturing. These include: Primary Metals (NAICS 331), Fabricated Metal Products (NAICS 332), Machinery Manufacturing (NAICS 333), Electrical and Electronic Products (NAICS 335) and Transportation Equipment Manufacturing (NAICS 336).¹⁷ These industries provided the basis for the industries examined in Table 2.

There are a significant number of large Niagara companies working in each of the industries in the Table 2 chart. However, most of these companies are not directly involved in manufacturing wind power components; they are relevant because their technologies, facilities and human resources might be suited to involvement in elements of wind power component manufacturing, but they are not there yet. These businesses have the potential to be “players” in the wind energy sector, providing employment opportunities once they become involved and active in the industry.

16 The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies in classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. It was developed jointly by Statistics Canada.

17 Niagara Development Corridor. (2007). *Advanced Material Manufacturing Clusters Niagara Region*.

Part Three

Profile of the Workforce

1. Occupation Classification and Workforce Profile

An employment study conducted by the European Wind Energy Association (EWEA) classifies wind occupations into the following five divisions according to the major business activities of the companies: manufacturers, developers, construction, operations & management and consultancies.¹⁸ The EWEA's classification is used as a reference for the occupations examined in this report because the Canadian wind industry profile closely aligns with it.

As mentioned previously, the current occupation opportunities in the Niagara region lie within the major wind power component manufacturing field. This includes the manufacture of towers, castings, blades, and machining and electric service.

Based on an industrial and employment structure analysis, table 3 summarizes the major wind energy occupations - according to business activities - with the related National Occupation Classification (NOC)¹⁹ code and the total number of people employed in Niagara. For a more comprehensive listing of potential occupations in the local green technology services cluster; please see Appendix A.

Sample occupational profiles related to wind energy occupations in Niagara are provided at the end of this report, and include occupation title, NOC code, main job description, related occupations, and educational and other occupational requirements. Ongoing development of occupational profiles will be carried out and made available through www.niagaraworkforceboard.ca. See Appendix B for further references.

A report on human resources in the Canadian wind industry by the Delphi Group in 2007, provided the following demographic details for the Canadian wind industry:²⁰

- Service technicians in the industry have an average age of 20-30 years
- Administrative, project development and management staff in the industry have an average age of 35 - 40 years
- The average level of education of service and maintenance staff is trade certificates
- The average level of education of administrative, project development and management staff is an engineering degree or a graduate level business degree
- Males make up roughly 90% of the workforce.

18 European Wind Energy Association. (2009). *Wind At Work*

19 The National Occupational Classification (NOC) is the nationally accepted reference on occupations in Canada. It provides a standardized language for describing the work performed by Canadians in the labour market. It is used to compile, analyze and communicate information about occupations, and to understand the jobs found throughout Canada's labour market.

20 The Delphi Group. (2007). *Situational Analysis of the Canadian Renewable Energy Sector with a Focus on Human Resource Issues*.

Table.3 Major Types of Wind Occupation and Employment Data in Niagara Region, 2009

Business activities	NOC	Occupation	Number of employees
Wind Farm Project Development (Managing all the tasks related to the development of wind farms)	122	Administrative and Regulatory Occupations	3630
	143	Finance and Insurance Clerks	3780
	225	Technical Occupations in Architecture, Drafting, Surveying and Mapping	480
	416	Policy and Program Officers, Researchers and Consultants	945
	721	Contractors and Supervisors, Trades and Related Workers	1040
Components Manufacturing and Wind Farm Construction (Wind turbine and components manufacturing, assembling, wind farm building, regular inspection and repair)	071	Managers in Construction and Transportation	865
	091	Managers in Manufacturing and Utilities	910
	211	Physical Science Professionals	35
	213	Civil, Mechanical, Electrical and Chemical Engineers	885
	221	Technical Occupations in Physical Sciences	45
	224	Technical Occupations in Electronics and Electrical Engineering	640
	524	Creative Designers and Craftspersons	30
	723	Machinists and Related Occupations	1535
	724	Electrical Trades and Telecommunication Occupations	1235
	725	Plumbers, Pipefitters and Gas Fitters	550
	726	Metal Forming, Shaping and Erecting Trades	1960
	727	Carpenters and Cabinetmakers	670
	728	Masonry and Plastering Trades	30
	731	Machinery and Transportation Equipment Mechanics (Except Motor Vehicle)	1205
	735	Stationary Engineers and Power Station and System Operators	210
	737	Crane Operators, Drillers and Blasters	215
	741	Motor Vehicle and Transit Drivers	100
	745	Longshore Workers and Material Handlers	1665
	843	Agriculture and Horticulture Workers	2910
	941	Machine Operators and Related Workers in Metal and Mineral Products Processing	470
942	Machine Operators and Related Workers in Chemical, Plastic and Rubber Processing	245	
948	Mechanical, Electrical and Electronics Assemblers	2200	
949	Other Assembly and Related Occupations	860	
951	Machining, Metalworking, Woodworking and Related Machine Operators	1530	
961	Labourers in Processing, Manufacturing and Utilities	2675	

Business activities	NOC	Occupation	Number of employees
Wind Farm Operation & Management (Operation of the wind farms and sales of the electricity produced)	011	Administrative Service Managers	1440
	112	Human Resources and Business Service Professionals	600
	141	Clerical Occupations, General Office Skills	4480
	145	Library, Correspondence and Related Information Clerks	3520
	147	Recording, Scheduling and Distributing Occupations	2705
	214	Other Engineers	495
	217	Computer and Information Systems Professionals	1275
	228	Technical Occupations in Computer and Information Systems	785
	512	Writing, Translating and Public Relations Professionals	640
	622	Mechanical Sales Specialists, Wholesale Trade	340
	642	Retail Salespersons and Sales Clerks	35
	736	Train Crew Operating Occupations	65
	761	Trades Helpers and Labourers	1195
	921	Supervisors, Processing Occupations	515
923	Central Control and Process Operators in Manufacturing and Processing	245	
Total Number of Employees			51885

Source: Niagara Workforce Planning Board. (2010).

2. Education and Training

As the Canadian wind energy sector grows, so too will the demand for a skilled and educated workforce. Skilled labourers, technicians, engineers and project managers are just a few of the “direct” occupations required to fill the human resource requirements of a wind energy project. Occupations that indirectly support the wind energy industry include lawyers, purchasing agents, bankers, insurance representatives – the list goes on.

While some occupations in the wind industry require an engineering background, many others offer good opportunities for individuals who may lack direct experience, but have enthusiasm and useful transferable skills. Due to Niagara’s strong industrial background, its workforce has a significant core skill set that is well positioned to transition into more technically advanced manufacturing jobs in the green economy. What these existing and new occupations have in common is a need to become familiar with an industry that is still in the early stages of development and expansion. Workers in both direct and indirect occupations will derive benefit from industry-specific education and training. Wind industry component manufacturing is highly specialized and has considerable technical and service requirements related to quality assurance. Technical and structured industry-specific training is commonly required by employers to train employees on proprietary technology and warranty requirements.

Most manufacturing, operation and service companies do their own internal training when staff is hired. When wind service maintenance and operation technicians are hired, some training is generally required to deal with specific turbine types from different manufacturers regardless of the level of the technician’s general experience. In addition to technical training, large turbine service and maintenance jobs also require safety and heights training. Software training for monitoring facility operation is also required but is generally provided by employers after hiring.

Due to the quantity of specialized skills required in the wind industry, it is generally felt that it would be useful to have a standardized wind technician certification established. In addition, the qualifications of new graduates from engineering and trades programs could be enhanced by the addition of wind industry related courses to their existing programs. This would greatly reduce the training burden associated with new hires in the industry.²¹

National wind energy associations and industry-specific software providers typically offer short courses and workshops at central locations or during pre-conference seminars. These are posted on the CanWEA website. Typical topics covered in such courses include:

- Fundamentals of Wind Energy
- Interconnecting Wind Power Plants to the Grid
- Wind Power Siting Workshop
- Transmission Workshop
- WindPRO Training Courses.²²

Some Canadian universities have introduced or are in the planning stages for programs in wind and general renewable energy materials. As an example, the Ontario Institute of Technology (UOIT) is offering a four-year Bachelor of Science program in Energy and the Environment. These graduates should more easily transition into employment opportunities within the green energy sector due to their understanding of the latest science within the related industries (wind included).

21 The Delphi Group. (2007). *Situational Analysis of the Canadian Renewable Energy Sector with a Focus on Human Resource Issues*.

22 Industry Canada. (2005). *Human Resources Needs in the Canadian Wind Energy Industry*.

Helpful information about the education and training required in engineering in Ontario can be accessed through the Professional Engineers Ontario website at: <http://www.peo.on.ca>.

While a large number of community colleges in Canada provide general training in renewable energy technologies, very few provide in-depth training focused solely on wind energy. Ontario colleges offer a number of programs that provide training in the renewable energies field.

Locally, Niagara College is in the initial stages of development for a Renewable Energies Technician program that will focus on wind energy as one of its core program components (projected start date is September, 2011).

For more information on Ontario universities and colleges, apprenticeship and other related training opportunities, visit the Ontario Ministry of Training, Colleges and Universities website at <http://www.tcu.gov.on.ca/>

Part Four

Summary

Environmental, energy and other “green” technologies has been identified as one of four emerging industry clusters in Niagara region (Niagara Region. (2009). *Niagara’s Economic Growth Strategy*). In addition, identifying and linking into “green opportunities” is one of the focused “paths” in the *Paths to Prosperity* report (St. Catharines -Thorold Prosperity Council, 2009). Reports such as these, together with locally driven initiatives including the Niagara Industrial Association’s focus on wind energy opportunities and the industry research and support provided by Niagara Economic Development Corporation, have forged a strong, integrated and supportive approach to establishing and supporting a local wind industry sector.

While progress has been made from an educational perspective, Ontario universities and colleges need to respond to the increasing education and workforce training demands of the growing green economy. In particular, an increase in short term training related to certificate, diploma and technology programs will better prepare the workforce to meet these demands and be more resilient to transition across industries. As the market grows, students and the existing workforce are encouraged to examine careers in related trades or engineering programs.

Currently, there is a need for more communication between industry, trade unions and wind training program developers. This issue needs to be resolved by a more cooperative and integrated approach to supporting this burgeoning green energy sector. Industry developers need to communicate their training needs, and program developers need to stay up-to-date on developments in the Canadian wind energy supply chain. An increase in domestic wind activities will have an impact on the labour demand within the sector.

The industry ideally wants educators and training institutions to provide specialized technical training for the wind industry. While most wind industry developers currently provide their own training, prospective employees who have some education and training in wind energy issues and technologies would be beneficial in reducing the burden of in-house training of new recruits. Having an available, highly skilled, trained local workforce provides a significant competitive advantage for the Niagara region.

Niagara is poised for opportunity. This position will be strengthened as the region advances the skills, knowledge and education of its labour supply in order to create and retain a workforce that will be able to effectively transition across existing and emerging economic sectors, industries and occupations.²³

23 Niagara Workforce Planning Board.(2009). *Niagara Labour Market Plan*.

Appendix A

Employment Related to Green Technology Services Cluster²⁴

Wind Power Industry	Occupation	NOC
Power Generation and Supply	Electrical power line installer	7244
	Electrical power line repairer	7612
	Customer service representative	1453
	Electrical powerhouse repairs	7243
	Electrical substation repairs	7243
	Electrical relay repair	7243
	Electronic powerhouse repair	2241
	Electronic substation repair	2241
	Electronic relay repair	2241
	Supervisor of mechanics	7216
	Supervisor of installers	7212
	Supervisor of repairers	7212
	Electrical engineers	2133
	Control and valve installer	7352
	Control and valve repairer	7352
	Electrician	7243
	Manager of production	0912
	Manager of operations	0912
Technical director	7212	
Aluminum and Metal Milling and Production	General maintenance and repair	
Alloy and Steel Manufacturing	Rolling machine setter	9411
Steel Manufacturing from Purchased Steel	Rolling machine operator	9512
Alumina and Aluminum Production	Rolling machine tender	9411
Other Nonferrous Metal Production Foundries	Manager of production	0911
Spring and Wire Product Manufacturing	Manager of operations	0912
Machine Shops and Threaded Product Manufacturing	Metal refining furnace operator	9516
Other Fabricated Metal Product Manufacturing	Industrial truck and trailer operator	7452
Agricultural, Construction and Mining Machinery Manufacturing	Metal pourer	9411
Forging and Stamping	Metal caster	9412
Architectural and Structural Metal Manufacturing	Crane/tower operator	7371
Hardware Manufacturing	Freight labourer	7452
Coating, Engraving and Heat Treating Metals	Stock labourer	8431
(continued on next page)	Material mover	7452
	Industrial machinery mechanic	7311
	Production worker	9516
	Cutting, punching and setting machine setters (metal and plastic)	9511

Appendix A

Wind Power Industry	Occupation	NOC
continued...	Cutting, punching and setting machine operators (metal and plastic)	9511
	Extruding and drawing machine setters	9511
	Extruding and drawing machine operators	9511
	Multiple machine tool setter	9511
	Welder	7265
	Cutter	9514
	Solderer	7265
	Brazer	7265
	Manager of production	0911
	Manager of operations	0912
	Inspector	9516
	Tester	9415
	Sorter	9611
	Sampler	9415
	Weigher	7452
	Freight labourer	7452
	Material mover	7452
	Maintenance and repair	
	Metal pourer	9411
	Metal caster	9412
	Grinding and polishing worker	9612
	Grinding, lapping, polishing and buffing machine tool setter	9612
	Computer controlled machine tool operator	9511
	Assembler	9486
	Fabricator	9514
	Lathe and turning machine tool operator	9511
	Lathe and turning machine tool setter	9511
	Structural metal fabricator	9514
	Engine assembler	9486
	Machine assembler	9487
	Computer controlled machine tool operator	9511
	Computer controlled machine operator	9511
	Plating and coating machine setter	9411
	Plating and coating machine operator	9497
	Coating, painting and spraying machine setter	9411
	Coating, painting and spraying machine operator	9497
	Heat treating equipment setter	9231
	Heat treating equipment operator	9231

Wind Power Industry	Occupation	NOC
Turbine and Power Transmission Equipment Manufacturing Motor Vehicle Parts Manufacturing	Team assembler	9484
	Machinist	7231
	Mechanical engineer	2132
	Multiple machine tool operator	9511
	Multiple machine tool setter	9511
	Computer controlled machine operator	7231
	Computer controlled machine setter	9511
	Industrial engineer	2141
	Tool and die maker	7232
	Quality control	2241
Electrical Equipment Manufacturing Other Electrical Equipment and Component Manufacturing	Electrical and electronic equipment assembler	9484
	Coil winder	9484
	Finisher	9484
	Electromechanical equipment assembler	9487
	Shipping/receiving	1471
	Traffic clerk	1473
	Extruding and drawing machine setter	9411
	Extruding and drawing machine operator	9411
Aerospace Product and Parts Manufacturing	Aircraft structure, surface, rigging and systems assembler	9481
	Aircraft mechanic	7315
	Service technician	
	Machinist	7365
	Inspector	7315
	Tester	9415
	Sorter	9611
	Sampler	9415
	Weigher	7452
	Engineer (other)	214
	Industrial engineer	2141
	Computer software engineer	2173
	Systems software engineer	2173
	Mechanical engineer	2132
	Manager of production	0911
	Manager of operations	9211
	Purchasing agent	1225

Appendix A

Wind Power Industry	Occupation	NOC
Ship and Ship Building	Welder	7265
	Cutter	9514
	Solderer	7265
	Brazer	7265
	Team assembler	9486
	Structural metal fabricator	7263
	Structural metal fitter	7263
	Mechanical engineer	2132
	Mechanical drafter	2253
	Plumber	7251
	Pipefitter	7252
	Steamfitter	7252
	Carpenter	7271
	Electrician	7242
Administrative Non Technical Planning Human Resources Public Relations	Site manager	0711
	Accounting	1431
	Reception	1414
	Sales	6221
	Communications specialist	5124
	Marketing specialist	4163
	Public relations representative	1121
	Human resources	1121
	Planning consent representative	0114
	Landowner negotiation specialist	
Policy analyst	4164	
WAsP	Program/software engineer	2173
	Operating system engineer	2174
Wind Farmer	Program manager	4161
	Software applications specialist	2173
WindFarm	Systems analyst	2171
	Systems administrator	2281
WindPro	Systems tester	2283

Appendix B

Potential Wind Energy Occupations in Niagara According to NOC²⁵

The sample wind industry “occupational profiles” provided below have been created by Niagara Workforce Planning Board based on information from the National Occupations Classification (NOC) system profiles. Occupations from the “Components Manufacturing and Wind Farm Construction” business activities section in Table 3 were chosen due to the significant numbers employed in these occupation classification areas in Niagara (according to NOC major group). The profiles are listed according to their NOC major group number and name and sub unit group number and name. The number of employees in Niagara, occupation title examples, educational requirements and other employment requirements are included.

Major group: 213 Civil, Mechanical, Electrical and Chemical Engineers

Number of employees: 885

Sub unit group: 2132 Mechanical Engineers

Mechanical engineers research, design and develop machinery and systems for heating, ventilating and air conditioning, power generation, transportation, processing and manufacturing. They also perform duties related to the evaluation, installation, operation and maintenance of mechanical systems.

Example Titles:

Acoustics engineer
Automotive engineer
Design engineer – mechanical
Energy conservation engineer
Engineer, power generation
Fluid mechanics engineer
Heating, ventilation and air conditioning (HVAC) engineer
Mechanical engineer
Mechanical maintenance engineer
Nuclear engineer
Piping engineer
Refrigeration engineer
Robotics engineer
Thermal design engineer
Tool engineer

Employment Requirements

- Bachelor’s degree in mechanical engineering or in a related engineering discipline is required.
- Master’s degree or doctorate in a related engineering discipline may be required.
- Licensing by a provincial or territorial association of professional engineers is required to approve engineering drawings and reports and to practice as a Professional Engineer (P.Eng.).
- Engineers are eligible for registration following graduation from an accredited educational program, and after three or four years of supervised work experience in engineering and passing a professional practice examination.
- Supervisory and senior positions in this unit group require experience.

25 Niagara Workforce Planning Board. (2009) *Niagara Labour Market Plan 2009-2013*.

Appendix B

Classified Elsewhere

Engineering Managers (0211)

Industrial and Manufacturing Engineers (2141)

Metallurgical and Materials Engineers (2142)

Power engineers or stationary engineers (in 7351 Stationary Engineers and Auxiliary Equipment Operators)

Major group: 948 Mechanical, Electrical and Electronics Assemblers

Number of employees: 2200

Sub unit group: 9485 Assemblers, Fabricators and Inspectors, Industrial Electrical Motors and Transformers

This unit group includes workers who assemble, fabricate, fit, wire and inspect heavy-duty industrial electrical equipment.

Example Titles:

Assembler and wirer, motors and generators

Assembler, switchgear and control panel

Coil winder, transformer

Control panel assembler

Electrical fitter

Fitter-assembler, AC (alternating current) and DC (direct current) motors

Inspector and tester, AC and DC motors

Inspector, electrical control panel

Panel board assembler – industrial electrical equipment

Power transformer assembler

Switchgear fitter-wirer

Transformer inspector

Transformer winder

Winder, AC and DC armatures

Wirer, electrical switchgear panels

Employment Requirements

- Completion of secondary school is usually required.
- College courses in electricity or electro-technology may be required.
- Several years of on-the-job training are usually provided.
- Set-up persons, inspectors and lead hands in this unit group may require experience as an assembler, fitter or wirer in the same company.

Classified Elsewhere

Assemblers and Inspectors, Electrical Appliance, Apparatus and Equipment Manufacturing (9484)

Assemblers of small electrical motors, transformers, circuit breakers or similar products (in 9484 Assemblers and Inspectors, Electrical Appliance, Apparatus and Equipment Manufacturing)

Electrical Mechanics (7333)

Electrical technicians who test heavy-duty electric motors, transformers or other industrial electrical equipment (in 2241 Electrical and Electronics Engineering Technologists and Technicians)

Supervisors, Electrical Products Manufacturing (9223)

Major group: 726 Metal Forming, Shaping and Erecting Trades

Number of employees: 1960

Sub unit group: 7265 Welders and Related Machine Operators

Welders operate welding equipment to weld metals. This unit group also includes machine operators who operate previously set up production welding, brazing and soldering equipment.

Example Titles:

Aviation welding technician

Brazing machine operator

Brazing machine setter

Electric arc welder

Journeyman/woman welder

Laser welding operator

Pressure vessel welder

Production welder

Soldering machine operator

Spot welder

Welder

Welder apprentice

Welder-fitter

Employment Requirements

Welders

- Completion of secondary school is usually required.
- Completion of a three-year apprenticeship program or a combination of over three years of work experience in the trade and some college or industry courses in welding is usually required to be eligible for trade certification.
- Trade certification is compulsory in Alberta and available, but voluntary, in Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Saskatchewan, British Columbia, Nunavut, the Northwest Territories and the Yukon.
- Interprovincial trade certification (Red Seal) is also available to qualified welders.

Welding, brazing and soldering machine operators

- Some secondary school education is required.
- Several months of on-the-job training are usually provided.
- Experience as a machine operator helper may be required.
- Experience with robotics may be required.

Classified Elsewhere

Supervisors of welders in this unit group (in 7214 Contractors and Supervisors, Metal Forming, Shaping and Erecting Trades)

Underwater welders (in 7382 Commercial Divers)

Wave soldering machine operators (in 9483 Electronics Assemblers, Fabricators, Inspectors and Testers)

Welding inspectors (in 2261 Non-Destructive Testers and Inspectors)

Welding technologists (in 2212 Geological and Mineral Technologists and Technicians)

Appendix B

Major group: 951 Machining, Metalworking, Woodworking and Related Machine Operators

Number of employees: 1530

Sub unit group: 9511 Machining Tool Operators

Machining tool operators set up and operate or tend metal-cutting machines designed for repetitive machining work. They are employed by metal products and other manufacturing companies and in machine shops. This unit group also includes workers who etch or chemically mill metal pieces.

Example Titles:

CNC machining tool operator

Aircraft parts etcher

Boring mill operator – metal machining

Lathe machining operator

Machining tool operator

Milling machine set-up operator

Production gear cutter

Production grinder operator – metal machining

Radial drill operator – metal machining

Employment Requirements

- Some secondary school education is required.
- College or other courses in machining may be required.
- Several months of on-the-job training are provided.
- Senior positions in this unit group, such as set-up operator, require experience as a machine operator.
- Experienced machining tool operators may become machinists or tool and die makers through apprenticeship training.

Classified Elsewhere

CAD/CAM and CNC programmers (in 2233 Industrial Engineering and Manufacturing Technologists and Technicians)

Machinists and Machining and Tooling Inspectors (7231)

Supervisors, Machinists and Related Occupations (7211)

Tool and Die Makers (7232)

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