

WORKFORCE CHALLENGES AND OPPORTUNITIES IN THE ECO-ROOF INCENTIVE PROGRAM AND GREEN ROOF BY-LAW

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Executive summary

This study evaluates the Eco-Roof Incentive Program and the Green Roof By-law from an economic development perspective, focusing on green jobs creation, workforce development and local business opportunity. A user interactive job estimation model is developed as a part of this study. Model results, combined with literature review, online surveys and conversations with industry players inform the major findings of this study. The following provides an overview of these findings:

- The potential economic benefits in employment generation and local business development associated with the eco-roofing industry are significant.
- Employment figures estimated in this study range between 0.6 to 1.1 person-years of employment per 1000 m² of green roof and 0.06 to 0.22 person-years of employment per 1000 m² of cool roofs.
- The Eco-Roof Incentive Program is estimated to have resulted in a minimum total of 20 person-years of new green employment and 19 person-years of greened existing employment to date.
- The Eco-Roof Incentive Program target is for 10% of total industrial, commercial and institutional roofing space in Toronto is to be made more environmentally friendly by 2020. In order to reach this target it is estimated that about 570 and 520 person-years of new green employment and greened existing employment, respectively, will be generated.
- The Green Roof By-Law is expected to generate a minimum of about 80 person-years of employment annually.
- Majority of job opportunities generated by eco-roofing projects are for general labourer and trainees, followed by jobs for roofing professionals and trainees.
- Unattractive apprenticeship salaries and poor attitude towards professions requiring physical labour are two of the major recruitment challenges faced by roofing industry, and the construction industry as a whole.
- Introduction of more college level training program for roofers would introduce and attract younger workforce such as recent high school graduates to trade level professions.
- There are currently no college level programs preparing general labourers or professionals for jobs in green roofs. Several green roof professionals have expressed concern over lack of unified and organized training in the green roofing industry.
- While forming a small part of this study, local procurement of material required in the eco-roofing industry could be of significant value to empowering the local economy. It is recommended that a more extensive study on supply chain of green and cool roofs be conducted.

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1 Background

In December 2009, City Council approved The Power to Live Green: Toronto's Sustainable Energy Strategy, which detailed an approach to build upon the goals for reducing greenhouse and smog causing emissions by adopting a number of recommendations to act as principles and targets for Toronto's sustainable energy future.

In an effort to build upon its adoption of the Green Economic Sector Development Strategy, and in recognizing the creation of jobs and economic opportunities as a result of the emergence of the green energy sector, the Green Jobs Action Team has been established. The objective of this action team is to advance policies, investments, collaborations and partnerships in the city to ensure that Toronto is delivering its commitments in the Power to Live Green, by making more jobs green and by creating more green jobs.

A number of City divisions have been developing and implementing several environmental initiatives in order to meet the goals and objectives of the City's sustainable energy strategy. While the environmental benefits of these initiatives are mostly quantified, their economic impact, specifically green jobs potential and workforce requirements, have not been thoroughly evaluated. Many of the City's environmental initiatives present several prospects for creating a variety of local green employment and procurement opportunities.

This document reports the result of evaluating the Eco-Roof Incentive Program (ERIP) and the Green Roof By-Law from a job creation and workforce development perspective. As a part of this analysis a Microsoft Excel model is developed. The model provides estimates for person-years of employment generated in various project phases and skill levels as a result of the initiative. Users have the option of modifying default assumptions, future scenario parameters, and program targets and observe the resulting changes in employment estimates. It must be noted that the model is not meant as a design tool, since the complexity of estimation parameters and their level of precision are not fit for that level of analysis. Rather, it is meant as a higher level evaluation tool for investigating aggregate employment impacts.

For the purposes of this study green jobs are defined as direct employment generated due to a City of Toronto environmental policy or program. Spin-off jobs related to this direct employment (e.g. clerical support, equipment transportation, etc) are considered indirect jobs and are not included in this analysis. Similarly, induced jobs, which are jobs generated due to re-spending of worker income in consumer goods and services, are not quantified.

Together with two similar reports on other programs, this study is a part of an initiative by the Green Jobs Action Team for developing a framework for evaluating the economic impact of City of Toronto environmental initiatives.

This document, together with two similar reports on other programs, is a part of an initiative by the Green Jobs Action Team for developing a framework for evaluating the economic impact of City of Toronto environmental initiatives. Results of this and future evaluations would allow the City to better understand additional benefits of environmental initiatives and plan for the future in order to strengthen Toronto's green economy.

2 Introduction

A Green Roof is a roof surface that supports the growth of vegetation over a substantial portion of its area for the purpose of water or energy conservation. It is comprised of a waterproofing membrane, drainage layer, organic growing medium (soil) and vegetation. A Cool Roof is a roofing system with high solar reflectivity and thermal emissivity. It may be either a coating applied over an existing roof system or a new single-ply waterproofing membrane.

Benefits of green roofs and cool roofs are well known and have been documented in numerous academic studies^{1,2}. These benefits include storm water flow reduction (green roofs only), improvement in air quality (green roof only), reduction in urban heat island effect, reduction in direct energy use and consequently reduction in greenhouse gas emissions.

In addition to these benefits, eco-roofs also contribute to the local economy through creation of new green jobs, greening of existing jobs, and supporting the green economy through local procurement of materials. As Krause et. al.³ state in a recent report on green jobs in green infrastructure:

"Green roofs are more labour intensive when compared to traditional grey infrastructure projects, with approximately 45% of each dollar spent on labour for green roofs...Green roofs, especially when undertaken as a retrofit, often have a very quick turnaround time of less than one year assuring a faster path towards more employment than other types of infrastructure projects."

When it comes to new cool roof membranes, there are generally no new jobs created, since cool roofs are essentially an alternative to regular roofing and generally require the same amount of labour. Jobs in new cool roof membranes are therefore treated as greened existing jobs. Jobs associated with reflective cool roof coating, which is applied to existing roofing systems, are considered new green jobs since such a provision is an additional component to basic roofing.

As mentioned earlier, only direct jobs resulting from the ERIP and the Green Roof By-Law are quantified here. These include jobs in technical planning and design, construction and installation and operation and maintenance.

The Eco-roof incentive program, launched in March of 2009, is designed to promote the use of green and cool roofs on Toronto's commercial, industrial and institutional buildings, and to help Toronto's business community take action on climate change. The program offers incentives of \$50 per square meter of green roof, up to \$100,000 and \$2-\$5 per square meter of cool roofs, up to \$50,000. The program's target is to make 10% of total industrial, commercial and institutional roof space located in Toronto more environmentally friendly by 2020.

To date, about 29 green roofs and 43 cool roofs in Toronto have received a total of \$0.64 million and \$0.56 million from the ERIP, respectively.

The Green Roof By-Law requires and governs construction of green roofs on new development with a minimum Gross Floor Area of 2,000 m². The Bylaw applies to new building permit applications for

¹ Currie, Beth Anne & Brad Bass (2010). "Using Green Roofs to Enhance Biodiversity in the City of Toronto". Discussion report, prepared for Toronto City Planning

² Banting, Doug; Hitesh Doshi, James Li & Paul Missios (2005). "Environmental Benefits and Costs of Green Roof Technology for the City of Toronto". Prepared for City of Toronto and Ontario Centres of Excellence

³ Krause, Michael; Peter Lowitt & Steve Peck (2010). "The Leaf Effect – Green Infrastructure and the promise of green jobs" *Living Architecture Monitor, Green Jobs issue, Winter, 2010*

residential, commercial and institutional development made after January 2010, and will apply to new industrial development as of January 2012. The green roof coverage requirement is graduated, depending on the size of the building, and it ranges between 20% and 60%. On a temporary basis the ERIP also accepts applications for new large ICI buildings citywide that are captured by the proposed Green Roof By-law.

Approximately 85,000 m² of green roof space will result from development applications received in 2010 under the Green Roof Bylaw.

3 Methodology

In 2010 The Tower Renewal Office commissioned a study by Professor Ted Kesik from the University of Toronto to look at workforce challenges and opportunities in the tower renewal industry in Toronto⁴. The methodology adopted by this study has guided a major component of the work presented here. Given the difference between the tower renewal industry and the eco-roofing roofing industry certain aspects of the methodology differ from those of the Tower Renewal study.

A large component of labour data collected for the employment models developed in this study has been through several personal meetings, phone conversations and e-mail correspondence with industry players involved in different aspects of green and cool roofing. A detailed database of job components, required skill level, and hours of work associated with each of the eco-roofing option has been compiled as a result (see Appendix B: Employment Breakdown).

The amount of work required per unit area of green or cool roofs depends on the size of the roof and the economies of scale that can be achieved in larger jobs. For data collection purposes in this study the average size of cool roofs (3000 m²) and green roofs (1000 m²) that have taken part in the ERIP are used. Installation of the waterproofing membrane, whether as a cool roof or as a component of a green roofing job, can also vary significantly in labour intensity depending on factors such as complexity of detailing, accessibility, roof configuration, roof height, etc. However, quantifying such factors and their impact on required labour hours would have been very difficult for the green and cool roofs in the ERIP and the Green Roof By-Law. As a result, rough estimates and general averages are used in employment estimations presented in this report.

Green roof labour requirements are extremely varied depending on the green roof features. In this study the most basic extensive green roof, with no additional features (e.g. lighting, guard rails, public access, ponds and pools and leak detection system) is studied. Therefore, the employment figures estimated here are the minimum expected number of jobs.

Green roof labour requirements are extremely varied depending on the green roof features. In this report the most basic extensive green roof is studied.

In addition to the primary research, a literature review of existing studies on the subject of employment in the eco-roofing industry was conducted. Significant findings from the literature review and comparable figures will be discussed later in this report.

In order to understand gaps and opportunities in workforce training an inventory of available training options in the eco-roofing field was conducted. In addition, an online survey on workforce training and

⁴ Kesik, Ted. (2010). "Tower renewal workforce challenges & opportunities" Report prepared for the Tower Renewal Office

recruitment was designed and implemented. This survey collected information from industry players in the region about the following:

- Basic information about the respondent and their business size;
- Whether they would manage with their existing staff size if demand for their services suddenly doubled;
- What skill areas are most challenging to recruit?
- What are the primary sources for finding labour in this field?
- What partnerships are working to help with recruitment and workforce development?
- What are the barriers/obstacles with recruitment?
- What are the primary sources for workforce development in the industry? and
- What are some of the gaps in quality or quantity of existing training programs?

The complete green roof industry survey is presented in Appendix A. A very similar survey for the cool roof industry was also conducted. Respondents to the survey were contacted through the phone and later through a follow up e-mail where a link to the online survey was provided. Some 12 companies completed the online survey. The results of the surveys will be discussed later in section 5 of this report.

3.1 User Interactive Employment Estimation Model

This study has resulted in a user interactive Microsoft Excel based job estimation model. This open architecture estimation tool provides capabilities for users to view and modify the base assumptions used in calculations. In addition, a number of opportunities are built in to allow for variable modification and quick result visualization. The main user interface page of the model guides the user through colour coded cells indicating what is default information, what are modifiable default assumptions, what are modifiable system specific variables, and what are estimation outputs. Model outputs include person-years of new green employment and greened existing employment. Employment figures are also broken down by project phase and occupation type.

This study has resulted in a user interactive Microsoft Excel based job estimation model. This open architecture estimation tool provides capabilities for users to view and modify the base assumptions used in calculations.

The following is a brief description on methodology of model development.

Employment estimations in this study are measured in jobs per unit area of roof. Certain components that are not a function of roof size, such as planning and design work by engineers and architects and storm water analysis, are quantified in jobs per roofing project. Average roof size is used to estimate the number of roofing projects.

Cool roofs are broken down to three different types based on variability in labour intensity. Table 1 provides a description of each type and the type of jobs associated with them.

Table 1 - Classification of cool roof types

Cool Roofing Type	New green jobs	Greened existing jobs
New reflective roofing membrane	Additional maintenance	Installation
Spray coating with reflective paint over existing membrane	Application and additional maintenance	None
Reflective layer over existing membrane	Installation and additional maintenance	None

As mentioned previously, employment numbers calculated for green roofs in this analysis are considered to be minimum estimates assuming very basic extensive green roofs with no additional features. Even under this assumption, however, there lies variability in the amount of work that is required for a green roof project. Table 2 provides a list of modifiable green roof variables and the associated employment effect. All of these variables and their employment effects are incorporated into the employment model architecture.

Table 2 - Modifiable job estimation variables for green roofs

Variable	Employment effect
Whether the green roof is on a new building versus and existing building	Incremental engineering and architecture work hours specifically associated with green roof design, planning and storm water analysis on a new building is minimal since such work is a component of the overall building design. In contrast, a notable amount of work is required by engineers and architects for green roofs on existing buildings, especially if a structural analysis report is part of permitting requirements.
Whether the existing roof requires structural analysis	
Whether the green roof system is the modular/roll-on type or the built-in-place type	Built-in-place green roof systems are estimated to be about 25% less labour intensive overall, compared to modular and roll-on systems.
Whether the existing roof requires a new waterproofing membrane	Replacement of the roofing membrane is a labour intensive component of green roofs; however, not all green roof installations are accompanied with a roofing replacement.
Whether the green roof system is accompanied by an automatic irrigation system	Installation of an automatic irrigation system calls for certain amount of work in plumbing and general trades.
Whether a storm water report is part of the requirements	An average storm water analysis and report takes about 40 engineering hours of work, however this requirement was lifted during the course of the ERIP, therefore not all green roof project in the ERIP resulted in engineering work in storm water analysis.

The models provide the user with the option for two types of analysis. The first provides estimation for hours required for completing a single green or cool roof with a set of user defined specifications. This component ignores program specification. The second component allows for evaluation of actual City of Toronto programs, the Eco-Roof Incentive program and the Green Roof By-Law.

The database of employment breakdown, illustrated in Appendix B: Employment Breakdown, tabulates number of hours of work and crew size for completing various components of an eco-roof. Using this database and specifications associated with a project sample or a program, the total hours of work required are calculated, which are then converted to person-years of employment. Each person-year of employment is considered to be made up of 1,960 hours of work. This figure is commonly used as average total number of hours in one year of full-time employment⁵. There are certainly limitations in making this broad assumption. Certain occupations have longer work hours than others. In addition, depending on the state of the industry, employers might ask employees to work overtime in the event of increased work load, rather than choosing to hire new staff. Nevertheless, this estimation approach is deemed acceptable at this level of analysis since it normalizes employment figures and facilitates further evaluation and comparisons.

One person-year of employment is equivalent to 1,960 hours of work.

Jobs in green roofing are broken down to three phases of planning and design, construction/installation and operation & maintenance. Furthermore, jobs in cool roofing are broken down into two phases of installation and maintenance⁶. Operation and maintenance jobs are considered for the entire lifetime of the roof, which is assumed to be 25 years for green roofs and 15 years for cool roofs. In addition, job estimations are also broken down by skill types. These include engineer/architect, drafter, roofing foreman, roofing trainee, general trade foreman, general labourer/trainee and plumber.

⁵ Singh, Virinder and Jeffrey Fehrs (2001). "the work that goes into renewable energy" Research report: Renewable Energy Policy Projects, Washington, DC.

⁶ There is minimal amount of planning and design work done by engineers or architects for cool roofs on an individual project basis. Initial system planning and design of cool roofs systems as a whole does require engineering skills, however, such one-time components are not included in the analysis.

4 Estimated Workforce Impacts

4.1 A typical example

Table 3 below displays hours of work associated with each of the three types of cool roofs for an average roof of 4000 m². As the numbers suggest, new cool roofing membranes are the only type that generate new green employment. Overall, reflective spray painting is the least labour intensive option, followed by the option for installing reflective layer over existing membrane, which requires about 2.5 times the labour hours, and installation of a new membrane, which requires about 3.9 times the amount of labour for reflective spray painting.

Table 3 - Sample work hours for various cool roof types

	Reflective spray paint over existing membrane	Reflective layer over existing membrane	New membrane
Roof area [m2]	4,000	4,000	4,000
% Cool roof coverage	75%	75%	75%
Cool roof area [m2]	3,000	3,000	3,000
Hours of greened existing employment	0	0	1,012
Hours of new green employment	329	807	258
Hours of work by Project Phase			
Installation	71	549	1,012
Maintenance	258	258	258
Hours of work by Occupation Type			
Foreman	6	32	169
General labourer /roofing trainee	323	775	1102

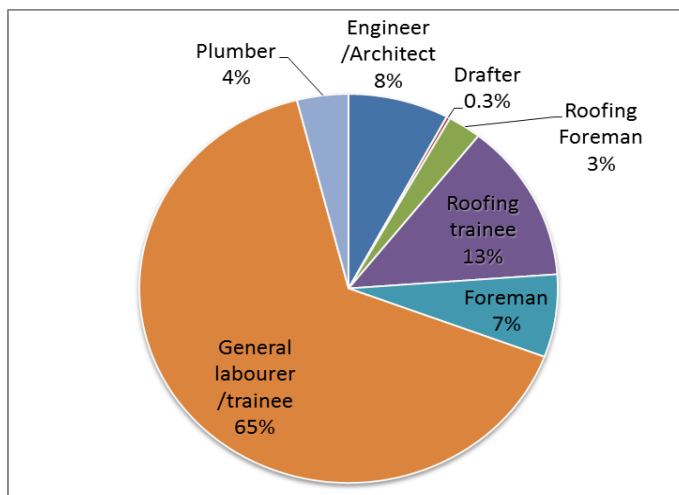
Similarly, Table 4 illustrates a sample green roof of average size of the modular/roll-on type installed on an existing building. It is also specified that a new roofing membrane, structural evaluation, automatic irrigation system and a storm water evaluation report are all required. In the user-interactive model the user has the option of modifying these assumptions. As the results suggest, majority of the work generated is new green employment, and it takes place during the manufacturing and installation phase⁷.

⁷ The term "manufacturing" refers only to manufacturing of green roof composite systems and does not include employment involved in manufacturing of individual product, such as roofing membrane.

Table 4 - Sample work hours for a typical green roof

Roof area [m2]	1000
% Green Roof coverage	50%
Roof area covered [m2]	500
Specifications	
Green roof is installed on a	Existing building
Extensive Green roof system is	Modular/Roll-on
Requires new roofing membrane (applies only to existing buildings)	Yes
Requires structural evaluation (applies only to existing buildings)	Yes
Irrigation System	Yes
Storm water evaluation	Yes
Hours of new green employment	865
Hours of greened existing employment	170
Breakdown of hours of work by project phase	
Planning and Design	87
Manufacturing and Installation	724
Operation and Maintenance	269
Breakdown of hours of work by occupation type	
Engineer/Architect	84
Drafter	3
Roofing Foreman	28
Roofing trainee	142
Foreman	74
General labourer/trainee	704
Plumber	43

As Figure 1 illustrates, majority (65%) of employment opportunities in the green roof example defined above are for general labourers/trainees. The remaining 35% of jobs are for general trade foremen, roofing foremen and trainees, engineers, architects and plumbers, with a very small percentage for drafters supporting engineering/architecture work.

**Figure 1 - Green roof employment breakdown by skill type**

4.2 Scope of existing initiative and future program expansions

Table 5 and Table 6 provide a summary of projects that have received green roof and cool roof incentives to date through the ERIP. In addition, the tables display estimation assumptions used in the models regarding roof specifications.

Table 5 - Statistics of green roof incentive projects to date

Green Roof Incentives to date	
Total amount of grants paid	\$ 642,585
Number of buildings	29
Total roof area covered [m2]	14,824
% new roofs (by area)	33%
% existing roofs (by area)	67%
% of installations with irrigation system	85%
% of existing roofs requiring structural analysis	100%

Table 6 - Statistics of cool roof incentive projects to date

Cool Roof Incentives to date	
Total amount of grants paid	\$ 487,240
Number of buildings	34
Total roof area covered [m2]	103,808
% New membrane (by area)	78%
% Spray coating over existing roof (by area)	0%
% Reflective layer over existing roof (by area)	22%

Table 7 and Table 8 display assumptions for the future of the ERIP. The program's 2020 target is used as the basis for the assumed area of coverage. This target states that 10% of the total industrial, commercial and institutional roofing space located in Toronto is to be made more environmentally friendly by 2020. It is assumed that the breakdown of green to cool roofs by area will be similar to the current observed ratio of 11 to 89.

Table 7 - Projections for future green roof incentive projects

Projected Green Roof Incentives	
Estimated amount of incentives	\$ 18,751,256
Total Available Flat Roof Area [m2]	39,267,565
Program Target for environmentally friendly roofing	10%
% of target made up of green roofs	11%
Roof area covered [m2]	419,519
Specifications	
% new roofs (by area)	0%
% existing roofs (by area)	100%
% of installations with Irrigation System	85%
% of existing roofs requiring structural analysis	100%

For the Green Roof By-Law employments estimates are made in an annual basis. Figures used in this estimation are based on the approximate area of green roof space that will result from development applications received during its first year of enforcement (2010). Assumptions for this annual estimation are illustrated in Table 9.

Table 8 - Projections for future cool roof incentive projects

Projected Cool Roof Projections	
Total Available Flat Roof Area [m2]	39,267,565
Program Target for environmentally friendly roofing	10%
% of target made up of cool roofs	89%
Roof area covered [m2]	3,388,606
% new membrane (by area)	78%
% cool roof coating (by area)	22%

Table 9 - Expected annual green roof statistics under the Green Roof By-Law

Green Roof By-law - Annual	
Minimum expected green roof area cover [m2]	85000
Specifications	
% new roofs (by area)	100%
% existing roofs (by area)	0%
% of installations with Irrigation System	85%

4.3 Evaluation of employment effect of programs

Table 10 summarizes estimation results for person-years of employment association with green roofs as a result of ERIP to date, meeting the ERIP 2020 target, and the Green Roof By-Law annually. Figures 1 through 4 illustrate the breakdown of projected employment figures by project phase and skill type.

Table 10 - Employment effect of current and projected green roof programs

	Green Roofs ERIP to date	Green Roofs ERIP Future Projections	Green Roof By-Law (Annually)
Person-years of new green employment	12	348	67
Person-years of greened existing employment	3	73	15
Person-years of employment by Project Phase			
Planning and Design	0.7	18	0
Manufacturing and Installation ⁸	10.1	287	58
Operation and Maintenance	4.1	115	23
Person-years of employment by Skill Type			
Engineer/Architect	0.7	17	0
Drafter	0.0	1	0
Roofing Foreman	0.4	12	2
Roofing trainee	2.1	61	12
Foreman	1.0	28	6
General labourer/trainee	10.1	285	58
Plumber	0.6	16	3

⁸ The term "manufacturing" refers only to manufacturing of green roof composite systems and does not include employment involved in manufacturing of individual product, such as roofing membrane.

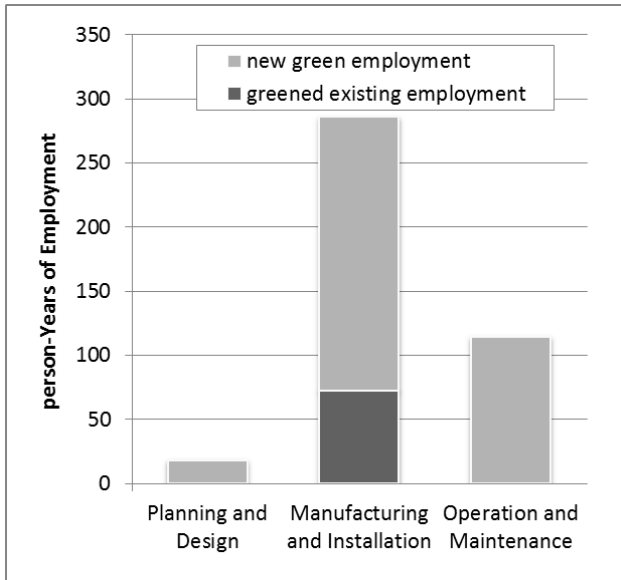


Figure 2 – ERIE for green roofs - Employment breakdown by project phase

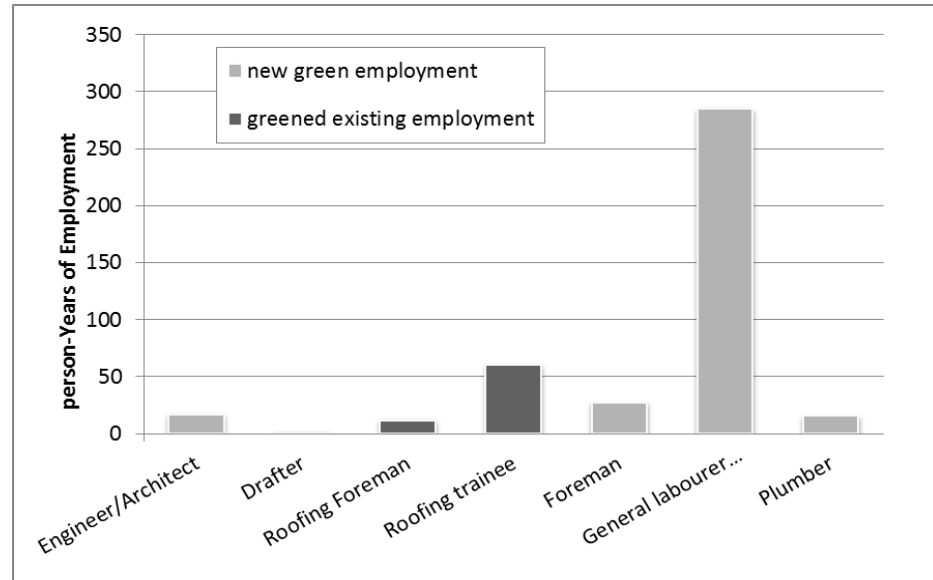


Figure 3 – ERIE for green roofs - Employment breakdown by skill type

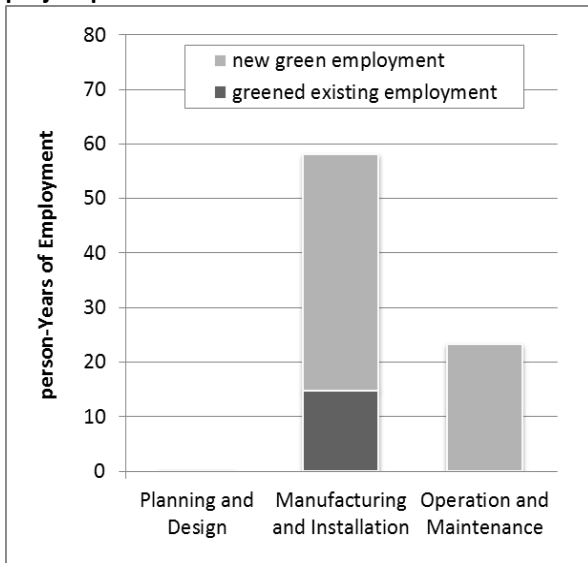


Figure 4 Green Roof By-Law - Employment breakdown by project phase

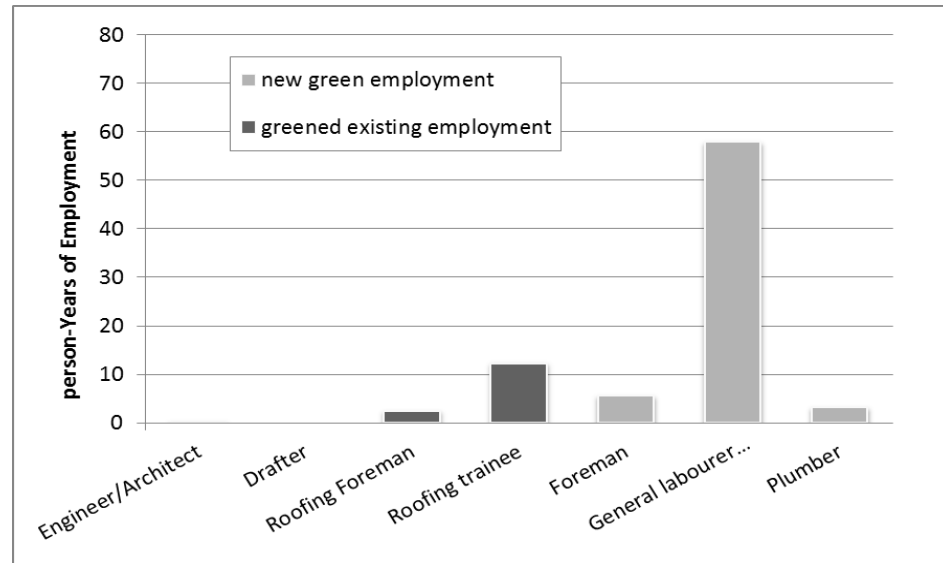


Figure 5- Green Roof By-Law - Employment breakdown by skill type

Similarly, Table 11 Table 10 summarizes estimation results for person-years of employment association with cool roofs as a result of ERIP to date and meeting the ERIP 2020 target in the future.

Table 11 - Employment effect of current and future cool roof programs

	Cool Roofs ERIP to date	Cool Roofs ERIP Future Projections
Person-years of new green employment	8	225
Person-years of greened existing employment	16	469
Person-years of employment by Project Phase		
Installation	18	541
Operation and Maintenance	5	154
Person-years of employment by Skill Type		
Foreman	3	82
General Labourer/Roofing Trainee	21	612

The ERIP is estimated to have resulted in a minimum total of 20 person-years of new green employment and 19 person-years of greened existing employment to date.

The Green Roof By-Law is expected to generate a minimum of about 80 person-years of employment annually.

Majority of job opportunities generated by eco-roofing projects are for general labourer and trainees, followed by jobs for roofing professionals and trainees.

It is evident that City of Toronto initiatives in eco-roofing have resulted in a several green employment opportunities so far. In addition, projections show that these opportunities can be quite significant in the future. As the results suggest, a minimum of over 1,000 new green jobs and greened existing jobs can be expected from meeting the targets of the ERIP program. In addition, the Green Roof By-Law is expected to create a minimum of about 80 person-years of employment annually. Majority of job opportunities generated by eco-roof projects are for general labourer and trainees, followed by jobs for roofing professionals and trainees.

In order to reach the ERIP target it is estimated that about 570 and 520 person-years of new green employment and greened existing employment, respectively, will be generated.

It must be noted that the presented breakdown of skill types are based on assuming minimum green roof features. As the industry gains momentum in Toronto it is expected that more and more building owners and developers will choose to go with additional features as they recognize the added benefits of more complex systems in the form of increases system performance and property values. Such trends would significantly increase the amount of work for green roof professionals involved in the planning and design phases.

Comparison of the results of the model developed by this study to estimates made by other researchers can be a valuable exercise in validating the results. However, as discussed in the methodology section and evident in the system specifications included in the employment model, eco-roof labour requirement is influenced by numerous factors, especially for green roofs. As a result, without

knowledge of specific assumptions made in other studies it is not possible to make direct comparisons between the results.

Employment figures estimated in this study range between 0.6 to 1.1 person-years of employment per 1000 m² of green roof and 0.06 to 0.22 person-years of employment per 1000 m² of cool roofs. Figures estimated by other studies for green roof job intensity are quite varied. Our estimates for green roof job intensity lie in between the upper and lower estimates found in existing literature. A report prepared for the Washington D.C. Economic Partnership and the Washington D.C. Office of Planning⁹ suggests that 0.42 person-years of employment can result from every 1000 m² of green roofs. Another study, on assessing opportunities for green roofs in Buenos Aires estimates 2.04 jobs per 1000 m². No existing studies were found on employment effect of cool roofs.

5 Workforce Challenges and Opportunities

General roofing training is offered at a small number of colleges in Toronto and vicinity. These include:

- Humber College offering a roof consultant program;
- Conestoga college offering a roofing fundamentals and roofer (apprenticeship) program through their new roofing skills centre in Waterloo; and
- Mohawk College, offering a roofer (apprenticeship) program.

Majority of roofing practitioners provide in-house training through multi-year apprenticeship programs. Graduates from a college apprenticeship program can often enter a roofing company's in-house program at two years into the 5-year program. Other means of training for roofers are industry associates and union training centres.

The common complaint expressed by roofing companies is lack of hands-on training in college training programs. Additionally, the industry has been seeing less and less interest from the younger workforce. This poor attitude towards physical labour is a common trend with most construction fields. As the Tower Renewal Workforce Challenges & Opportunities study indicates:

“[Skilled workers] are rapidly becoming an endangered species in a world where much higher status and prestige are attached to knowledge workers.... Nearly 50,000 workers in the Ontario construction industry are set to retire in the next several years and there does not appear to be a replacement strategy in place at the provincial level¹⁰”

College level training program for roofers introduce and attract younger workforce such as recent high school graduates to trade level professions.

This highlights the value of college level training program for roofers, which introduce and attract younger workforce such as recent high school graduates to trade level professions.

Poor attitude towards physical labour and negative

⁹ The Louis Berger Group, Inc (2008). "Green collar jobs demand analysis" Final Report. Prepared for the Washington D.C. Economic Partnership and the Washington D.C. Office of Planning.

¹⁰ Kesik, Ted. (2010). "Tower renewal workforce challenges & opportunities" Report prepared for the Tower Renewal Office

perspective towards labour intensive professions also applies to the green roof industry. As we saw earlier, the largest component of skill types required in the green roof industry is general labourer/trainee.

There are currently no college level programs preparing general labourers or professionals for jobs in green roofs. The Humber College roof consultant program offers an elective course on green roofs amongst 16 other elective options. Majority of general labourers in green roof installations are trained on the job. Moreover, majority of higher level skilled professionals such as engineers, architects and landscape architects gain most of their knowledge either on the job or through the Green Roof Professional (GRP) program offered by Green Roof for Healthy Cities, a North American industry association based in Toronto.

Several green roof professionals and university professors have expressed concern over lack of unified and organized training in the green roofing industry. In addition, some argue that more strict regulations and benchmarking is needed in order to ensure acceptable quality of work. It is further suggested that such responsibilities should be in the hand of academic institutions or government rather than industry stakeholders. Some professionals believe that the industry in Toronto is on a race to the bottom as we try to use the cheapest green roof systems with the cheapest roofing membranes. Their concern is that leakage issues as a result of lack of proper attention to the waterproofing membrane, in addition to lack of proper maintenance and/or automatic irrigation systems will likely result in several failed systems in the year to come. This can be damaging to the reputation of the industry and the future programs that the City of Toronto is investing on.

There are currently no college level programs preparing general labourers or professionals for jobs in green roofs. Several green roof professionals have expressed concern over lack of unified and organized training in the green roofing industry.

There are currently preliminary talks between Humber College and Green Roof for Healthy Cities about offering the Green Roof Professional accreditation through Humber College. The status of this initiative is currently unknown.

6 Local procurement opportunities

Local procurement of materials involved in construction of green and cool roofs can have a significant impact on development of local businesses. Currently Tremco and IKO are the only two manufacturers of roofing membranes located in Toronto. The Toronto roofing material market is supplied through these and other GTA wide local suppliers and manufacturers, in addition to those based in nearby provinces and states. There are also some local manufacturers of cool roof paints such as Reflektor Coatings of Canada, based in Richmondhill and Durock Alfacings International located in Vaughan.

Local procurement of material required in the eco-roofing industry could be of significant value to empowering the local economy. It is recommended that a more extensive study on supply chain of green and cool roofs be conducted.

In addition to waterproofing membranes green roofs require a number of other types of materials. Figure 6 illustrates the composition of a typical extensive green roof.



Figure 6 Green roof composition¹¹

The following list, prepared by the Canadian Mortgage and Housing Corporation¹², provides a summary of material content of green roofs. These include:

- Roof membranes and root repellent layers.
- Drainage layers, landscaping cloth, curbs, irrigation systems and other specialty products.
- Substrate, light-weight soils and amendments.
- Plants specifically for green roof applications (vines, sod with wildflowers or alpine/succulent varieties, soil and seed/plant sprout mixes, seeded erosion blankets, etc.).

While some companies are committed to sourcing majority their products locally, others chose to ship modules manufactured entirely in the US, such as those by Green Roof Blocks. Some green roof suppliers manufacture their green roof system in the GTA, however the green roof components are sources from other provinces and united states. Hydortech, for instance, sources its membrane and insulation from Montreal, growing medium from Milton, and vegetation from Virginia.

The growing medium and vegetation components of green roofs are two that have high potentials for local sourcing. Some industry professionals express concern over the current City of Toronto requirements for the composition of the growing medium and believe that the regulations limit the use of local compost.

Some local manufacturers of green roof systems include:

- Xeroflor - nursery located in southern Ontario;

¹¹ City of Toronto website. "What is a green roof?". Accessed through <http://www.toronto.ca/greenroofs/what.htm>

¹² Greenbacks from Green roofs: Forging a New Industry in Canada, CMHC, Toronto

- Sedum Master - Princeton, Ontario;
- LiveRoof Ontario Inc. - Guelph, Ontario; and
- BioRoof - Burlington, Ontario.

While this study has not focused extensively on local procurement opportunities of green and cool roof components, this area is of significant value to empowering the local economy, given the expected trends in the eco-roofing industry. Therefore, it is recommended that a more extensive study on supply chain of green and cool roofs be conducted.

7 Summary of Major Findings

The following summarizes the significant findings resulting from this study based on the research, surveys and interviews conducted.

- The potential economic benefits in employment generation and local business development associated with the eco-roofing industry are significant.
- Employment figures estimated in this study range between 0.6 to 1.1 person-years of employment per 1000 m² of green roof and 0.06 to 0.22 person-years of employment per 1000 m² of cool roofs.
- The Eco-Roof Incentive Program is estimated to have resulted in a minimum total of 20 person-years of new green employment and 19 person-years of greened existing employment to date.
- The Eco-Roof Incentive Program target is for 10% of total industrial, commercial and institutional roofing space in Toronto is to be made more environmentally friendly by 2020. In order to reach this target it is estimated that about 570 and 520 person-years of new green employment and greened existing employment, respectively, will be generated.
- The Green Roof By-Law is expected to generate a minimum of about 80 person-years of employment annually.
- Majority of job opportunities generated by eco-roofing projects are for general labourer and trainees, followed by jobs for roofing professionals and trainees.
- Unattractive apprenticeship salaries and poor attitude towards professions requiring physical labour are two of the major recruitment challenges faced by roofing industry, and the construction industry as a whole.
- Introduction of more college level training program for roofers would introduce and attract younger workforce such as recent high school graduates to trade level professions.
- There are currently no college level programs preparing general labourers or professionals for jobs in green roofs. Several green roof professionals have expressed concern over lack of unified and organized training in the green roofing industry.
- While forming a small part of this study, local procurement of material required in the eco-roofing industry could be of significant value to empowering the local economy. It is recommended that a more extensive study on supply chain of green and cool roofs be conducted.

Appendix A – Workforce Survey

City of Toronto Green Roof Industry Survey

The City of Toronto Economic Development and Culture Division along with the Toronto Environment Office are undertaking a study to identify gaps in supply of skilled labour in the green roof industry. The study focuses on all aspects of green roofs, from conceptual design and energy modeling to maintenance. It will also identify gaps in university and college training programs. This research will ultimately identify ways in which the City of Toronto can help with the uptake of the green roof industry in Toronto.

To help us reach these goals we ask that you take about 5 minutes to complete this online survey.

We assure you that any information you provide is entirely confidential and the source of the data will not be reported. Only aggregate data from several sources will be analyzed.

If there are any questions or comments please feel free to call Sheyda Saneinejad at 416-397-4831 or e-mail her at ssanein@toronto.ca,

Thank you!

1. Please enter the name of your business / firm.

Please enter the name of your business
/ firm. .

Is your business located in the Greater
Toronto Area and Hamilton?

2. At what capacity is your business involved in the extensive green roof industry?

- At what capacity is your business involved in the extensive green roof industry? Manufacturer/Grower
- Design and consulting
- Installation
- Maintenance

Others (please specify)

3. What is your current volume of green roof related work (e.g. 10 medium scale (5000 sqft) green roofs per year)?

What is your current volume of green roof related
work (e.g. 10 medium scale (5000 sqft) green
roofs per year)? .

Do you have slack labour? In other words, if
demand for your services in green roofs suddenly
doubled, would you manage with your existing
staff size?

What could the City of Toronto do to help the
growth of the green roof Industry?

4. What are the top 4 skill areas that are most challenging to recruit?

- Roofer
- Foreman
- General labourer
- Structural engineer
- Architect
- Landscape Architect

Others (please specify)

5. What are the primary sources for finding labour in your field today?

- head hunters
- on-line postings
- united way programs
- high school recruitment fairs
- OYAP
- union calls
- colleges
- father and son industry,
- inter-generational recruitment
- engineers through universities

Others (please specify)

6. What partnerships are working to help you recruit and/or source labour?

- Colleges
- co-ops
- OYAP/YMCA
- Friends and family
- Unions

Other (please specify)

7. What are the top 3 - 5 barriers/obstacles for recruitment and selection today in GTA?

- Perception of the trades not viewed as a career

- Nepotism
- Low salary for apprenticeship
- Shortage of qualified engineers/architects
- Many youth don't have the Grade 12 Physics and Math
- Non English speaking people need CIC Enhanced Language Training

Others (please specify)

8. What are the primary sources for training and workforce development today?

- Industry associations
- Union training centres
- Co-op in high schools
- Universities for Engineers/Architects
- Colleges and universities for green technology
- Colleges for construction trades
- INGO associations e.g. Canada Green Building Council
- On-job training
- Government training centres

Others (please specify)

9. What partnerships exist in training and development?

- Apprenticeships monitored by local Apprenticeship Councils
- Construction association and Ministry of Training, Colleges and Universities and Apprenticeship Council
- LEED training
- Colleges of the Trades
- Co-ordination between locals and companies
- Unions working with universities and colleges

Others (please specify)

10. What are some of the gaps in quality and quantity of training programs available through colleges and universities in preparing qualified green roof professionals?

What are some of the gaps in quality and quantity of training programs available through colleges and universities in preparing qualified green roof professionals?

Appendix B: Employment Breakdown

Table 12 - Breakdown of Green Roof Job Components (per 1000 sq.ft.)

Phase	Job Component	Job Title	Type of work	Total Hours	Full Time Employees
Planning and design¹³					
	Feasibility study			18	
		intermediate architect/Architect	Site Review	4	1
		Intermediate engineer	Structural evaluation	14	1
	Design Development			25	
		Intermediate engineer	Minor Detailing, Construction Specs.	20	1
		Drafter	Drafting of technical drawings	3	1
		landscape architect	plan material selection	2	1
Manufacturing/Growing (not applicable to Built-in-Place systems)					
	Module/roll Manufacturing			47	
		Foreman	supervision - plant growing work	9	1
		trades person	plant growing work	37	4
Construction/Installation					
	Contract Administration			10	
		Intermediate engineer	permits and approvals, project management, etc	10	1
	re-roofing with high quality membrane			31	
		Foreman	Supervision of work, leakage test	5	1
		Journeyman Roofer	Installation of roofing and flashings	26	5
	Irrigation system			29	
		plumber	irrigation system installation and supervision	8	1
		trades person	irrigation system installation	21	1
	installation (of modular/roll on system)			26	
		Foreman	supervisory	4	1
		General labourer/Trainee	installation	22	5
	installation (of Built-In-Place system)			62	
		Foreman	supervisory	10	1
		General labourer/Trainee	installation	44	5
		trained trades person	initial watering and maintenance	8	2

¹³ Planning and design work is quantified at a per-project basis as opposed to per unit area. Each green roof project is assumed to be about 1000 m².

Table 10- Continued

Phase	Job Component	Job Title	Type of work	Total Hours	Full Time Employees
System Evaluation					
	Storm Water Analysis ¹⁴			44	
		Engineer	Site visit, analysis, report writing	44	1
Operation and maintenance¹⁵					
	Operation and Maintenance			49	
		trained trades person	intense maintenance for first 1 or 2 years	6	1
		trained trades person	occasional maintenance for the remainder of green roof life (Assuming 25 year life)	44	1

¹⁴ Applies only to a limited number of green roof incentive projects before the program requirements were modified and the requirement was lifted

¹⁵ Initial maintenance hours associated with built-in-place green roofs (plants planted on-site) are built into the installation/construction hours

Table 13 - Breakdown of Cool Roof Job Components (per 1000 sq.ft.)

Phase	Job Component	Job Title	Type of work	Total Hours	Full Time Employees
Construction/Installation					
	Option a) New reflective roofing membrane			31.3	
		Foreman	Supervision of work, leakage test	5.2	1
		Journeyman Roofer	Installation of roofing and flashings	26.1	5
	Option b) Reflective spray painting over existing roofing membrane			2.2	
		Foreman	Supervision of work	0.2	1
		Journeyman Roofer	Spray washing and spray painting	2.0	2
	Option c) Installation of reflective layer over existing roofing membrane			17.0	
		Foreman	Supervision of work	1.0	1
		Journeyman Roofer	Installation of reflective layer and detailing	16.0	4
Operation and maintenance¹⁶				8	
	Operation and Maintenance			8.0	
		General labourer/Trainee	Cleaning of reflective surface (assuming 15 year life)	8.0	2

¹⁶ O&M values applied to all three roofing options