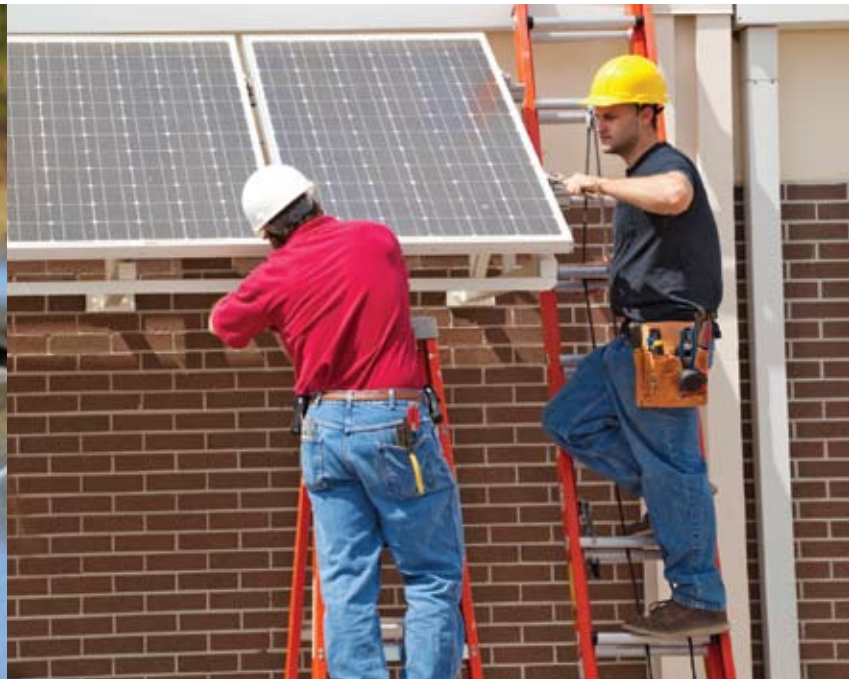

Building the Green Economy:

Employment Effects of Green Energy Investments for Ontario

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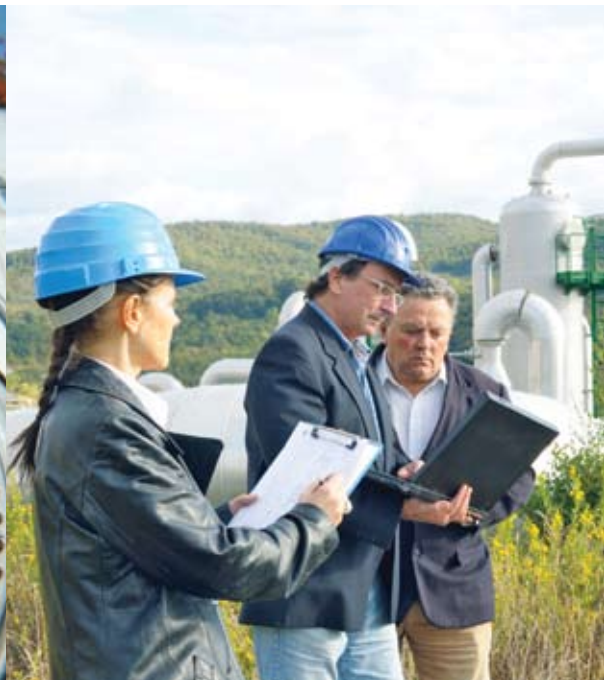

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Contents

FOREWORD

These are difficult times. We are in the grip of the worst global economic crisis since the Great Depression, yet our best scientists are telling us that unless we act now to dramatically reduce greenhouse gas emissions then we rob our children of their chance for economic, ecological and social stability.

Fortunately, this report from the Political Economy Research Institute demonstrates that we do not have to choose between addressing the economic and climate crises, for investments in energy efficiency and green energy will create tens of thousands of new jobs to power our economic recovery, while combating climate change.

This report also makes it clear that most of these 'new' green-collar jobs are in fact familiar jobs, repurposed and expanded through investments in a low-carbon economy. The green economy will require construction, manufacturing and steel workers, as well as engineers, administrators, accountants and research scientists. The people employed in these jobs will help consumers cut their energy use and hence bills by improving energy efficiency. And they will create new industries and new economic opportunities for Ontarians to design, build and install the green energy technologies that this province, and the planet, need if we are to avoid dangerous levels of global warming.

The government of Ontario is to be congratulated for recognizing this opportunity and responding with the introduction of the Green Energy Act. To realize the full potential of this Act, however, the government must now do two things.

First, while the proposed legislation puts forward an impressive framework, the government must get the detailed policies and regulations right if this framework is to result in real projects happening on the ground. Particularly important amongst the outstanding issues are the prices and payment conditions of the proposed feed-in tariffs, resolving issues around grid connection, and measures to ensure the province captures a higher proportion of the 'upstream' jobs in manufacturing.

Secondly, Minister Smitherman must follow through on his commitment to "raise the bar on our plans to harness Ontario's vast green-power potential." As this report shows, without a significant increase in the amount of conservation and green power resources being built into Ontario's electricity system from what was contained in the Ontario Power Authority's 2008 Integrated Power System Plan, the Province will not achieve its goal of at least 50,000 new green jobs as a consequence of the Green Energy Act.

Our organizations are prepared to work with the government to ensure the Green Energy Act achieves its full potential, and to make Ontario a leader in the transition to the green economy of the twenty-first century.

GEAA **Blue Green Canada** **WWF-Canada**

SUMMARY OF STUDY

The government of Ontario is poised to implement an ambitious Green Energy Act. This program has the potential to produce substantial benefits to the citizens of Ontario, both in terms of environmental protection and the expansion of employment opportunities. The focus of this study is on the potential employment benefits of a green investment agenda for Ontario.

Two Investment Agendas Examined

- **Baseline Integrated Power System Plan (IPSP):**
  - $18.6 billion green investment spending program over 10 years;
  - Includes six green investment areas;
    - Conservation and demand management
    - Hydroelectric power
    - On-Shore Wind
    - Bioenergy
    - Waste energy recycling
    - Solar Power.
- **Expanded Green Energy Act Alliance (GEAA) Program:**
  - $47.1 billion green investment spending program over 10 years;
  - Includes two additional green investment areas in addition to six in IPSP;
    - Off-Shore Wind
    - Smart grid electrical transmission system.

Methodology for Estimating Employment Effects of Green Investment Programs

- **We utilize data from the input-output tables of Ontario as our primary data resource:**
  - The input-output figures for Ontario are supplemented by data from both the Canada-wide and United States input-output tables.
- **We estimate three types of employment effects in Ontario for a given level of green investment spending:**
  - Direct effects—jobs created within Ontario by the targeted activities, such as Conservation and demand management, Hydroelectric power, and Solar Power;
  - Indirect effects—jobs associated with industries within Ontario that supply intermediate goods and services for the targeted green investment activities, such as hardware and metal products;
  - Induced effects—the employment creation that results when people who are paid through the green investment projects spend the money that they have earned on other products within the province.
- **The three factors in establishing relative employment effects of alternative green investment projects are:**
  - Labour intensity of spending—how much spending goes toward hiring workers as opposed to spending on supplies, buildings, land, or energy;
  - Local content of spending—how much spending remains within Ontario, as opposed to spending on imports; and
  - Wage rates—for a given level of total spending on workers, more jobs are created if wages are lower.

Employment Estimates

- **Baseline $18.6 billion IPSP Program:**
  - $1.86 billion spending per year for 10 years;
  - Will generate about 35,000 jobs per year;
    - 15,500 direct, 11,600 indirect, and 8,100 induced jobs.
- **Expanded $47.1 billion GEAA Program:**
  - $4.71 billion spending per year for 10 years;
  - Will generate about 90,000 jobs per year;
    - 38,400 direct, 31,100 indirect, and 20,900 induced jobs.

Range of New Jobs Created

- **Wide range of jobs:**
  - Includes construction labourers, sheet metal workers, financial auditors, engineers, concrete-forming operators, secretaries, accountants, building inspectors, and research scientists;
    - Most jobs pay over $20 per hour.
  - Of the jobs that are below $20 per hour, most will be in construction and manufacturing;
    - These relatively low-paying jobs are likely to offer training and job ladders that provide more opportunity for advancement than do low-paying service sector jobs, such as in the food service, hotel, or health care industries.

Measures to Enhance Local Content of Ontario Green Investment Projects

- **Increase proportion of investment tied to location-specific activities:**
  - Virtually all construction activity is location-specific;
    - Retrofitting buildings or building hydroelectric power plant is necessarily conducted on location, within Ontario;
    - Overall, conservation and demand management will naturally yield high local content.
- **Pursue green investment at highest possible scale:**
  - Increases overall opportunities for local businesses;
    - Local businesses will be more willing to invest in maintaining competitiveness when there are greater overall opportunities.
- **Incentives and subsidies for local businesses in import-competing sectors:**
  - Tax credits; public matching funds for private investments; loan guarantees;
  - Ontario provincial government capable of administering and financing such incentive/subsidy programs.

Introduction

The government of Ontario is currently considering an ambitious green energy investment program proposed by Premier Dalton McGuinty, known as the Green Energy Act (GEA). According to the official website describing the GEA, the overarching aim of the initiative is to "secure Ontario's place as the continent's leading green economy, helping to create over 50,000 green collar jobs and generating billions of dollars of economic activity in the first three years alone." This plan includes a commitment to phasing out the province's coal plants by 2014, and to rebuild the Ontario economy on a foundation of energy conservation and renewable energy sources.[1]

It is not clear from the GEA website how it was estimated that 50,000 jobs would be generated by this initiative in its first three years. In this study, we present an approach for estimating employment effects of green investments in Ontario as a general proposition, as well as two sets of specific estimates based on alternative green investment scenarios for the province. The first set of estimates is based on an earlier green investment program for Ontario known as the Integrated Power System Plan (IPSP). Even though this program is not presently under active consideration by Ontario policymakers, it still provides a useful benchmark for estimating employment effects of a concerted green investment agenda for the province.[2] According to this proposal, the government of Ontario would spend about $18.6 billion over 10 years for investments in six clean energy areas: conservation and demand management; on-shore wind; hydroelectric power; bioenergy; solar energy; and waste energy recycling. We assume this total spending allocation of $18.6 billion is spread evenly over the full 10 years of the program, at a rate, therefore of about $1.86 billion per year. We estimate that this level of investment, $1.86 billion per year for 10 years, will create in the range of 35,000 new jobs within Ontario over the 10-year period. We detail below how we derive these job estimates. We also will present details as to the types of jobs that are likely to be created, and the average wage levels associated with the various new job opportunities generated by a green investment project in Ontario of this magnitude.

In our second set of job estimates, we consider the job effects of an enhanced green investment program based on the proposals embedded in the Green Energy Act. We refer to this proposal as the Green Energy Act Alliance (GEAA) plan. In this enhanced plan, we allow that the total level of spending rises by about $28.5 billion, for a total over 10 years to $47.1 billion. This is a 153 percent increase in clean energy investment spending relative to the baseline IPSP. We again assume the full level of spending is spread evenly over the 10-year period, so that the annual GEAA plan would be about $4.71 billion per year. In the GEAA plan, we consider the impacts of higher levels of spending for each of our initial six clean energy investment areas. We also incorporate spending levels for two additional clean energy spending areas, off-shore wind power and so-called "smart grid" electrical power transmission systems. Under this more ambitious program, we estimate that total job creation will rise by about 55,000 total jobs, for a total employment expansion of about 90,000 over the 10-year period of the enhanced IPSP program.

In what follows, we first explain our approach for estimating job effects. We then show figures documenting the job creation effects that would result within the Ontario economy from spending $1 million in each of the eight clean energy activities. Based on our methodological approach and these basic estimates of job creation per $1 million, we are then able to present in detail our job figures both for the baseline IPSP at $1.86 billion per year, and the effects of the

1 The McGuinty government's Green Energy Act and related initiatives are described at the website: www.ontariogreenenergyact.ca/green.html

2 Details for the IPSP plan are based on the information filed with the Ontario Energy Board, in particular Sections D-4-1 (Conservation Resources), D-5-1 (Renewable Resources) and G-2-1 (Plan Cost).

enhanced GEAA plan, amounting to $4.71 billion per year in green investment spending. We also show how green investment spending at these levels will expand electricity-generating capacity in Ontario, based on the Ontario Power Authority's projections of megawatt capacity associated with various specific types of green investments. With our basic job estimates in hand, we then also provide data on job categories and wage rates associated with the various types of employment generated by these green investment programs.

Once we have these basic projections in place, we then finally consider measures for potentially enhancing the impact of all such green investment programs for Ontario, through increasing the extent to which the flow of investment funds are able to reach businesses within the region itself—i.e. to increase the proportion of local content associated with any overall level of green investments.

How Clean Energy Projects Create Jobs

Spending money in any area of the Ontario economy will create jobs, since people are needed to produce any good or service that the economy supplies. Thus, any government investment program, as with any private sector investment, will create jobs.

There are three sources of job creation associated with any expansion of spending:

1. **Direct effects**—the jobs created within Ontario, for example, by retrofitting homes to enhance energy conservation or to build wind energy farms;
2. **Indirect effects**—the jobs associated with industries within Ontario that supply intermediate goods for the building retrofits or wind farms, such as lumber, steel, glass and transportation;
3. **Induced effects**—the expansion of employment within Ontario that results when people who are paid in the construction or steel industries spend the money they have earned on other products within the province.

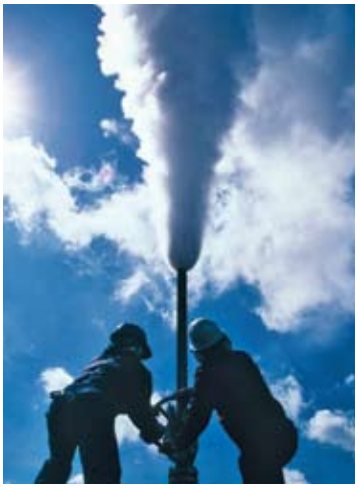
Our estimates will begin by focusing first on direct and indirect effects. We will then consider induced effects in a separate section.

At the outset, it is important to be clear that all of our job projections are absolute, or gross, figures. By this, we mean that we are simply calculating how many jobs in Ontario will be generated by a given dollar amount of spending in the province through a green investment program. We are not comparing this level of job creation with other potential investment projects, all of which, of course, would also generate job creation. For example, public spending on health and education in Ontario will also generate direct, indirect, and induced jobs in the province. As another example, private sector spending on fossil fuels will also generate direct, indirect, and induced jobs. In other research papers, we have examined the *relative* job creation effects of these alternative investment spending areas, but that issue is beyond the scope of this paper.[3]

As such, within this paper, we are not addressing the corresponding point that by spending more on clean energy investments and creating jobs through these investments, the Ontario government and the provincial economy more generally, are almost certainly foregoing other options for spending money and creating jobs. And again, we do not consider in this discussion the question of whether a green investment program is the most effective way to generate jobs in the region.

3 See, for example, Pollin and Garrett-Peltier (2007) and Pollin et al. (2008).

Methodology for Estimating Direct and Indirect Job Effects



Our primary tools for generating estimates of the employment impacts of spending on clean energy projects in Ontario are the input-output tables for the province of Ontario and the national input-output tables for Canada as a whole. In the appendix, we present an extended discussion of our methodology in working with these input-output models. Here we present a brief non-technical summary of the fuller discussion.

The input-output model allows us to observe relationships between different industries in the production of goods and services. We can also observe relationships between consumers of goods and services, including households and governments, and the various producing industries. For our purposes specifically, the input-output modeling approach enables us to estimate the effects on employment resulting from an increase in final demand for the products of a given industry. For example, we can estimate the number of jobs directly created in the construction industry for each $1 million of spending on construction. We can also estimate the jobs that are indirectly created in other industries through the $1 million in spending on construction—industries such as lumber and hardware. Overall, the input-output model allows us to estimate the province-wide employment impacts from a given level of spending.

As yet, the survey data used to develop the Ontario input-output tables do not specifically recognize wind, solar, biomass, or building retrofitting as industries in their own right. This is also the case for the input-output tables for Canada as a whole. The same gaps in data also apply for the input-output tables within the U.S. economy.

As such, in order to estimate employment impacts in these industries, we had to construct synthetic "industries" by combining components of industries that are now included in the government accounts.[4] For example, we have created within the model a synthetic representation of the biofuels industry which consists of a combination of farming, forestry, wood products and refining. We have assigned relative weights to each of these industries in terms of their contributions to producing biomass products. Once we constructed this synthetic biofuels industry for Ontario within our input-output model, we were able to estimate the employment effects that would result from increased spending on biofuel products in Ontario, just as we can now, within the existing input-output tables for Ontario, directly estimate employment effects in traditional fossil fuel industries.

Within the framework of this general methodological approach, we have encountered challenges using the available input-output data tables for Ontario. The most significant difficulty is that the level of detail for the industry-by-industry categories for the Ontario economy is not adequate by itself to make reliable employment projections. As such, we have needed to integrate detailed data from the input-output tables from the broader Canadian data. We have also had to draw on the U.S. input-output tables to help us develop estimates of some of the detailed industry-by-industry supply-chain linkages for Ontario. We explain the details of our data extrapolation methodology in the appendix. We acknowledge that by relying on these extrapolations, our employment estimates are somewhat less reliable than they would have been had we been able to rely entirely on figures directly from the Ontario input-output tables. Nevertheless, we are confident that our estimates do provide a broadly accurate portrait of the employment-generating possibilities of any investment program associated with Ontario's Green Energy Act.

4 For the U.S. economy, we are in the process of completing our own survey of the renewable energy and energy efficiency industries. The questions in our survey are drawn from those used for the U.S. Department of Commerce input-output tables. Once the survey is completed, we will therefore be able to incorporate our results into the standard input-output model, and generate calculations for the renewable energy and energy efficiency sector—as well as its subsectors, such as building weatherization, mass transit, wind power, solar power, and biomass fuels—just as we now do with traditional energy sectors, such as oil.

Direct and Indirect Job Creation

In Table 1, we present figures for direct, indirect and combined direct/indirect job creation through spending $1 million in each of the eight green energy areas incorporated in either the baseline IPSP or the expanded GEAA projects, i.e. conservation, on- and off-shore wind power, hydroelectric, bioenergy, solar power, waste energy recycling and smart grid electrical transmission systems. As we see, the job creation capacities of these various clean energy activities are fairly similar. In terms of direct job creation, we see that job creation ranges between about 7 and 8.4 jobs per $1 million in spending. Then, with respect to indirect job creation, we see the range is between about 4 and 8 additional jobs per $1 million in spending. Overall then, total direct and indirect job creation per million in spending ranges between about 12 and16 jobs per $1 million in spending.

TABLE 1. EMPLOYMENT IMPACTS OF ALTERNATIVE ONTARIO GREEN ENERGY INVESTMENTS: JOB CREATION PER $1 MILLION IN SPENDING

Energy Source	Direct job creation per $1 million in spending (# of jobs)	Indirect job creation per $1 million in spending (# of jobs)	Direct + Indirect job creation per $1 million in spending (# of jobs)
Conservation and demand management	9.0	5.2	14.2
Hydroelectric	8.2	6.0	14.2
On-shore wind	7.6	7.1	14.7
Off-shore wind	7.6	8.2	15.8
Bioenergy	8.4	8.0	16.4
Waste energy recycling	8.2	7.9	16.1
Solar	8.2	7.6	15.8
Smart grid	7.0	7.1	14.1

Sources: See Appendix

Clearly, the differences are modest in the relative job creation effects of these various clean energy activities. But why would there be any differences at all in relative job creation potential? Three factors are at work in this, as well as any other, inter-industry comparison of job-generating effects for a given amount of spending. They are:

Relative labour intensity. This measures how much of a given amount of money is spent on hiring workers, as opposed to spending on supplies, rent, land, transportation and energy.

Local content. This includes the proportion of total spending for a given project that remains within the province of Ontario as opposed to being spent on supplies of all sorts outside the province.

Pay levels. If a given amount of spending is used to pay people lower average wages, this means that this given spending level can create more jobs.

In Table 2 below, we illustrate how differences in these three factors will lead to differences in job creation for two hypothetical green energy investment projects in Ontario. As the table shows, by varying the degree of labour intensity, local content, and compensation between hypothetical "Green Energy Project 1" and "Green Energy Project 2", we end up generating six jobs in Project 1 and eight jobs in Project 2 for a given $1 million in spending.

Table 2. Relative direct employment creation from alternative hypothetical green energy spending projects in Ontario: $1 million in expenditures

	Green Energy Project 1	Green Energy Project 2
Labour intensity of production	50% spending on labour = $500,000	60% spending on labour = $600,000
Local Ontario content	60% = $300,0000 Ontario wage bill	80% = $480,000 Ontario wage bill
Average compensation	$50,000	$60,000
Total employment	**6 DIRECT JOBS** **(= $300,000 Ontario wage bill/ $50,000 wage)**	**8 DIRECT JOBS** **(= $480,000 Ontario wage bill/ $60,000 wage)**

Baseline IPSP Program: Direct and Indirect Employment Estimates

Working from our estimates of job creation per $1 million of expenditure, we now project the direct and indirect job effects of the baseline IPSP program of $18.6 billion in green energy investments over 10 years. For simplicity, we assume that spending is allocated on an equal basis over the life of the project, i.e. at a rate of $1.86 billion/year. This figure is crucial, since, the appropriate way to measure the overall level of job creation from the project is on the basis of year-to-year expenditures, not the cumulative 10-year figures.

It is important to establish this point clearly. To illustrate the issue, let's consider, for example, the total employment-generating potential from the largest areas of projected investment spending within the IPSP or GEAA projects, energy conservation and hydroelectric power. With energy conservation, a large proportion of the total spending will almost certainly be allocated to building retrofits to improve energy efficiency. Most of the direct employment creation here will be for construction crews. For most structures, the amount of time the crew will require for the retrofit will be a matter of weeks or months. In almost all cases, the work will be completed in less than one year's time. But for purposes of simplicity, let's assume a crew of 100 workers is employed retrofitting one large building each year, before moving on to another similarly large building. In that situation, the total level of employment generated by the overall level of spending on retrofits will be based on the year-to-year spending levels. That is, the total level of employment is 100 jobs per year for 10 years. It would be inaccurate to count the employment level for this work crew cumulatively over the full 10-year spending cycle, i.e. add up a total level of employment as being equal to 1,000 jobs on building retrofits over the 10-year period.

The same principle applies to projects to develop hydroelectric power stations, which are likely to be a number of relatively small-scale dam-construction projects distributed throughout the province, as opposed to one or two massive initiatives in this area. The main work in expanding Ontario's hydroelectric capacity will be in constructing that capacity throughout the province. There will be jobs associated with post-construction administration and maintenance. But these will be modest in scale relative to the level of employment generated by the initial construction of the dams. Thus, assume that the construction of one dam requires a construction crew of 50 workers, to be employed over a two-year period. In this case, the total employment generated by one such dam construction project will be 50 workers per year. Again, it would be inaccurate to add up this level of employment for the two-year project cumulatively, to show that 100 workers had been employed over the two-year period.

The figures for total spending and employment per year are shown in Table 3. To begin with in column 1 of Table 3, we show the level of investment spending that the Ontario Energy Board had projected for the six clean energy areas in the baseline IPSP. As we see, the largest area of spending is in energy conservation, which accounts for about $660 million per year, or 35 percent of the total $1.86 billion per year project. We estimate that this level of expenditure for Ontario would generate about 9,400 direct plus indirect jobs every year in Ontario over the life of the 10-year project, including about 6,000 direct and 3,400 indirect jobs.

Table 3. Employment impacts of baseline IPSP green energy investments for Ontario direct and indirect job creation through $1.86 billion/year in new spending in alternative green energy areas

Energy Source	Baseline IPSP Spending Allocation on Annual Basis	Direct job creation	Indirect job creation	Direct + Indirect job creation
Conservation and demand management	$657 million (35% of total)	5,946	3,417	9,363
Hydroelectric	$523 million (28% of total)	4,291	3,138	7,429
On-shore wind	$450 million (24% of total)	3,400	3,204	6,604
Bioenergy	$94 million (5% of total)	791	756	1,547
Waste energy recycling	$83 million (4% of total)	681	656	1,337
Solar	$50 million (3% of total)	409	380	789
Totals	**$1.86 billion**	**15,517**	**11,551**	**27,068**

Sources: See Appendix

The next-largest area of spending is hydroelectric power, which had been targeted to receive about $520 million per year over the 10-year period, about 28 percent of the total IPSP project. As Table 3 shows, we project that this level of investment would generate a total of about 7,400 direct plus indirect jobs.

The remaining details for on-shore wind, bioenergy, waste energy recycling and solar are all presented in Table 3. As we see, for all of these projects, we estimate that total direct and indirect job creation over 10 years would reach about 27,000 jobs for Ontario.

Induced Job Creation from Baseline IPSP Program

It is much more difficult to estimate the size of the induced employment effects—or what are also commonly termed "multiplier effects"—than to estimate direct and indirect employment effects of a program such as the baseline IPSP project. Of course, we know that when about 26,000 more people become employed directly and indirectly through a green energy investment project, those people will spend most of the money they have newly earned on other products in the economy. Moreover, we have a good sense of what percentage of the additional income people receive will be spent by them, i.e. between about 90-94 percent.[5]

But how much this extra spending will mean in terms of overall job creation depends on what the existing conditions are in the economy, including how many people are unemployed,

5 This range is derived from both the expenditure/income ratio from Ontario input-output tables and income and spending data from Statistics Canada.

what the inflation rate is, and whether the increase in government spending is targeted to either encourage or discourage private-sector investment. A 2002 article by economists at the International Monetary Fund surveyed the professional literature estimating the size of the induced effects in a range of countries, including Canada, in a range of circumstances and time periods.[6] They report wide variations in these estimates. This includes some estimates of a negative induced effect—e.g. an overall expansion of less than $1 billion resulting from an initial $1 billion stimulus—to a doubling of the initial expansion—e.g. $2 billion in overall expansion emerging out of an initial $1 billion stimulus.

The IMF survey paper did not consider induced effects within the context of a regional or provincial, as opposed to a national economy. In fact, the channels through which induced effects operate are distinct when we are considering a regional or provincial economy, such as Ontario, as opposed to a national economy such as Canada or the United States. The difference is over the access to alternative financing tools for a national government as opposed to a provincial government. National governments have the capacity to inject new spending into the economy either through an expansion of the money supply (monetary policy) or by increasing the government's fiscal deficit (fiscal policy). Provincial governments do not have any control over monetary policy and they have less capacity to operate with fiscal deficits.

Considering these various factors, it is appropriate, if anything, to underestimate rather than overestimate the induced employment effect, even if the program is designed, and conditions are favorable, for a relatively large induced effect. We therefore assume that the induced employment effects of the baseline IPSP program will add 30 percent to the overall level of job creation generated by the direct and indirect effects. This is in line with the lower-end estimate of such effects reported in the IMF survey study. It is also consistent with the estimates we have generated through formal modeling exercises with the input-output tables for the U.S. economy, where we have a more detailed data set on which to base a formal estimate.

Finally, we would reiterate that this estimate of induced job creation effects—as with the figures for direct and indirect job creation—represent absolute gains in employment for Ontario. We are not considering here the fact that alternative spending projects would also generate job creation. We are also not addressing the related consideration, that by spending more on green energy investments and creating jobs through these investments, the Ontario government and the provincial economy more generally, is also spending less money on other activities. If we were to incorporate this consideration into our analysis, we would obtain a measure of net job creation through the IPSP program. But such considerations are beyond the scope of this study.

Total Job Creation through Baseline IPSP Program

In Table 4, we bring together our estimate of job creation through the baseline IPSP clean energy investment program. As we see, our estimate is that this $1.86 billion program will generate about 35,200 jobs in total, including about 15,500 direct jobs, 11,500 indirect jobs and 8,100 induced jobs.

6 The fact that the IMF study is focused on induced effects in terms of *output and income* and we are concerned with induced effects on *employment* does not affect the overall approach or implications of the findings significantly. This is because employment growth generally varies closely with income and output growth. There will be differences between the two based, for example, on different consumption functions for households at different income levels—with poorer households spending a higher fraction of an overall income increase then richer households. But relative to the wide range of the output multipliers themselves reported in the IMF survey, this factor will play only a small role in generating divergences between the induced effects as related to employment on the one hand, and income and output on the other.

Table 4. Total job creation through baseline IPSP program direct, indirect, and induced jobs created through $1.86 billion/year in new spending in alternative green energy areas	
Direct jobs	15,517
Indirect jobs	11,551
Induced jobs	8,121
Total job creation	**35,189**

Sources: See Appendix

It will be useful to give some perspective on this level of employment creation in Ontario within the context of the overall provincial labour market. For 2008, the total level of employment in Ontario was 6.7 million people. Thus, the level of job creation generated by the IPSP project would represent an increase in total employment in the region by about one-half of one percent.

The figure becomes more significant when measured in proportion to the rate of unemployment in Ontario. For 2008, there were 467,000 people unemployed in the province, generating an unemployment rate of 6.5 percent, in an overall labour force (i.e. employed plus unemployed workers) of 7.2 million. The 35,200 increase in employment through the baseline IPSP program is equal to about 7.5 percent of the number of unemployed people.

As a simple exercise, if we therefore could assume that the increase in employment generated by the IPSP green investment agenda were injected into the 2008 Ontario labour market, and no other changes were to occur in the provincial labour market, that would mean that 2008 unemployment in Ontario would have fallen from 6.5 to 6.0 percent.

Employment Effects from Green Energy Act Alliance Plan

As discussed above, the estimating model we are working with assumes a proportional effect on job creation relative to any increases or declines in spending levels. As such, when we move from the baseline IPSP program, budgeted at about $1.86 billion per year over 10 years, to an expanded GEAA program, at $4.71 billion per year, the expansion in employment is proportional to the roughly 150 percent increase in spending. The one factor that might make a difference in generating an overall job projection is the introduction of off-shore wind and smart grid as two new green energy investment projects in GEAA plan relative to the baseline IPSP. But as we saw in Table 1, the job creation for off-shore wind, at around 16 direct plus indirect jobs, and smart grid, at 14.1 jobs per $1 million in spending, are both in line with the job creation effects of the other green energy spending projects. As such, incorporating these additional projects in the GEAA program relative to the IPSP does not alter the relationship generating a roughly 150 percent increase in employment associated with the 150 percent increase in overall green energy investment spending.

Table 5 presents the employment projections for the GEAA program. The first column shows the new spending totals for the various specific programs, and the second column shows how much each specific program area would be increasing under the GEAA plan relative to the baseline IPSP proposal. As we see, the largest increase in total dollars would go to conservation and demand management, which would rise by $732 million, a 111 percent increase over the baseline spending level of $657 million. In percentage terms, the largest gain for a carry-over program from the baseline IPSP would be for solar power. This is slated to rise from $50 million

in the baseline program to $757 million, a percentage increase of about 1,400 percent. In addition, the GEAA investments include the new investments of $500 million for smart grid and $195 million for off-shore wind power.

Table 5 then shows the breakdown in employment estimates of the various green energy investment categories, with our figures both for direct and indirect job creation. These results are generated on the basis of the same job creation per $1 million in spending figures that we presented in Table 1. As we see, our estimate is that this increased level of spending with the GEAA plan will generate a total of about 38,400 direct jobs and 31,100 indirect jobs, for a total amount of direct plus indirect employment creation just below 70,000 jobs.

Table 5. Employment Impacts of "Green Energy Act Alliance (GEAA) Program for Ontario Direct and Indirect Job Creation through $4.71 billion/year in New Spending in Alternative Green Energy Areas

Energy Source	Expanded GEAA Spending Allocation on Annual Basis	Increased Spending relative to Baseline IPSP	Direct job creation	Indirect job creation	Direct + Indirect job creation
Conservation and demand management	$1.39 billion (29% of total)	+$732 million (+111%)	12,570	7,224	19,794
Hydroelectric	$523 million (11% of total)	No increase	4,291	3,138	7,429
On-shore wind	$1.03 billion (22% of total)	+$580 million (+129%)	7,782	7,333	15,115
Off-shore wind	$195 million (4% of total)	New program	1,477	1,603	3,081
Bioenergy	$94 million (2% of total)	No increase	791	756	1,547
Waste energy recycling	$224 million (5% of total)	$141 million (+170%)	1,838	1,772	3,610
Solar	$757 million (16% of total)	$707 million (+1414%)	6,190	5,756	11,946
Smart grid	$500 million (11% of total)	New Program	3,490	3,560	7,050
Totals	**$4.71billion**		**38,430**	**31,141**	**69,571**

Sources: See Appendix

This level of job creation for Ontario will, in turn, also generate more jobs through the induced job effect channel. Here again, we apply the same rough approach as above in estimating the induced job creation effect from the $4.71 billion annual green investment spending through the GEAA plan. The results are summarized in Table 6. As we see there, under the GEAA plan, we estimate that induced jobs will amount to a bit less than 21,000 jobs, on top of the roughly 70,000 jobs generated directly and indirectly through the $4.71 billion GEAA program. Overall then, we estimate that the GEAA program will generate around 90,000 jobs in Ontario.

Table 6. Total job creation through GEAA program direct, indirect, and induced jobs created through $4.71 billion/year in new spending in alternative green energy areas	
Direct jobs	38,430
Indirect jobs	31,141
Induced jobs	20,871
Total job creation	**90,442**

Sources: See appendix

How significant is an employment expansion at this level relative to the size of the Ontario labour market in 2008? An increase of 90,000 jobs is equal to about 1.2 percent of the 2008 Ontario work force of 7.2 million workers. If we were to assume that the increase in employment generated by the expanded IPSP program were injected into the 2008 Ontario labour market, and no other changes were to occur in the provincial labour market, that would mean that 2008 unemployment in Ontario would fall sharply, from 6.5 to 5.2 percent. Of course, many more considerations come into play in establishing real-world labour market conditions. But this simple exercise does provide some indicator as to how significant an increase of 90,000 jobs would be within the context of the Ontario economy.

How Much Could Ontario's Power Supply Expand?

The Ontario Green Energy Act and related green investment initiatives for the province will, of course, need to succeed not simply through their environmental or employment benefits. As a first order of business, they must also be effective at supplying energy to consumers in Ontario. It is beyond the scope of this study to estimate the extent to which either the $18.6 billion IPSP or the $47.1 billion GEAA programs will be able to expand the province's energy supply. But as a reference, it is useful to report here the figures that the World Wildlife Fund of Canada have developed based on figures provided by the Ontario Power Authority itself. To avoid misunderstanding with these figures, we emphasize again that we have not derived them through our own research or modeling and therefore cannot vouch for their accuracy.

Table 7. Estimated megawatts of energy supplied or conserved through alternative green investment programs
(Estimates derived by World Wildlife Fund-Canada from Ontario Power Authority figures)

Baseline IPSP Investments	10-year Green Investment Budget	Megawatts of Energy Supplied or Conserved
Conservation and demand management	$6.6 billion	3500 MW
On-shore wind	$4.5 billion	4270 MW
Hydroelectric	$5.2 billion	1,278 MW
Bioenergy	$9.9 billion	2,079 MW
Solar	$0.5 billion	88 MW
Waste energy recycling (CHP)	$0.8 billion	586 MW
Total	**$18.6 billion**	**11,801 MW**

Source: WWF-Canada from IPSP figures.

Expanded GEAA Investments	10-year Green Investment Budget	Megawatts of Energy Supplied or Conserved
Conservation and demand management	$13.9 billion	7,400 MW
On-shore wind	$10.3 billion	7,270 MW
Off-shore wind	$1.9 billion	750 MW
Hydroelectric	$5.2 billion	1,278 MW
Bioenergy	$0.9 billion	2,079 MW
Solar	$7.6 billion	1,738 MW
Waste energy recycling (CHP)	$2.2 billion	1,586 MW
Smart Grid	$5.0 billion	Not available
Total	**$47.1 billion**	**22,101 MW**

Sources: WWF-Canada based on IPSP and Ontario Power Authority's "Cost Assumptions for Planned Generation"

As Table 7 shows, the $18.6 billion program over 10 years would create nearly 12,000 MW of either new electrical generating or conservation capacity. An expanded $47.1 billion investment program would produce more than 22,000 MW in new capacity. As of March 2009, the OPA operates with about 27,000 MW of total electricity-generating capacity. As such, assuming these estimates of new capacity that we are reporting are accurate, the $18.6 billion green investment program could either expand capacity by 44 percent or, correspondingly, replace 44 percent of existing capacity with green energy sources. The $47.1 billion investment program could either expand capacity by 82 percent or replace existing capacity by that amount.

Range of Employment Opportunities Created

In Table 8 below, we present data on some of the major types of occupations that will be required to carry out each of the specific projects associated with the green investment agenda, either at the more modest baseline IPSP level or the expanded GEAA program. Because of data limitations, we are unable to develop a reliable comprehensive breakdown of all the jobs that are created in each of the clean energy activities, or a reliable estimate of how many jobs of each type will be created by each of the green energy investment areas. Still, the listings provided in Table 8 do provide an informative overview of the main job categories associated with green investments in Ontario, and the wages that workers earn from these projects. We present the wage rates both on an hourly basis and in terms of overall yearly income.

TABLE 8. MAJOR OCCUPATIONS ASSOCIATED WITH ONTARIO GREEN ENERGY INVESTMENT PROJECTS

8A) CONSERVATION AND DEMAND MANAGEMENT

Area of employment	Average Hourly Wage, 2007 (dollars/hour)	Average Annual Income from Wages (= hourly wage x 2080 hours)
Construction		
Construction labourers and helpers	$17.84	37,100
Construction managers	25.54	53,128
Electricians	24.56	51,086
Professional/technical services		
Energy auditor*	23.15	48,156
Financial auditors and accountants	24.77	51,522
Administrative clerks	17.34	36,057
Appliance manufacturing		
Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing	16.19	33,665
Other labourers in processing and manufacturing	15.31	31,843
Other products machine operators	16.95	35,247
Information and advertising		
Marketing researchers and consultants	21.02	43,712
Sales, marketing and advertising managers	23.25	48,351
Customer service, information and related clerks	12.85	26,724

Source: See technical appendix

**Note: "Energy Auditor" does not exist as an occupational title in the Labour Market Information Service. The wages reported here are those for "Electrical and Electronic Engineering Technologists and Technicians," which have similar education and training requirements.*

8B) HYDROELECTRIC POWER

Area of employment	Average Hourly Wage, 2007 (dollars/hour)	Average Annual Income from Wages (= hourly wage x 2080 hours)
Architecture and engineering		
Civil engineer	$31.37	65,250
Civil engineering technologists and technicians	20.22	42,056
Architectural technologists and technicians	21.20	44,096
Professional and scientific services		
Financial auditors and accountants	24.77	51,522
Lawyers	34.07	70,866
Administrative clerks	17.34	36,057
Cement and concrete manufacturing		
Supervisors, other products manufacturing and assembly	23.45	48,776
Concrete, clay and stone forming operators	17.28	35,945
Other labourers in processing and manufacturing	15.31	31,843
Electrical equipment manufacturing		
Electrical engineering technologists and technicians	22.30	46,382
Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing	16.19	33,665
Other products machine operators	16.95	35,247
Construction		
Heavy equipment operators	21.56	44,852
Construction labourers and helpers	17.84	37,100
Construction managers	25.54	53,128

Source: See technical appendix

8C) ON-SHORE WIND

Area of employment	Average Hourly Wage, 2007 (dollars/hour)	Average Annual Income from Wages (= hourly wage x 2080 hours)
Construction		
Electrical mechanics	$23.80	49,504
Construction labourers and helpers	17.84	37,100
Construction managers	25.54	53,128
Machinery		
Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing	16.19	33,665
Machinists	17.69	36,790
Welders, cutters, solderers, and brazers	19.95	41,490
Fabricated metal		
Metalworking machine operators	17.35	36,095
Labourers in metal fabrication	15.98	33,231
Welders, cutters, solderers, and brazers	19.95	41,490
Misc. Professional, scientific and technical services		
Financial auditors and accountants	24.77	51,522
Lawyers	34.07	70,866
Administrative clerks	17.34	36,057

Source: See technical appendix

8D) OFF-SHORE WIND

Area of employment	Average Hourly Wage, 2007 (dollars/hour)	Average Annual Income from Wages (= hourly wage x 2080 hours)
Construction		
Heavy equipment operators	$21.56	44,852
Construction labourers and helpers	17.84	37,100
Construction managers	25.54	53,128
Machinery		
Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing	16.19	33,665
Machinists	17.69	36,790
Welders, cutters, solderers, and brazers	19.95	41,490
Fabricated metal		
Metalworking machine operators	17.35	36,095
Labourers in metal fabrication	15.98	33,231
Welders, cutters, solderers, and brazers	19.95	41,490
Misc. Professional, scientific and technical services		
Financial auditors and accountants	24.77	51,522
Lawyers	34.07	70,866
Administrative clerks	17.34	36,057
Cement and concrete manufacturing		
Supervisors, other products manufacturing and assembly	23.45	48,776
Concrete, clay and stone forming operators	17.28	35,945
Other labourers in processing and manufacturing	15.31	31,843

Source: see technical appendix

8E) BIOENERGY

Area of employment	Average Hourly Wage, 2007 (dollars/hour)	Average Annual Income from Wages (= hourly wage x 2080 hours)
Farms		
Farmers and farm managers	$13.84	28,793
Farm workers	12.32	25,631
Harvesting labourers	10.64	22,124
Forestry		
Supervisors, logging and forestry	19.31	40,169
Logging machine operators	20.13	41,879
Silviculture and forestry workers	19.58	40,719
Wood products		
Other wood processing machine operators	21.37	44,439
Labourers in wood, pulp and paper processing	16.11	33,514
Material handlers	15.82	32,902
Refining		
Supervisors – chemical, petroleum & gas processing	20.28	42,172
Chemical plant machine operators	17.70	36,809
Labourers in chemical products processing	16.43	34,180

Source: See technical appendix

8F) WASTE ENERGY RECYCLING

Area of employment	Average Hourly Wage, 2007 (dollars/hour)	Average Annual Income from Wages (= hourly wage x 2080 hours)
Professional and scientific services		
Financial auditors and accountants	$24.77	51,522
Lawyers	34.07	70,866
Administrative clerks	17.34	36,057
Construction		
Electricians	24.56	51,086
Construction labourers and helpers	17.84	37,100
Construction managers	25.54	53,128
Electrical equipment manufacturing		
Electrical engineering technologists and technicians	22.30	46,382
Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing	16.19	33,665
Other products machine operators	16.95	35,247
Machinery manufacturing		
Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing	16.19	33,665
Machinists	17.69	36,790
Welders, cutters, solderers, and brazers	19.95	41,490

Source: See technical appendix

8G) SOLAR

Area of employment	Average Hourly Wage, 2007 (dollars/hour)	Average Annual Income from Wages (= hourly wage x 2080 hours)
Construction		
Electricians	$24.56	51,086
Construction labourers and helpers	17.84	37,100
Construction managers	25.54	53,128
Electronics manufacturing		
Electrical and electronics engineers	33.35	69,362
Electronics assemblers, fabricators, installers and testers	15.54	32,327
Other products machine operators	16.95	35,247
Electrical equipment manufacturing		
Electrical engineering technologists and technicians	22.30	46,382
Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing	16.19	33,665
Other products machine operators	16.95	35,247
Misc. Professional, scientific and technical services		
Financial auditors and accountants	24.77	51,522
Residential and commercial installers and servicers	15.57	32,378
Administrative clerks	17.34	36,057

Source: See technical appendix

8H) Smart grid

Area of employment	Average Hourly Wage, 2007 (dollars/hour)	Average Annual Income from Wages (= hourly wage x 2080 hours)
Construction		
Electricians	$24.56	51,086
Construction labourers and helpers	17.84	37,100
Construction managers	25.54	53,128
Machinery manufacturing		
Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing	16.19	33,665
Machinists	17.69	36,790
Welders, cutters, solderers, and brazers	19.95	41,490
Electronics manufacturing		
Electrical and electronics engineers	33.35	69,362
Electronics assemblers, fabricators, installers and testers	15.54	32,327
Other products machine operators	16.95	35,247
Electrical equipment and component production		
Electrical engineering technologists and technicians	22.30	46,382
Assemblers and inspectors, electrical appliance, apparatus and equipment manufacturing	16.19	33,665
Other products machine operators	16.95	35,247

Source: See technical appendix

As the eight panels of Table 8 show—one panel for each of the green investment areas—new job activities will certainly be created in carrying out a green program, such as installing solar panels and researching new ways to build efficient bioenergy refineries. But the vast majority of jobs that will be created are in the same areas of employment that people already work in today. For example, constructing wind farms creates jobs for sheet metal workers, machinists and construction labourers, among many others. Conservation and demand management activities will employ construction workers—to retrofit buildings, as one major conservation activity—appliance manufacturers, and market researchers, to help encourage people to integrate conservation measures into the fabric of their lives. Creating hydroelectric power will require the services of engineers and architects, financial auditors, and concrete-forming operators.

Given that any green investment program that includes a variety of investment strategies will also engage a wide range of occupations, it follows that the pay range will be correspondingly diverse. The fact that these are cutting-edge clean energy projects does not, by itself, alter any of the basic facts about differential pay rates in the Ontario economy.

Thus, as we see in Table 8, conservation and demand management activities will employ electricians earning $24.56 an hour as well as construction labourers earning $17.89. Bioenergy projects will engage low-paid farm workers at $12.32 an hour as well as chemical refining supervisors earning $20.28. All of the green investment projects will also require the usual range of support services, such as lawyers, accountants, and building inspectors, along with the administrative staff required to deliver these services.

From the sample of occupations presented here, we can reasonably conclude that a large majority of new jobs created directly and indirectly will offer decent pay, i.e. above $20 an hour. But as the data in the table indicate, there will also be large numbers of directly and indirectly created jobs—i.e. a significant minority of new employment opportunities—that will pay below $20 an hour. A good share of these directly and indirectly created jobs will be in various construction and manufacturing trades. In such sectors, opportunities to receive training and move up established job ladders are more widely available than with most low-paying jobs in service sectors, such as restaurants, hotels, or health care. As such, the green investment agenda will, relatively speaking, expand decent employment opportunities even among people who are initially employed on green projects at low pay.

Increasing Employment Expansion by Raising Local Content

Any green investment initiative advanced by the government of Ontario will of course have as its main purpose to provide benefits for the citizens of Ontario. One important way in which benefits within the province can be increased is to channel funds from the new investment activities as much as possible to businesses operating within Ontario itself. As we have seen above, raising the level of local content-directed spending is one of the three factors—along with labour intensity and wage rates—that will establish how many jobs will be created in Ontario by a given amount of new investment spending. At the same time, the citizens of Ontario will not want to purchase more expensive or lower-quality products as part of the green energy transformation simply because these products are supplied by local businesses. The aim, therefore, will be to encourage Ontario business firms as much as possible to be competitive producers of green economy goods and services. What are some appropriate policy options for Ontario to promote local content within the broader green investment agenda?

To begin with, a high proportion of the overall level of activity associated with green investments are location specific—that is, they are activities that can be performed only within Ontario if they going to be expanding the sources of green energy for the province. The specific case in point here is the construction-related activity associated with the eight green investment areas that would be conducted through the IPSP or GEAA programs. For example, all of the building retrofitting activity that falls under "conservation and demand management" will necessarily be conducted within Ontario. Buildings in Toronto can be retrofitted only by construction workers located in Toronto. As such, a high level of local content activity is automatically built into a green investment agenda to the extent that construction work is a component of the overall spending program.

We can see this more specifically in considering the range of green investment activities associated with installations, audits and upgrades. These will all necessarily be performed locally. Thus, as we show in the appendix, 65% of jobs in conservation and demand management are in repair construction and other technical services that must occur on site. Similar numbers are assigned to renewable energy installations with the highest number of construction jobs (50%) attributed to hydroelectric project development. All renewable projects include local construction jobs as well as professional and technical services that can be completed at the local level. These projects will also vary widely by scale, from very large construction projects to very small installation, repair, and weatherization activities. However, most of projects of this sort will be relatively small-scale, carried out necessarily in all communities throughout the province.

By contrast, manufactured goods as well as services that do not have to be performed on location—such as many engineering services—can be conducted outside of Ontario. As such, the overall level of job creation in Ontario through a green investment agenda will diminish to the extent that such activities, relative to construction, represent a significant share of total investment spending.

Table 9. Location-specific and import-competitive activities within green investment strategies

	Location-specific activities % of total activities	Import-competitive activities % of total activities
Conservation and demand management		
repair construction	50	
energy auditing	15	
household appliance manufacturing		10
publishing industries and information services		15
advertising and related services		10
Hydroelectric		
construction	50	
cement and concrete production		18
electrical equipment and component manufacturing		12
engineering		10
professional, technical and scientific services		10
On-shore wind		
construction	25	
professional, technical and scientific services		10
plastic product manufacturing		12
fabricated metal manufacturing		12
machinery manufacturing		35
electronic products		3
electrical equipment and components		3
Off-shore wind		
construction	25	
professional, technical and scientific services		10
plastic products		10
fabricated metal products		10
machinery manufacturing		27
electrical components		2
electronic products		2
cement and concrete products		8
water transportation	6	
Bioenergy		
crop production		25
forestry		25
wood products		20
chemical manufacturing (refining)		20
professional, scientific and technical services		10
Waste energy recycling (also called "Combined Heat and Power")		
repair construction	15	
other construction	15	
professional, scientific and technical services		20
electrical equipment and component manufacturing		25
machinery manufacturing		25

Table 9. Location-specific and import-competitive activities within green investment strategies *(continued)*

	Location-specific activities % of total activities	Import-competitive activities % of total activities
Solar		
other construction	30	
fabricated metal products		17.5
electrical equipment and component manufacturing		35
professional, scientific and technical services		17.5
Smart grid		
other construction	25	
machinery production		25
electrical equipment and component manufacturing		25
electronic equipment manufacturing		25

Source: See appendix

In Table 9, we present data on the main activities tied to each of the eight green investment areas. This table shows the proportion of location-specific and import-competitive activities for the eight green investment areas. As the table shows, these distinctions break down cleanly: we categorize all construction activity as being location specific and virtually everything else as being open to import competition. For example, under conservation and demand management, construction accounts for 50 percent of all the activity, and this therefore represents a 50 percent share of location-specific activity for conservation and demand management. Energy auditing, which also falls under conservation and demand management, also needs to be done at specific locations. According to our estimates, this activity will represent another 15 percent of total conservation and demand management activity. Overall then, for conservation and demand management, 65 percent of total activity is location-specific and only 35 percent is subject to import competition.

With hydroelectric power, construction accounts for 50 percent of all activity, so in this case, that 50 percent represents location-specific activity, while the other 50 percent of activities—cement and concrete production, electrical equipment manufacturing, engineering, and professional services—could all be performed outside of Ontario. The percentages of location-specific activities falls to 25 percent and lower in the other green investment sectors.

The data in Table 9 thus support one simple strategy for increasing local content: to increase the proportion of overall investment spending in areas that are necessarily location-specific. That would include, first, conservation and demand management. By the same logic, all else equal, the province would want to lower the level of spending on bioenergy, where none of the associated activities are necessarily location-specific. Crop production, forestry, wood product production, refining, and professional services could all be performed outside of Ontario.

There is a second, less obvious, factor that will inherently promote local content within the overall green investment agenda. That is to pursue this program at the largest possible scale. When the overall level of investment activity is high, local Ontario business firms will see greater opportunities to gear themselves up to becoming competitive. By contrast, if the overall amount of investment opportunities are modest, local firms that are not already competitive with importers are more likely to forego the costs of bringing their operations to the point where they could compete effectively with importers.

Beyond this, the province can also offer a range of incentives and subsidies to assist local businesses in establishing and maintaining a competitive position in supplying manufactured goods and import-competitive services for the green economy. For example, the green investment components of the Obama stimulus program offers three types of incentives/subsidies for private businesses located within the U.S: tax credits, public matching funds for private green investment projects, and loan guarantees for financial institutions that are prepared to finance green investment projects. Overall, these private incentives could amount to about $100 billion in total, which is roughly equal to the overall level of direct public spending on green investments in the Obama stimulus program.

Of these three types of incentives/subsidies, the largest in potential size within the Obama program is the loan guarantee program. Especially in the current financial environment, with private financial institutions being highly risk averse, using government loan guarantees to lower private risk for green investments is a promising strategy. It is also a policy that can be implemented effectively at the level of a state or provincial government as well as on the national scale.

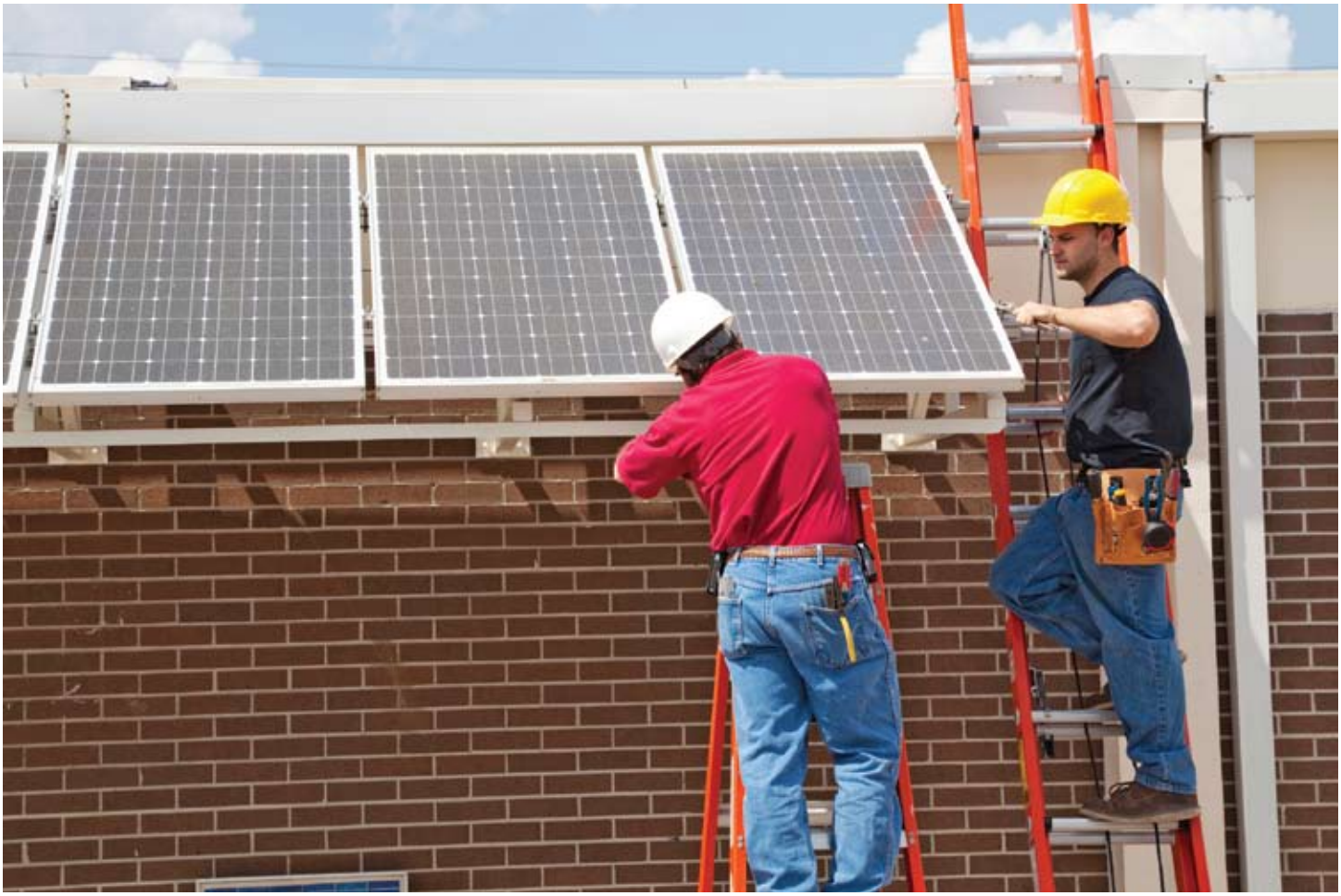
Overall, the Ontario provincial government should examine all of these options carefully as means of increasing the local content of its green investment agenda. The various government entities in the province should also be focused on distributing the local content employment opportunities equitably throughout the province.

CONCLUSION

The government of Ontario is poised to implement an ambitious Green Energy Act. This program has the capacity to produce substantial benefits to the citizens of Ontario both in terms of environmental protection and the expansion of employment opportunities. The government itself has set as a goal of the Green Energy Act to create around 50,000 new jobs in Ontario within three years.

According to the estimates we have developed for this study, a significant green investment agenda for Ontario does indeed offer the potential to create jobs within the 50,000 range anticipated by the government, or perhaps still higher, depending on the level of investment spending that emerges out of the Green Energy initiative. We find that a green investment program at the level of the baseline IPSP program of $18.6 billion over 10 years could create about 35,000 jobs per year through six areas of green investments—conservation and demand management; hydroelectric power; on-shore wind power; bioenergy; waste energy recycling; and solar power. We also find that a more ambitious $47.1 billion 10-year investment program, associated with the Green Energy Act Alliance, would create around 90,000 jobs per year within Ontario. This program would include all six of the investment areas within the IPSP agenda and would also include investments in off-shore wind power and a smart grid electrical transmission system.

The jobs that would be created through either of these programs would span a wide range of occupations, such as construction labourers, sheet metal workers, financial auditors, engineers, concrete-forming operators, secretaries, accountants, and building inspectors. Of course, there will also be a strong demand for scientists and other researchers with the ability to commercialize renewable energy technologies. Most of the jobs are likely to pay at least above $20 per hour. But even among those jobs which pay below $20 per hour, most will be in construction and manufacturing. As such, these relatively low-paying positions are likely to offer training and job ladders that provide more opportunity for advancement than would be the case in low-paying service sector jobs, such as in the food service, hotel, or health care industries.



One way in which the government can enhance the benefits of the Green Energy Act for citizens of Ontario is to increase the proportion of total spending that is channeled to local businesses within Ontario—i.e. to increase the local content of the spending program. As we discuss, there is one simple way to increase the proportion of local content in the overall spending package. This is to focus spending as much as possible on activities that are location-specific, especially construction-related work. Thus, conservation and demand management activities will inherently promote local content because about 65 percent of all the activities within this category are location specific, with about 50 percent concentrated in construction alone. Also, operating the Ontario green investment program at the largest scale will also create more opportunities for local businesses. This is because these local businesses will be more inclined to compete for green investment contracts when they understand that the overall level of opportunity is high. Finally, for the manufacturing and energy service activities that are not location-specific, the government of Ontario should consider developing a program of incentives and subsidies for local businesses, including tax credits, matching grants, and loan guarantees.

TECHNICAL APPENDIX

Estimating Employment Effects through Input-Output Analysis

Input-output tables for the province of Ontario as well as the Canadian national economy are compiled by Statistics Canada. Each year, Statistics Canada collects survey information to compile an input table, an output table, and a final demand table. These tables show the linkages between industries and institutions economy-wide. The tables are available at various levels of detail, from the S-level (highly aggregated) to the W-level (highly disaggregated). At the provincial level, only S-level detail is publicly available. This corresponds to 25 sectors. At the national level, more detailed tables are available, such as the L-level tables (105 industries) and W-level tables (over 500 industries). The input-output model we have developed for this report combines the Ontario S-level tables with the Canadian L-level tables. We discuss the methodology for using these tables below.

Using the input-output model to examine employment multipliers

The input-output tables available from Statistics Canada (StatCan) show linkages in terms of production and use of goods and services. In order to study the effects on employment, rather than simply output, we also need to obtain employment/output ratios. We obtained output levels by industry from the StatCan industry tables and employment by industry from the 2006 Census. (See list below for data sources.) By multiplying the vector of industry-specific employment/output ratios through the symmetric input-output table, we obtain an employment requirements table.

The employment requirements table shows us both the number of jobs directly created and indirectly created, as a result of demand for a particular industry's product. For example, if demand for construction is $1million, we can immediately see both the number of construction industry jobs supported by this level of demand (direct employment effects), as well as the number of jobs supported in other industries which supply inputs to construction, such as lumber and hardware (indirect employment effects).

Employment requirements and energy industries

The StatCan input-output tables organize industries according to the North American Industrial Classification System (NAICS). This system, unfortunately, does not identify energy industries as such. While certain industries such as oil and gas extraction or coal mining are identified in the tables, others such as wind and solar are not. Furthermore, the oil and gas industry does not consist solely of extraction but also of research, manufacturing and distribution. Therefore for both identified and unidentified energy industries we must make certain assumptions in using the input-output tables to study output and employment.

For each energy strategy, we identified the industries most relevant to the strategy and assigned weights for the share of that industry within the energy strategy. These weights were chosen based on various industry journals and energy reports, as well as our best judgment when information was unavailable. So, for example, we defined hydroelectric power as 50% heavy and civil construction, 18% cement and concrete production, 12% electrical equipment and component manufacturing, and 10% each engineering and technical/scientific services. In this way, we were able to use weighted averages of the figures in the output and employment tables to generate estimates of output and employment in the hydroelectric industry, given a certain level of demand for that industry's product. In order to ensure that our employment estimates for each energy strategy were not driven primarily by the weights we assigned, we ran the model with various alternative weighting schemes and found that the results were in fact quite robust and varied only slightly even when weights changed quite drastically. The weights used for all of the energy industries in this study are as follows:

Conservation and demand management
50% repair construction
10% household appliance manufacturing
15% professional/technical services (energy auditors)
15% publishing industries and information services
10% advertising and related services

Hydroelectric
50% construction
18% cement and concrete production
12% electrical equipment and component manufacturing
10% engineering
10% professional, technical and scientific services

On-shore wind
25% construction
10% professional, technical and scientific services
12% plastic product manufacturing
12% fabricated metal manufacturing
35% machinery manufacturing
3% electronic products
3% electrical equipment and components

Off-shore wind
25% construction
10% professional, technical and scientific services
10% plastic products
10% fabricated metal products
27% machinery manufacturing
2% electrical components
2% electronic products
8% cement and concrete products
6% water transportation

Bioenergy
25% crop production
25% forestry
20% wood products
20% chemical manufacturing (refining)
10% professional, scientific and technical services

Waste energy recycling
(also known as Combined Heat and Power)
15% repair construction
15% other construction
20% professional, scientific and technical services
25% electrical equipment and component manufacturing
25% machinery manufacturing

Solar
30% other construction
17.5% fabricated metal products
35% electrical equipment and component manufacturing
17.% professional, scientific and technical services

Smart Grid
25% other construction
25% machinery production
25% electrical equipment and component manufacturing
25% electronic equipment manufacturing

It is important to note that the industries in each energy strategy above are mainly construction/installation and manufacturing industries. That is, we are assuming that the investments in this study represent an increase in new production and use of these energy systems, rather than simply ongoing maintenance and operations.

Ontario: Input-Output Data and Methodology

As mentioned above, input-output tables are only publicly available at the S-level (25 sectors) for the province of Ontario. This level of aggregation is too high to be able to define the energy industries as we have done above. For example, manufacturing is one of the 25 sectors in the S-level tables, and therefore we can not separately identify manufacturing of fabricated metal or manufacturing of electrical equipment and components. Therefore, using only the S-level tables for this study would be insufficient. While we would like to retain the specificity of Ontario's economy, we need to supplement these tables with the Canadian national L-level tables. These L-level tables, while less geographically specific, have more detailed industry information. We can therefore construct the energy industries as listed in the previous section. By using both the S-level Ontario data as well as the L-level Canadian data, we can obtain both a measure of geographic specificity as well as industrial specificity.

Direct effects

In order to measure direct effects, we modeled the Ontario economy and the Canadian economy separately. Using the S-level tables as well as employment/output ratios for these 25 sectors, we obtained direct employment multipliers for each of the 25 sectors in the Ontario economy. We then used the input-output tables for the Canadian economy at the L-level, or 105-industry level of detail. Here we continued to apply the employment/output ratios specific to the province on Ontario. Our Canadian model is thus a hybrid of the Ontario and Canadian data. By using Ontario's employment/output ratios, we maintain some of the productivity measures specific to Ontario while using the input-output relationships that apply more generally to the Canadian national economy. We thus form an employment requirements table at the 105 industry level of detail, and obtain direct employment figures for these 105 industries.

We then compared the two sets of direct employment multipliers obtained above. We saw that the figures specific to Ontario (at the 25-sector level) were much higher than those obtained at the 105-industry level. This result obtains mainly from the fact that all manufacturing is contained within the same sector when we analyze the 25-sector data. Therefore, agricultural manufacturing and electrical component manufacturing share the same multiplier. However, this is an unrealistic expectation, since agricultural production (through its supply chain) generally has a much higher labour intensity than production of electric goods. Thus, the manufacturing multiplier obtained at the 25-sector level would be inflated for non-agricultural manufacturing, and would not be accurate to use for analyzing the energy industries in this study.

We therefore use the midpoint of the direct effects obtained from the Ontario S-level data and the Canadian L-level data. Through this method, we can more precisely target the relevant manufacturing, construction and service industries included in our energy strategies.

Indirect effects

Generally, the indirect effects would be obtained through the same method as the direct effects. However, due to the aggregation issues mentioned above, the indirect effects obtained through the Ontario and Canadian I-O tables were highly inflated. Therefore, rather than reporting figures which seemed implausible, we extrapolate indirect effects from the direct effects achieved above. Namely, we assume that the supply-chain relationships in Ontario are similar to those in the United States. This does not imply that the two countries have similar productivity measures, only that the use of supplies and distribution of output is similar in both countries.

Using IMPLAN 2.0 software and data from the U.S. Bureau of Economic Analysis, we modeled the eight energy industries in this study for the U.S. economy. We then measured the ratio of indirect/direct employment effects for each of the eight areas. Finally, we applied these ratios (measures of supply chain relationships) to the direct employment effects we obtained for Ontario.

Occupations: Data and Methodology

In this study, we are concerned not only with the number of jobs that will be created through alternative green investment programs, but also with the occupations that are likely to be in demand as a result. As with the input-output data, the occupational data available from Statistics Canada is too highly aggregated for the purposes of this study. We therefore used both U.S. and Ontario data to determine the occupations and wages that are representative of the 8 energy areas. More precisely, we used U.S. data to determine which occupations are likely to be in high demand, and we used Ontario wage data for each of those occupations.

The U.S. Bureau of Labour Statistics conducts and publishes the results of their Occupational Employment Survey (OES) each year. The most recently published data – the May 2007 "Occupational Employment and Wage Estimates" – shows detailed information on occupation by industry at multiple levels of NAICS detail. Most relevant for this study, these estimates report the share of an occupation within each industry.

Using these data, we analyzed the occupations in each of the 8 energy areas and selected the top 3 occupations (by share) within each industry that comprise our 8 energy areas. So, for example, hydroelectric power is composed of construction, cement manufacturing, engineering and so on. We identified the top 3 occupations in construction, the top 3 in cement manufacturing, the top 3 in engineering, etc., based on the May 2007 OES data.

Having identified the most relevant occupations, we then used Ontario wage data to report hourly and annual average wages. Service Canada's "Labour Market Information Service" provides data on employment and average wages for a range of occupations and geographical areas, including for the province of Ontario. Using the occupations identified above, we then report the average hourly wage provided by the Labour Market Information Service. The annual average wage is simply 2080 times the average hourly wage (52 weeks*40 hours per week = 2080).

Data Sources

Statistics Canada:

- **Ontario – Symmetrical Provincial I-O Table, S-level**
- **Canada – Symmetrical National I-O Table, L-level**
- **2006 Census – Employment by Industry - Ontario.**

Service Canada:

- **Ontario – Labour Market Information Service – Wages by Occupation.**

U.S. data:

- **IMPLAN 2.0 and 2006 IMPLAN data, Minnesota IMPLAN Group, Inc.**
- **Bureau of Economic Analysis, Input-Output Tables**
- **Bureau of Labour Statistics, May 2007 Occupational Employment and Wage Estimates.**

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