# Sustainable Energy: Durham Region

## Definition and Context

In Canada, electricity is generated from a variety of sources of energy, including nuclear, hydro, natural gas, coal, wind, biomass, and solar. (National Energy Board, 2018) Sustainable energy pertains to sources of primary energy that can be maintained for a definable period of time. Sustainable energy is mainly considered to be from sources such as solar power, wind, biomass etc., where sources are of non-sustainable energy are oil and natural gas, etc. On the other hand, renewable energy is accessed from sources which can be naturally replenished with time. In many scenarios, sustainable and renewable energy sources are often used interchangeably, however, whether a renewable source of energy is sustainable or not depends upon the intensity and level of energy use. (Jenden, Lloyd, Stenhouse, Yyelland, & Donev, 2019) While Durham Region uses both sustainable and non-sustainable energy sources in its operations, the sections below describe the main forms of renewable energy sources used in the Region.

## Nuclear Energy

The self-sufficiency index measures, for each type of energy, how much of the energy consumed in an area is generated within the area. In Durham Region, 100 percent of electricity consumed in Durham Region is generated in Durham Region. (Regional Municipality of Durham, 2017) This is due to the nuclear energy that the Region generates.

Nuclear power generation uses thermal energy to generate electricity, however, it does not emit any greenhouse gases, and thus is considered to be friendlier to the environment compared to fossil fuels. Canadian nuclear generation facilities use Canadian Deuterium Uranium (CANDU) reactors with uranium from Saskatchewan as fuel. Four active nuclear power plants are in operation in Canada with 19 operating reactors. Two of these plants are located in Durham Region, and are managed by Ontario Power Generation (OPG). They are operating in the municipalities of Pickering and Clarington. The Darlington Nuclear Generating Station located in Clarington houses four reactors with an installed capacity of approximately 3,700 mega watts. Pickering Nuclear Generating Station houses six operating reactors with installed capacity of 3,100 mega watts. OPG plans to operate Pickering until 2024. Darlington Plant is refurbishing four of its reactors and is scheduled for completion in 2026. However, Government of Canada indicates that while nuclear generation will continue to be important, it will play a diminishing role in the future and has no plans for new capacity. (National Energy Board, 2018)

## Wood Waste Energy

Wood waste generates a form of biofuel, and is acquired by burning wood to create energy. Energy created by wood waste, along with other forms of organic materials, are called energy from Biomass. Wood waste energy in particular is considered to be carbon neutral due to its botanical origin. As of 2014, Canada had approximately 70 biomass generating power plants. High biomass provinces tend to have active forestry industries; thus British Columbia, Alberta, Ontario, Quebec and New Brunswick are the provinces with the largest biomass capacity and generation. (National Energy Board , 2017)

According to the Durham Community Energy Plan, between 2011 and 2015, wood waste generated 1,051,249 Giga Joules (GJ) , i.e., .64 percent of all energy in the Region, making it the largest non-nuclear renewable energy sector in Durham Region.

Many wood waste energy plants recycle a combination of wood waste as well as other recyclable waste.

Index Energy Systems in Ajax provides biomass generated heating and cooling system to the Ajax community centre and the Ajax Pickering Hospital[1]. It is also affiliated with Simtor Environmental Limited which operated a waste transfer and recycling facility in Whitby.

## Solar Energy

Solar energy is the technology used to harness the sun's energy to generate electricity for human use. (National Geographic , 2019) The most common method of converting solar energy into electricity is through photovoltaic (PV) cells, i.e., solar panels. The amount of electricity generated depends on the intensity of sunlight reaching the panel face. Solar energy remains one of the costliest technologies and cost is a barrier to widespread adoption of the technology. However, in recent times, production costs have decreased and solar projects in Canada have been developing rapidly. Currently solar energy represents about .5 percent of national electricity generation, with over 98 percent of the Canada's solar power generation capacity being located in Ontario. (National Energy Board , 2018) Durham Community Energy Plan calculates that between 2011 and 2015, .12 percent of all and 14 percent of all non-nuclear renewable energy electricity generation was through PV panels. The Plan also calculates that in Durham Region, electricity generation from solar installations has grown by over 2130 percent between 2011 and 2015. Solar energy companies have established businesses in Durham Region, concentrating primarily on PV installations and solar power equipment manufacturing. Currently there are a minimum of two solar energy establishments in Ajax and Pickering respectively, one in Whitby and five in Oshawa[2]. In addition, there are approval for seven solar farm projects in various municipalities of Durham Region including at Newcastle and Scugog[3.] In addition, Durham Region companies are also installing PV panels in order to generate energy in-house, for example, Promotional Products Fulfillment & Distribution in Whitby installed 500kw Solar System in 2012. This is the largest solar rooftop installation in Durham Region and generates enough power an estimated 75 homes for a year[4].

## Solid Waste Energy

Waste management falls primarily within the jurisdiction of provincial, territorial and municipal governments. 33 million tonnes of waste are disposed of each year in Canada, the vast majority of which goes to landfills. Since any type of substance can end up in a landfill, it may leak contaminants into the ground and waterways. Composting organics for fertilizer is perhaps the most obvious means of managing this waste stream, however, there are now innovative ways to turn organic materials into fuel and petrochemicals. As was apparent in testimony, there are two essential processes that can yield fuels: thermochemical or biological.

Between 2011 and 2015, solid waste from Durham Region produced 100,415 GJ of energy, which amounted to .06 percent of all energy. (Durham Sustain Ability , 2017) Currently, Durham Region sends garbage to the Durham York Energy Centre located in Clarington. DYEC produces gross

[1]Retrieved from https://www.appro.org/articles/4644-biomass-information
[2] Retrieved from https://www.google.com/search?q=durham+region+solar+energy&oq=durham+region+solar+energy&aqs=chrome..69i57j0j69i64.6149j0j7&sourceid=chrome&ie=UTF-8
[3] Retrieved from https://www.ontario.ca/page/renewable-energy-projects-listing
[4] Retrieved from https://www.ppfd.com/index.php/ppfds-sustainable-energy-strategy/

electrical output of 17.5 MW and a net output of approximately 14 MW. Electricity is sold to the provincial grid under a power purchase agreement (PPA) with Ontario Power Authority (OPA).[5]

## Wind Energy

Wind turbines harness kinetic energy from moving air and converts them into electricity, given that the weather patterns are favourable. Wind turbines are generally mounted in groups and are then known as wind farms or wind power plants. Electricity generated from wind power plants may be utilised locally or placed on electric grid. Energy derived from wind may also be converted to hydrogen and used as a form of fuel for transportation or stored for subsequent power generation. (Natural Resources Canada, 2016)

In 2017, wind energy met approximately six percent of Canada's electricity demand, and eight percent of Ontario's electricity demand. (CanWEA, n.d.) It is still relatively unused in Durham Region with 17,285 GJ produced between 2011 and 2015. Wind energy contributed to one percent of renewable energy in the Region of Durham. (Durham Sustain Ability , 2017) Currently, there is at least one wind farm in Durham Region. The **ZEP Wind Farm Ganaraska** is a 17.60 megawatt (MW) wind energy project located in the town of **Orono, Ontario**. In April 2010, the project was awarded a 20-year term power purchase agreement under the Feed-in Tariff (FIT) program. The project consists of nine Senvion (formerly named REpower) MM92 wind turbines, with a rated capacity of 2.05 MW or 1.88 MW[6]. In addition, another wind farm called **Clarington Wind Farm**, with five turbines with total generation capacity of 8.1 MW has been approved by the Ontario Government[7].

## Geothermal Energy

Geothermal energy is contained in the rock and fluids beneath the Earth's crust. It can be found from shallow ground to several miles below the surface, and even farther down to the extremely hot molten rock called magma. To produce geothermal-generated electricity, deep wells are drilled into underground reservoirs to tap steam and very hot water that drive turbines linked to electricity generators. (National Geographic Society, 2019) Ontario Home Builders estimates that geothermal heating and cooling system, although environmentally sustainable with lower electricity costs, is still vastly expensive to install, especially in private established homes. In Southern Ontario, the installation cost may vary between $ 22,500 and $ 29,000 for a house with 2,300 sqft. area8. Some Ontario farmers have installed geothermal heating systems in their livestock barns, but the practice is still relatively unused.[9]

Between 2011 and 2015, Durham Region has generated 27,800 GJ of geothermal energy, which is approximately one percent of all non-nuclear renewable energy generation is the Region. However, public and private investment in geothermal energy has increased. In 2018, $ 9 million has been committed towards the Simcoe Geothermal Field project. The multi-year initiative will build geothermal field, new central plant and piping network. Upon completion in April 2019, the geothermal field and connected heat pump house will harness 550 tonnes (1.9 megawatts) of clean, sustainable geothermal power in Durham College campus. Additionally, the **Simcoe Geothermal Field and Innovation Centre**, in partnership with Siemens, will create opportunities to act as living labs that provide new experiential learning opportunities. Students will explore green-energy technologies and

[5] Retrieved from https://www.durhamyorkwaste.ca/Home/QuickFacts.aspx
[6] Retrieved from http://www.capstoneinfrastructure.com/OurBusiness/PowerInfrastructure/PowerInfrastructureInDevelopment/Wind/Ganaraska
[7] Retrieved from https://www.ontario.ca/page/renewable-energy-projects-listing
[8] Retrieved from https://buildersontario.com/cost-of-geothermal-heating
[9] Retrieved from http://www.omafra.gov.on.ca/english/engineer/ge_bib/geotherm.htm

careers while faculty will receive assistance in developing lessons incorporating geothermal technology into the curriculum.

## Biogas (Renewable Natural Gas-RNG) Energy

Biogas is a renewable source of methane gas, created when organic matter breaks down in an oxygen-free environment. This biological process is referred to as Anaerobic Digestion (AD). The main component of biogas is methane, also the key component of natural gas. Biogas can be upgraded to Renewable Natural Gas (RNG), which is carbon neutral and interchangeable with conventional natural gas. Biogas comes from agricultural sources such as livestock manure or crop residue, organic materials from businesses and households, landfills or biosolids from wastewater treatment[10]. Canada's natural gas utilities have set a target of five percent of renewable blended natural gas in the pipeline distribution system by 2025 and 10 percent by 2030.

Between 2011 and 2015 Durham Region has generated 37,653 GJ of biogas, which is approximately three percent of all non-nuclear renewable energy generated in Durham Region. (Durham Sustain Ability , 2017) While there is yet to be a biogas plant in the Region, the Region has indicated favourable view of the Ontario Government *Organics Action Plan* and the beneficial uses of organic wastes including opportunities for the generation of renewable natural gas. (Regional Municipality of Durham, 2017)

## Employment in Durham Region Sustainable Energy Sector

North America Industry Classification (NAIC) System[11] does not provide specific classification for sustainable energy industries for sustainable energy occupations. Sustainable energy is a multi-sectoral industry and there can be sustainable energy initiatives in each of the broader category of industries. In addition, analysis finds that 60 percent of environmental job postings are in five boarder sectors; NAICS 54 Professional, scientific, and technical services. NAICS 61 Educational services, NAICS 91
Public administration , NAICS 31-33 Manufacturing, and NAICS 56 Administrative and support and waste management and remediation services (Eco Canada , 2018) Based on the presence of sustainable energy efforts described above and breaking them down to four-digit NAICS, the following subsectors are considered to be most pertinent to the sustainable energy industry.

*Table 1 Sustainable Energy subsectors from NAICS 2017*

| Four -digit NAICS for sustainable energy |
|---|
| 2211 Electric power generation, transmission and distribution |
| 3336 Engine, turbine and power transmission equipment manufacturing |
| 2371 Utility system construction |
| 5621 Waste collection |
| 5622 Waste treatment and disposal |
| 5629 Remediation and other waste management services |

The table above lists pertinent sub-sectors which may describe the state of the sustainable energy industry in Durham Region in terms of employment, wages and education.

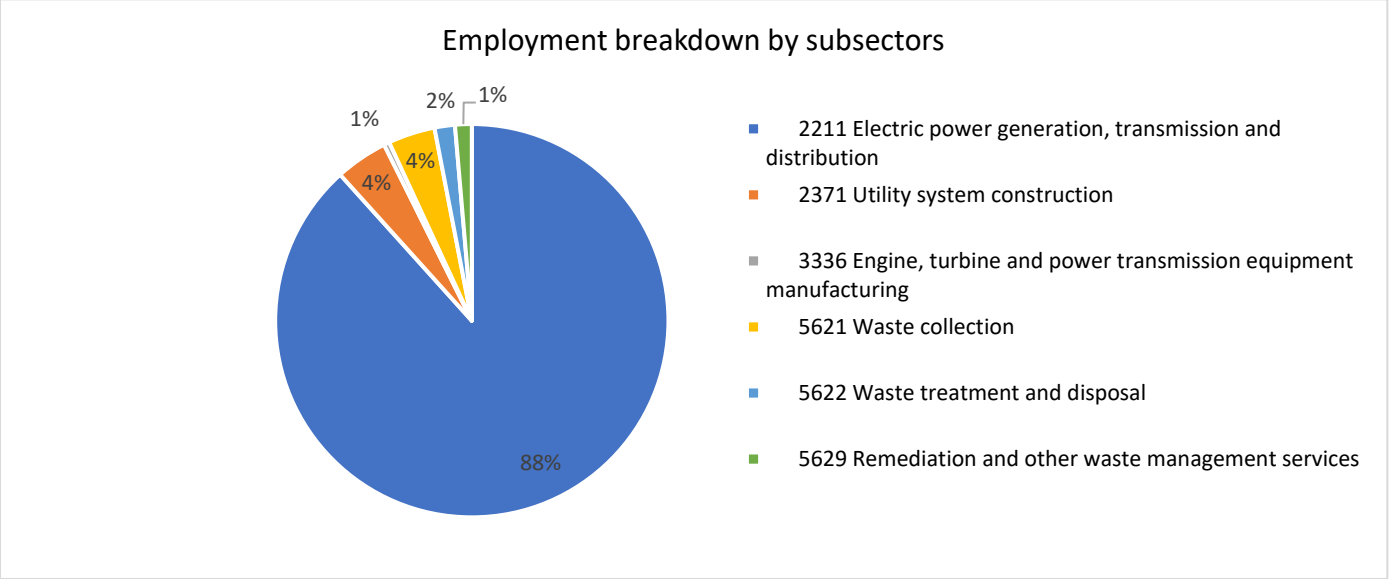
[10] Retrieved from https://biogasassociation.ca/about_biogas/
[11] The North American Industry Classification System (NAICS) is a hierarchical classification system for industries, developed by the national statistical agencies of Canada, United States and Mexico. (Statistics Canada, 2017). This classification system divides the economy into 20 major sectors grouped by production criterion, which are further divided into 102 sub-sectors and 324 industry groups (Statistics Canada, 2017). To know more about NAICS please visit *http://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=307532,*

*Table 2 Sustainable energy employment in Durham Region (Place of Work)[12]; from Census 2016 custom purchased data*

| Sustainable energy sub-sectors | Total employees |
|---|---|
| 2211 Electric power generation, transmission and distribution | 8,700 |
| 2371 Utility system construction | 425 |
| 3336 Engine, turbine and power transmission equipment manufacturing | 45 |
| 5621 Waste collection | 380 |
| 5622 Waste treatment and disposal | 165 |
| 5629 Remediation and other waste management services | 135 |
| Total | 9,850 |

Considering the selected four-digit subsectors, sustainable energy sector employs[13] approximately 10,000 people in Durham Region. The table also shows that among all employment in the sector, 8,700 are employed in the NAICS 2211 *Electric power generation, transmission and distribution* sector. In this sector, Ontario Power Generation (OPG) alone employs a minimum of 6, 700 people, with 4,500 people in the Pickering Plant[14] and another 2,200 people in the Darlington Plant. (Sustainable Clarington Community Advisory Committee, 2014)

*Figure 1 Sustainable energy employment breakdown in Durham Region (Place of Work); from Census 2016 custom purchased data*




The figure above describes the breakdown of sustainable energy employment in Durham Region, and shows that the largest subsector is 2211 *Electric power generation, transmission and distribution,* with 88 percent market share. 2371 *Utility system construction* and 5621 *Waste collection* both have

[12] All numbers are provided on the basis of *Place of Work* estimation, i.e., employees who work in Durham Region, to avoid conflation with employees who may reside in Durham Region but are employed outside of Durham Region

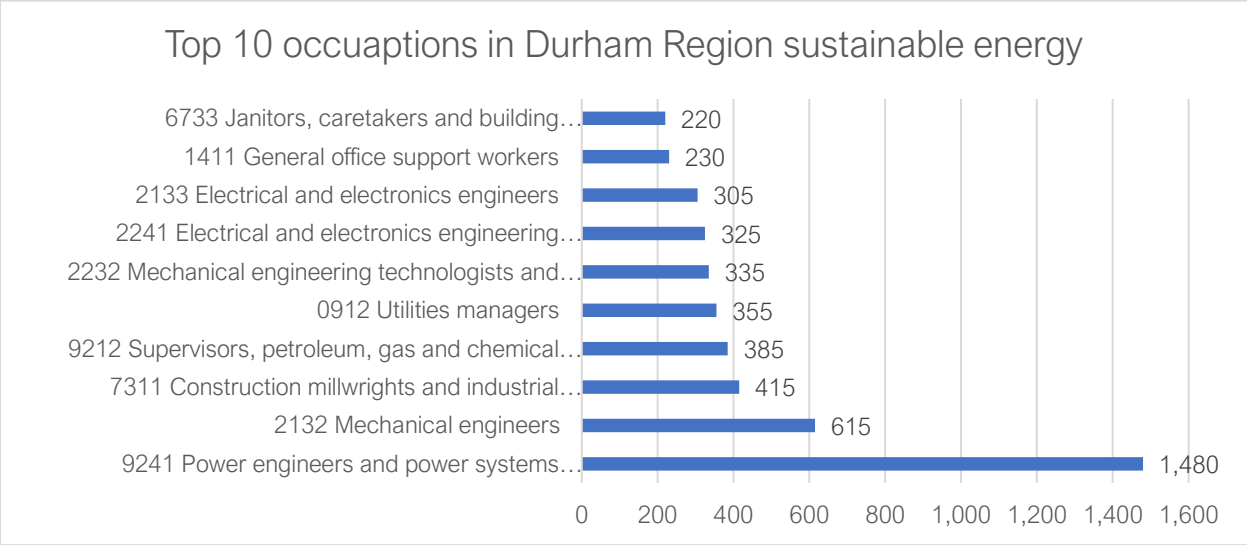
[13] All numbers are provided on the basis of Place of Work estimation, i.e., employees who work in Durham Region, to avoid conflation with employees who may reside in Durham Region but are employed outside of Durham Region

[14] https://www.pickering.ca/en/business/majoremployers.aspx

approximately four percent of employees each, and 3336 *Engine, turbine and power transmission equipment manufacturing* is the smallest subsector with .5 percent of employment.

## Top Occupations in Durham Region Sustainable Energy

*Figure 2 Sustainable energy top 10 occupations[15] in Durham Region (Place of Work); from Census 2016 custom purchased data*



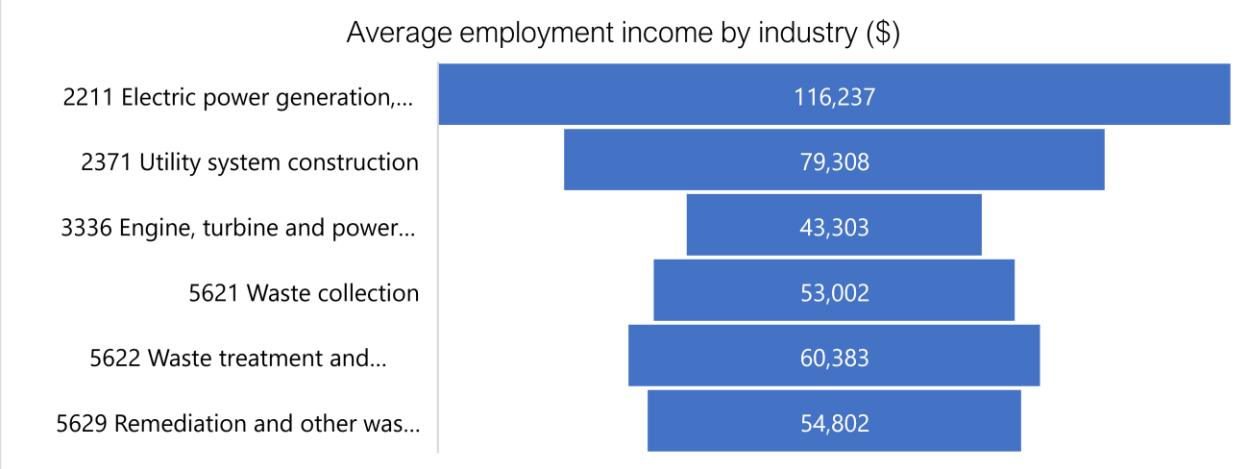

The figure above lists the top 10 occupations in the sector. As it is seen, top ten occupations employ nearly 50 percent of all people in the sector. Additionally, 15 percent of all employees are employed as *Power engineers and power systems operators,* and another six percent are employed as *Mechanical engineers.* *General office support workers* and *Janitors, caretakers and building superintendents* are non-specialised position but occupy the ninth and tenth spots, due to the size of the business establishments involved in this sector.

## Employment Income

Employment income level may provide an indication of the specialisation of the industry as well as overall resource generation from the industry.

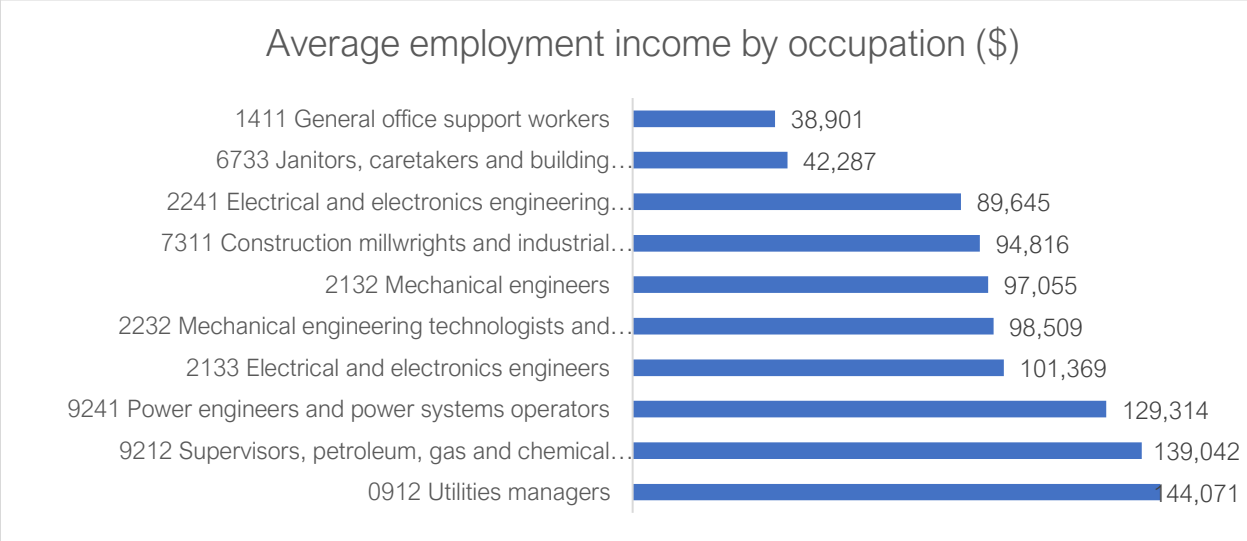
[15] The National Occupational Classification System (NOCS) is developed by the government of Canada, as the Canadian standardized taxonomy and framework for communicating about labour market information, and is sorted by skill levels and skill types (Government of Canada, 2018x). Occupations within this taxonomy are grouped by the type of work required for each job, including the employment requirements, job description and responsibilities, tasks and duties (Government of Canada, 2018x).

*Figure 3 Sustainable energy industry average employment income in Durham Region (Place of Work); from Census 2016 custom purchased data*




All the subsectors in the sustainable energy industry is medium to highly paid, with 2211 *Electric power generation, transmission and distribution* employees earning an average yearly income of $ 116,237. 3336 *Engine, turbine and power transmission equipment manufacturing* employees earned the lowest employment income in this subsector with $ 43,303.

*Figure 4 Sustainable energy occupations average employment income in Durham Region (Place of Work); from Census 2016 custom purchased data*

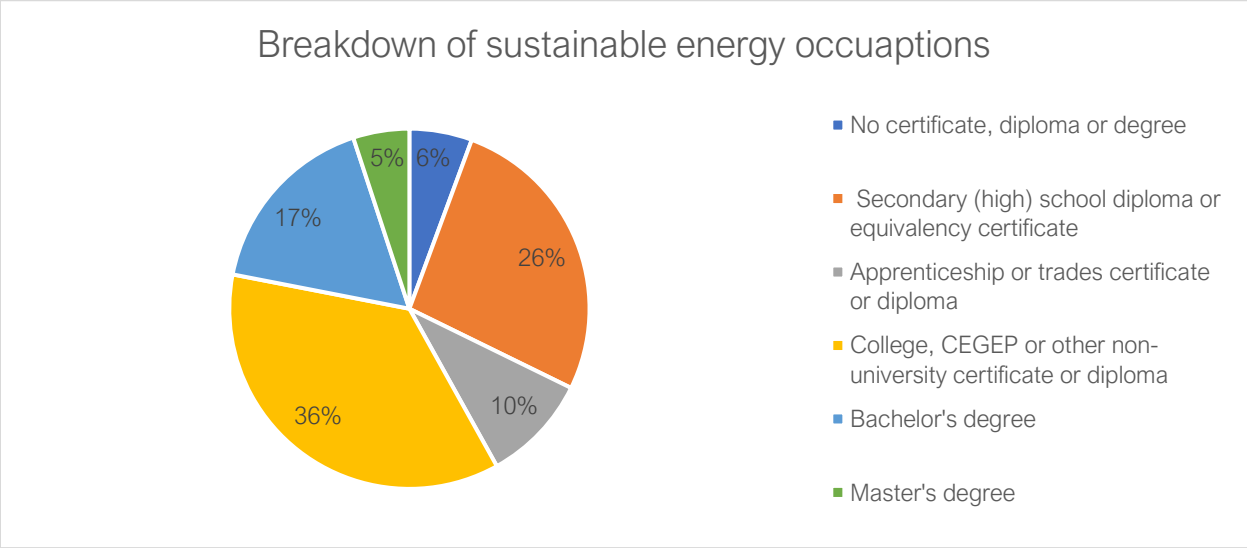



The figure above presents the average employment income, with *Utility managers* earning $ 144,071, followed by *Supervisors* in petroleum, gas and chemical processing and utilities earning $ 139,042. Overall, the top ten occupations are all relatively well paid with the top eight occupations earning above the average employment income level in Durham Region.

## Education

Sustainable energy generation requires technical education with concentration on science and engineering fields.

*Figure 5 Sustainable energy occupations education attainment in Durham Region (Place of Work); from Census 2016 custom purchased data*




The figure above provides a breakdown of educational attainment of all employees in the sector, and only six percent of the employees in the top ten occupations are without any certificate, diploma or degree. In total, 22 percent of employees have at least a Bachelor's degree and another 36 percent have a non-university certificate or diploma.

Detailed breakdown of educational attainment for sustainable energy are available by three-digit NAICS, however these information may not be presentative of this sector because of the presence of a few other sectors, which have been amalgamated together to form the three-digit NAICS. However, education the three-digit NAICS are provided below:

*Table 3 Sustainable energy sub-sector education attainment in Durham Region (Place of Work); from Census 2016 custom purchased data*

| Three-digit sustainability sub-sector | No certificate, diploma or degree | Secondary (high) school diploma or equivalency certificate | Apprenticeship or trades certificate or diploma | College, CEGEP or other non-university certificate or diploma | Bachelor's degree | Master's degree | Earned doctorate |
|---|---|---|---|---|---|---|---|
| 221 Utilities | 140 | 1345 | 1085 | 3515 | 1940 | 520 | 70 |
| 237 Heavy and civil | 155 | 370 | 120 | 310 | 170 | 45 | 0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| engineering construction | | | | | | | |
| 333 Machinery manufacturing | 125 | 440 | 140 | 320 | 150 | 15 | 0 |
| 562 Waste management and remediation services | 125 | 245 | 80 | 180 | 35 | 10 | 0 |

*Table 4 Sustainable energy occupations education attainment in Durham Region (Place of Work); from Census 2016 custom purchased data*

| | No certificate, diploma or degree | Secondary (high) school diploma or equivalency certificate | Apprenticeship or trades certificate or diploma | College, CEGEP or other non-university certificate or diploma | Bachelor's degree | Master's degree |
|---|---|---|---|---|---|---|
| 0912 Utilities managers | 10 | 40 | 45 | 145 | 110 | 30 |
| 1411 General office support workers | 225 | 1210 | 85 | 1230 | 275 | 35 |
| 2132 Mechanical engineers | 0 | 10 | 10 | 70 | 725 | 305 |
| 2133 Electrical and electronics engineers | 0 | 0 | 10 | 45 | 375 | 140 |
| 2232 Mechanical engineering technologists and technicians | 0 | 65 | 90 | 280 | 35 | 10 |
| 2241 Electrical and electronics engineering technologists and technicians | 0 | 90 | 95 | 310 | 70 | 15 |
| 6733 Janitors, caretakers and building superintendents | 395 | 1335 | 225 | 635 | 70 | 20 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 7311 Construction millwrights and industrial mechanics | 20 | 140 | 460 | 465 | 20 | 0 |
| 9212 Supervisors, petroleum, gas and chemical processing and utilities | 25 | 80 | 60 | 215 | 85 | 15 |
| 9241 Power engineers and power systems operators | 0 | 220 | 80 | 935 | 260 | 35 |

## Sustainable Energy Education in Durham Region

Durham Region is host to a number of higher education institutions providing multiple post - secondary training on the field of sustainable energy. The courses provided in Durham Region are as follows:

### *Name of Educational Institution: Durham College*

| Subject | Length of degree | Name of Degree | Location |
|---|---|---|---|
| Building Construction Technician | Four semesters | Ontario College Diploma | Whitby |
| Carpentry and Renovation Technician – NEW | Four semesters | Ontario College Diploma | Whitby |
| Chemical Engineering Technology | Six semesters | Ontario College Advanced Diploma | Oshawa |
| Chemical Engineering Technology (fast-track) | Two semesters | Ontario College Advanced Diploma | Oshawa |
| Chemical Laboratory Technician | Four semesters | Ontario College Diploma | Oshawa |
| Civil Engineering Technician (Co-op option available) | Four Semesters | Ontario College Diploma | Whitby |
| Civil Engineering Technology (Co-op option available) | Six semesters | Ontario College Advanced Diploma | Whitby |
| Electrical Engineering Technician | Four semesters | Ontario College Diploma | Whitby |
| Electrical Techniques | Two semesters | Ontario College Certificate | Whitby |
| Electro-mechanical Engineering Technology | Six semesters | Ontario College Advanced Diploma | Oshawa/ Whitby |

| | | | |
|---|---|---|---|
| Electronics Engineering Technician | Four semesters | Ontario College Diploma | Oshawa |
| Electronics Engineering Technology | Six semesters | Ontario College Advanced Diploma | Oshawa |
| Heating, Ventilation and Air Conditioning Techniques (HVAC) | Two semesters | Ontario College Certificate | Whitby |
| Mechanical Engineering Technician | Four semesters | Ontario College Diploma | Oshawa campus |
| Mechanical Engineering Technician – Non-Destructive Evaluation | Four semesters | Ontario College Diploma | Oshawa |
| Mechanical Engineering Technician – Non-Destructive Evaluation (fast-track) | Two semesters | Ontario College diploma | Oshawa |
| Mechanical Engineering Technology | Six semesters | Ontario College Advanced Diploma | Oshawa campus |
| Power Engineering Techniques – Fourth Class – NEW | Two semesters | Ontario College Certificate | Whitby |

*Name of Educational Institution: University of Ontario Institute of Technology*

| Subject | Duration | Name of degree | Location |
|---|---|---|---|
| Chemistry | Four or five years | Bachelor of Science (Honours)/Bachelor of Science and Management (Honours) | North Oshawa |
| Electrical Engineering | Four or five years | Bachelor of Engineering (Honours) /Bachelor of Engineering and Management (Honours) | North Oshawa |
| Health physics and radiation science | Four years | Bachelor of Science (Honours) | North Oshawa |
| Mechanical Engineering | Four or five years | Bachelor of Engineering (Honours) /Bachelor of Engineering and Management (Honours) | North Oshawa |
| Nuclear Engineering | Four or five years | Bachelor of Engineering (Honours) /Bachelor of Engineering and Management (Honours) | North Oshawa |
| Sustainable Energy Systems | Four years | Bachelor of Technology (Btech) | North Oshawa |
| Mechanical Engineering (Doctoral program) | Approximately 48 months, based on full-time study | Doctor of Philosophy (PhD) | North Oshawa |
| Mechanical Engineering (Master's program) | Approximately 24 months, based on full-time study | Master of Applied Science/Master of Engineering | North Oshawa |
| Nuclear design Engineering (Graduate diploma) | Approximately eight months, | Graduate Diploma | North Oshawa |

| | | | |
|---|---|---|---|
| | based on full-time study | | |
| Nuclear Engineering (Doctoral program) | Approximately 48 months, based on full-time study | Doctor of Philosophy (PhD) | North Oshawa |
| Nuclear Engineering (Master's program) | Approximately 24 months, based on full-time study | Master of Applied Science/Master of Engineering | North Oshawa |
| Nuclear Technology (Graduate diploma) | Approximately eight months, based on full-time study | Graduate Diploma | North Oshawa |
| Nuclear Engineering | Approximately 24 months | Graduate Diploma with McMaster University | North Oshawa |
| Nuclear Engineering (Professional Masters) | Time limit of five years | Master of Engineering | Offsite |
| Electrical and Computer Engineering (Doctoral Program) | Approximately 48 months, based on full-time study | Doctor of Philosophy (PhD) | North Oshawa |
| Electrical and Computer Engineering | (24 months, based on full-time study | Master of Applied Science/Master of Engineering | North Oshawa |

### *Key Performance Indicators: Durham College*

Each year, Durham College produces a Graduate Employment Report based on information compiled from the KPI survey. The information contained in the report profiles the employment status of Durham College graduates from post-secondary programs in 2016. Six months after graduation, graduates are contacted by an independent consulting firm (hired by the Ministry of Training, Colleges and Universities), regarding their employment status. The table below represents programs within the sustainable energy sector.

*Table 5 Durham College Graduate Employment Report Fall 2017*

| Program Name | Total Graduates | Percentage Working (related occupation) | Percentage Working (total) |
|---|---|---|---|
| Chemical engineering technology – fast-track | 6 | 0 | 67 |
| Chemical engineering technology | 20 | 38 | 75 |
| Chemical Laboratory Technician | 50 | 50 | 78 |
| Electrical engineering technician | 61 | 25 | 67 |
| Electrical techniques | 21 | 55 | 82 |

| | | | |
|---|---|---|---|
| Electro-mechanical engineering technology | 19 | 67 | 89 |
| Electronics engineering technician | 8 | 25 | 25 |
| Electronics engineering technician | 20 | 67 | 67 |
| Electronic engineering technology | 16 | 0 | 100 |
| Heating, Ventilation and Air Conditioning Techniques (HVAC) | 51 | 50 | 83 |
| Mechanical engineering – Non-destructive evaluation | 7 | 50 | 100 |
| Mechanical engineering – Industrial | Data supressed because of small number of graduates | | |
| Mechanical engineering technician | 17 | 29 | 71 |
| Mechanical engineering technology | 23 | 63 | 100 |
| Power engineering technician | 42 | 50 | 86 |

### *Key Performance Indicators: UOIT*

UOIT is also responsible for publishing Key Performance Indicators for undergraduate programs, including employment rates 6 months and 2 years following graduation. Although there is less detail than the Durham College KPI data, the indicators still provide a basic understanding of what programs of study are related to higher employment. The table below represents programs within the sustainable energy sector, and is the most recent publicly available data, for graduates from 2014.

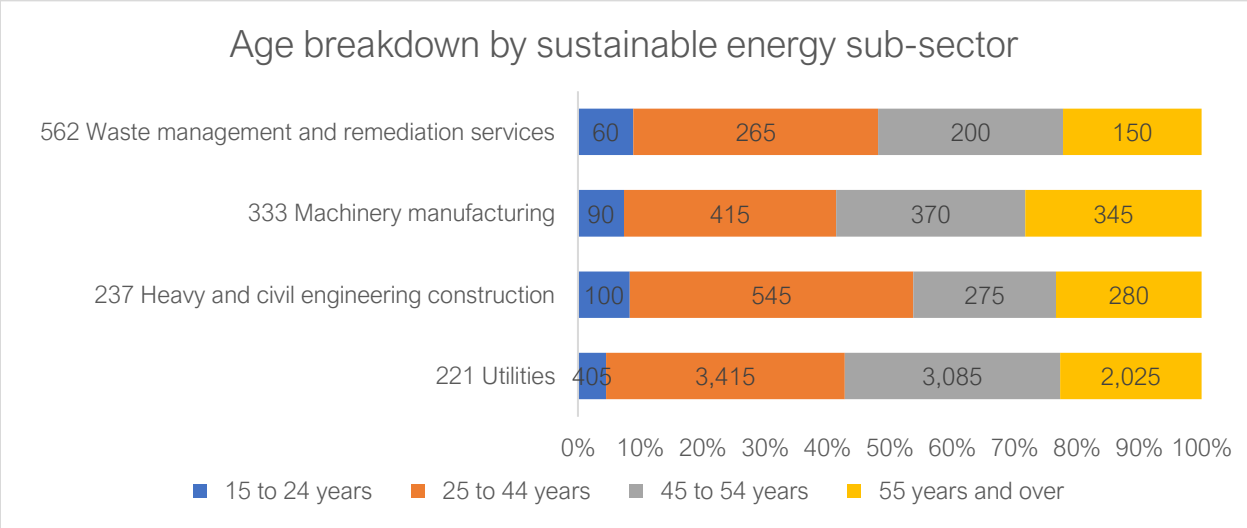
*Table 6 Graduation, Employment, and COISL Loan Default Rates: UOIT, 2015-2016*

| Program | Graduation rate | Employment Rate (6 Months) | Employment Rate (2 Years) |
|---|---|---|---|
| Engineering | 63.6 | 78.4 | 90.3 |

UOIT only provides information on broader topics and not by programs, and the graduate employment rate is the number of graduates of bachelors or first professional degree programs expressed as a percentage of labour force after graduation. (UOIT, 2018)

## Age Breakdown

**Figure 6 Age breakdown of sustainable energy sub-sector; from Census 2016 custom purchased data**




The chart above describes the age breakdown of the employees in the sustainable energy by the three- digit sub-sectors. The breakdown shows that employees aged 15-24 years form on average of less than 10 percent of total employment. Employees aged 25-44 years form between 30 and 60 percent of employees, depending on the sub-sector. Similarly, employees aged 45-54 years form approximately 20 percent of the workforce and employees aged 55 years and over form another 20 percent of the workforce.

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