



# Maximizing Jobs from Clean Energy

## Ontario's "Buy Local" Energy Policy

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### Executive Summary

Ontario's bold renewable energy program contains excellent examples of policy that marries economic and environmental goals. Unique among programs that set a guaranteed price for electricity from renewable energy projects, Ontario's program also boasts a domestic content requirement. Sixty percent of the value of wind and solar projects interconnected under the program must be sourced from within the province.

Ontario's clean energy program encourages local ownership and distributed generation, in part to broaden support for renewable energy and in part to capture the increased economic impact generated from local ownership.

The domestic content requirement has already resulted in the promise of 43,000 jobs and dozens of new manufacturing plants to support the 5,000 MW of new clean energy. The public cost of these jobs compares very favorably with state and federal job creation strategies in the United States. If U.S. states were to emulate Ontario's strategy the public costs would likely be significantly lower, given Ontario's currently low retail price for electricity and its weaker wind and solar resources.

*“The domestic content requirement has already resulted in the promise of 43,000 jobs and dozens of new manufacturing plants to support the 5,000 MW of new clean energy. ”*

Ontario's domestic content provisions have been challenged by Japan and others in a complaint to the World Trade Organization, although it is unlikely that a definitive ruling would occur before the program is implemented. American states could also be vulnerable to challenges under the commerce clause if they imitate Ontario, although economic development strategies that offer incentives to in-state business development (rather than barriers to out-of-state businesses) have been upheld in the past.

Ontario's renewable energy driven economic development strategy, although still in its infancy, offers significant lessons to American states. With as much as 70 percent of U.S. renewable energy systems manufactured overseas, state policymakers could learn from Ontario's success.<sup>1</sup>

## Acknowledgments

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Thanks to Paul Gipe for his tireless cataloguing of feed-in tariff policies around the world and to the Ontario Power Authority for their commitment to making FIT Program data public. Thanks also to Paul Gipe, Toby Couture, Greg LeRoy and my colleagues at ILSR for their thoughtful review.

All shortcomings, of course, are my responsibility.

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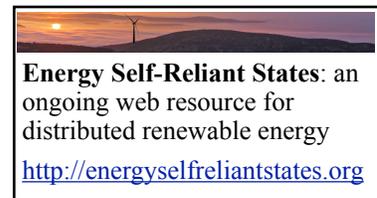
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## Introduction

Those pioneering states and nations willing to bear the short term higher costs of renewable energy are increasingly developing policies that allow them to maximize the economic benefits generated from these up front costs.

Ohio, for example, requires that 50 percent of the renewable energy needed to meet its state renewable electricity mandate be generated inside the state. Germany's pioneering Feed-in-Tariff (FIT) law, which gave a guaranteed price to renewable energy sufficient for a return on investment, applied only to in-country generation.

The province of Ontario, Canada, has gone one step further. Companies eligible for its FIT prices must spend 40-60 percent of the cost of the wind or solar installation inside the province. Ontario also provides an incentive for community owned facilities and fast-tracking for distributed generation.

While still in its infancy, Ontario's coherent and focused program has generated a remarkable response from both investors and manufacturers, a response that could translate into tens of thousand of new well-paid jobs. Indeed, Ontario's FIT may compare very favorably with the cost per job created in traditional incentive programs in the United States.

Ontario's renewable energy program is an excellent example of policy that marries economic and environmental objectives. This Policy Brief offers insights and information on Ontario's unusual clean energy program with a focus on its cost, economic potential, and unique provisions to encourage local content and ownership.

### ***If Ontario were a U.S. state it would rank...***

*...5th in population (between FL and IL)*

*...2nd in size (between AK and TX)*

*...6th in gross state product (between IL and PA)*

*...4th in city population, Toronto (between Chicago and Houston)*



*Note on currency: the figures gathered for this report were given in both U.S. and Canadian dollars. Since the two are at near parity, U.S. dollars will be used throughout.*



## Outline and History of Ontario Feed-in Tariff Policy

In late 2006, Ontario adopted the Renewable Energy Standard Offer Program (RESOP). The basic principle was that offering investors a price sufficient to earn them a reasonable return on equity (initially determined to be 11 percent<sup>2</sup>) is the best way to promote renewable energy.

RESOP supported renewable energy projects of 10 megawatts (MW) and smaller that connected to the low-voltage transmission system (50 kilovolts and under). The program provided a 20-year contract for a price of 11 cents per kilowatt-hour for wind, hydro, and bioenergy projects with a new contract price receiving a modest inflation adjustment each year.<sup>3</sup> Solar projects received a 20-year contract at 42 cents per kilowatt-hour (kWh) with no inflation adjustment.<sup>4</sup>

The first major revision to the RESOP occurred in 2008 when a price bonus of 3.52 cents per kWh was added for electricity delivered reliably during peak hours<sup>5</sup> (not including solar PV projects).

Program revisions also helped reduce gaming by large developers by restricting generators to a maximum of 10 MW per transformer station and 50 MW per resource type under development at one time. Progress milestones were also required for projects in the queue.<sup>6</sup>

These anti-gaming provisions were crucial for two reasons. First, developers were reserving program and grid capacity for projects with little prospect of commercial operation, delaying renewable energy development. Second, these “phantom projects” were shouldering aside viable projects from smaller developers that could create a larger and quicker economic impact.

The provincial power authority signed contracts for 1,400 MW of renewable energy through January 2009 under the RESOP.<sup>7</sup>

In late 2009, RESOP was superseded by the new Feed-in Tariff (FIT) Program, adopted as part of the Green Energy Act of 2009. The legislation passed the provincial legislature by a vote of 59-13 thanks to strong support from the majority left parties.

The FIT Program differentiated tariffs by project size and location, split commercial-scale from residential-scale projects and created a separate microFIT program for projects under 10 kilowatts (kW). The program also added security deposits to three different stages of project development, to further deter project developers from trying to reserve program capacity with little intention of reaching commercial operation.

### Ontario Feed-in Tariff Timeline

#### Late 2006 - Standard Offer Launched

- Renewable energy producers get a premium price for power, guaranteed grid connection, and long term contract.
- Solar price = 42 cents per kWh
- Non-solar price = 11 cents per kWh
- Projects under 10 MW
- Connection to low-voltage grid (< 50 kV)

#### Mid-2008 - Standard Offer Revised

- Slight increase in non-solar price.
- Inclusion of peak price adder (for non-solar projects).
- Anti-gaming provisions including restricting generators to a maximum of 10 MW per transformer station and 50 MW per resource type under development at one time.
- Progress milestones required for projects in queue.

#### Late 2009 - FIT Program Launched

Green Energy Act launches Feed-in Tariff Program

- Prices differentiated by size and technology.
- Additional anti-gaming provisions add security deposits at three project milestones.
- Program split into microFIT (under 10 kW) and FIT Program (over 10 kW).

## MicroFIT and FIT Program Prices

Ontario's FIT Program prices are matched to the size-specific cost of generating electricity from the various renewable energy sources. There are two programs: the regular FIT contract for projects over 10 kW and the microFIT program for projects under 10 kW.

**Table 1** provides the price and contract terms for technologies in the microFIT program which in practice consists almost entirely of solar PV.<sup>8</sup>

**Table 1 – Prices for Ontario MicroFIT program (October, 2010)**

Technology	Price per kWh	Contract Term (years)	Percent Escalated (portion of consumer price index)
<b>Solar PV</b>			
Rooftop	\$0.802	20	0
Ground-Mounted	\$0.642	20	0
<b>Wind</b>	\$0.135	20	20%
<b>Waterpower</b>	\$0.131	40	20%
<b>Biomass</b>	\$0.138	20	20%
<b>Biogas</b>	\$0.160	20	20%
<b>Landfill gas</b>	\$0.111	20	20%

The FIT program supports projects over 10 kW and differentiates prices based on technology, location, and project size.<sup>9</sup> **Table 2** illustrates the contract terms for developers in the FIT Program. With the exception of waterpower (40 years), contract terms are for 20 years.

*“Ontario's Green Energy Act could propel the province past California as the most innovative North American leader in the renewable energy field.”*

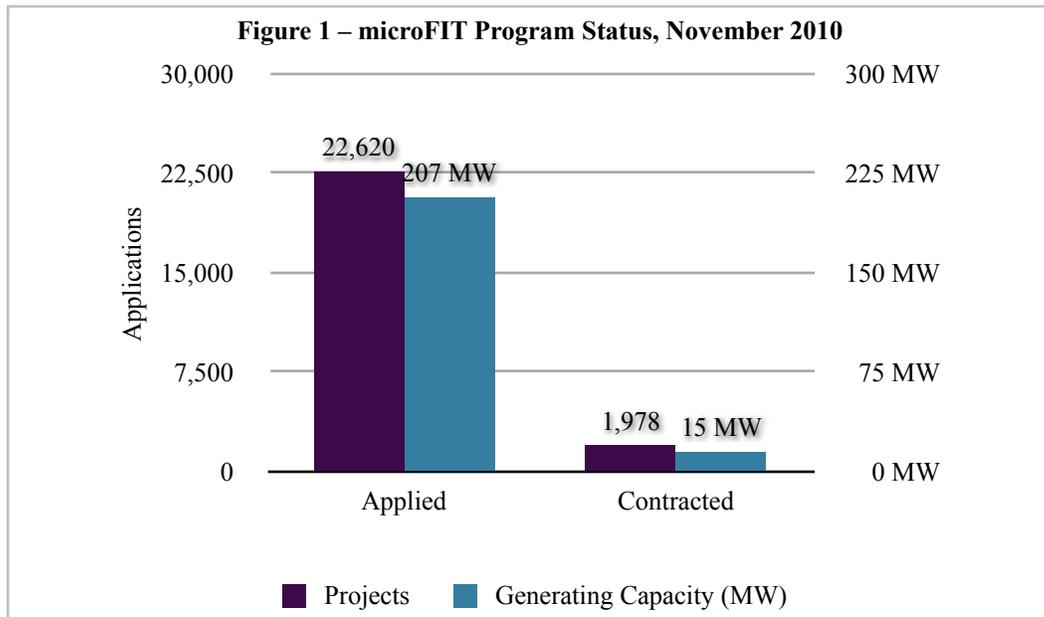
*Denis Hayes, first Earth Day coordinator and first head of the Solar Energy Research Institute (now National Renewable Energy Laboratory)*

Table 2 – Prices for Ontario FIT program (October, 2010)

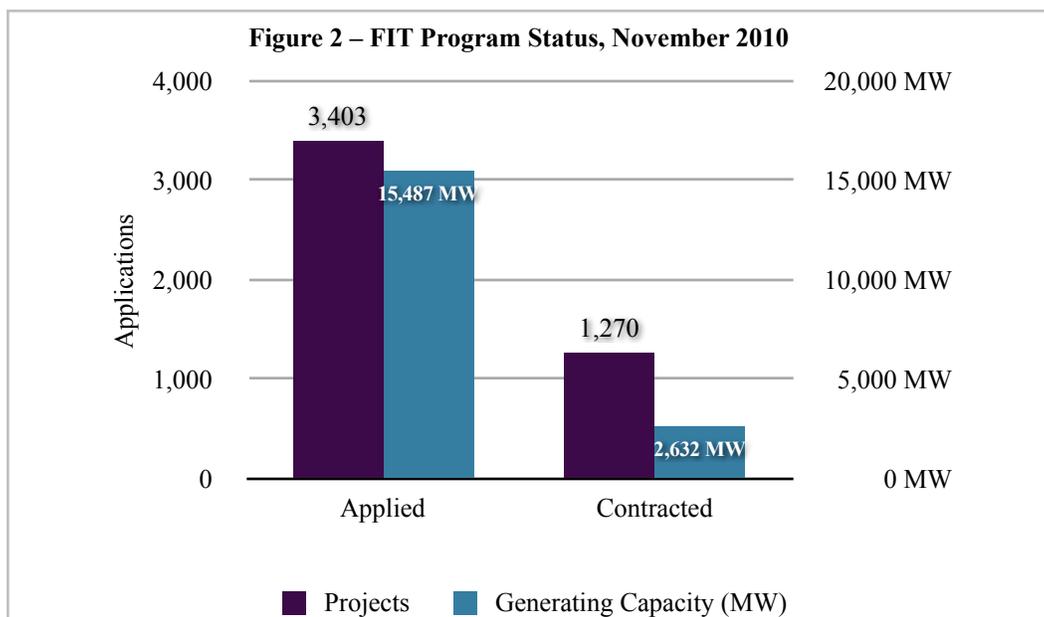
Technology	Size Tranches	Price per kWh	Contract Term (years)	Percent Escalated (portion of consumer price index)
<b>Solar PV</b>				
Rooftop	10 to 250 kW	\$0.713	20	0%
Rooftop	250 to 500 kW	\$0.635	20	0%
Rooftop	over 500 kW	\$0.539	20	0%
Ground-Mounted	under 10 MW	\$0.443	20	0%
<b>Wind</b>				
Onshore	Any size	\$0.135	20	20%
Offshore	Any size	\$0.190	20	20%
<b>Waterpower</b>				
	under 10 MW	\$0.131	40	20%
	10 to 50 MW	\$0.122	40	20%
<b>Biomass</b>				
	under 10 MW	\$0.138	20	20%
	over 10 MW	\$0.130	20	20%
<b>Biogas</b>				
On-Farm	under 100 kW	\$0.195	20	20%
On-Farm	100 to 250 kW	\$0.185	20	20%
Off-Farm Biogas	under 500 kW	\$0.160	20	20%
Off-Farm Biogas	500 kW to 10 MW	\$0.147	20	20%
Off-Farm Biogas	over 10 MW	\$0.104	20	20%
<b>Landfill gas</b>				
	under 10 MW	\$0.111	20	20%
	over 10 MW	\$0.103	20	20%

## Current Status

The Ontario Power Authority's two FIT programs have been immensely popular, attracting proposals for nearly 25,000 projects representing thousands of megawatts (MW). The microFIT program is 99 percent solar PV, and as of October 12, 2010, had over 21,000 applications for 193 MW of capacity. However, so far only 15 MW has been contracted, representing 1,978 projects (**Figure 1**). The pace of contracts has been steady through late 2010, with a weekly average of 100 contracts signed (accounting about 10 kW apiece). However, few of these projects are producing electricity yet.



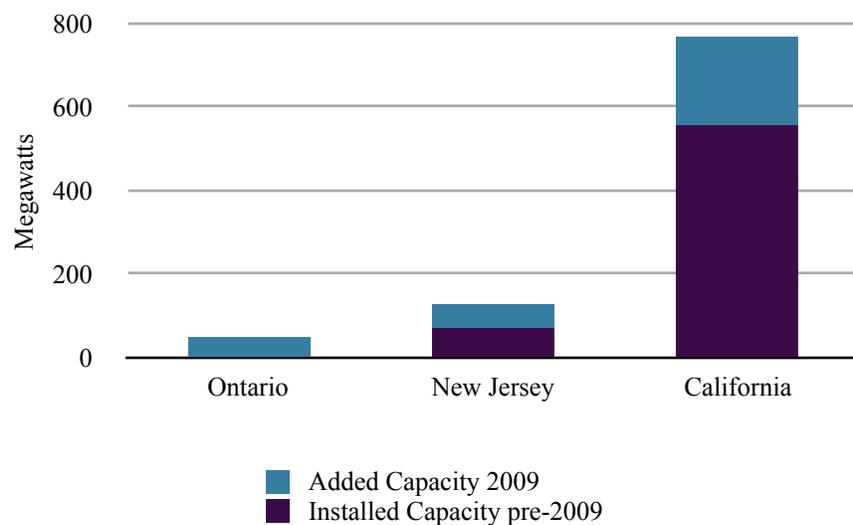
The FIT program has processed a similar number of applications (1,000) but the amount of power is much greater. Over 2,600 MW has been contracted under the FIT Program since its 2009 inception (**Figure 2**).<sup>10</sup> The Ontario Power Authority has not released data on the number of projects by size tranche, so it's not clear how much of the power comes from smaller projects as opposed to larger ones. The FIT Program has progressed steadily, signing an average of 30 contracts worth 50 MW per week from mid-September until late-November. The data in **Figure 1** and **2**, does not include the 1,400 MW contracted under the RESOP.



While the number of on-line projects is small, it is significant. Under the RESOP, Ontario installed 46 MW of solar PV in 2009 (just 2 MW had been installed previously) and while that represents scarcely 5% of the total MW currently contracted in the program, it was sufficient to make Ontario the third largest solar PV market in North America in 2009. Only two U.S. states had more solar PV installed in 2009: New Jersey (57 MW) and California (212 MW).<sup>11</sup> The impressive showing also put Ontario in 4th place in terms of total installed capacity with 48 MW (behind New Jersey, California and Colorado). Market estimates show Ontario will likely be the 2nd largest solar market in North America by early 2011 and the largest by 2012.<sup>12</sup>

**“Market estimates show Ontario will likely be the 2nd largest solar market in North America by early 2011 and the largest by 2012.”**

**Figure 3 – Total Installed Solar PV Capacity for Ontario, New Jersey, and California (2009)**



### Canada's Largest Solar Rooftop

Just outside of Toronto, a newly constructed call center for LoyaltyOne hosts a 165 kW solar array, with panels covering the entire roof and the adjacent carport. The system was the first solar project to be completed under the FIT Program.

Credit: CARBON49 (<http://tinyurl.com/27rjex8>)



## Program Costs and Benefits

Unlike the various solar programs in the United States, Ontario's is not funded through tax incentives or grants but through the price paid for the electricity. Thus the payments are based on performance, unlike many U.S. tax incentives that are based on cost. All contracted projects are paid per kWh generated, with all payments and interconnection costs passed through to ratepayers. The FIT Program will make payments of approximately \$1.15 billion per year once the currently contracted projects (2,600 MW) come online. This translates to a cost per kWh of approximately 0.8 cents (Ontarians consume a total of 145 billion kWh per year).<sup>13</sup>

Tyler Hamilton of the *Toronto Star* put the program costs in perspective:

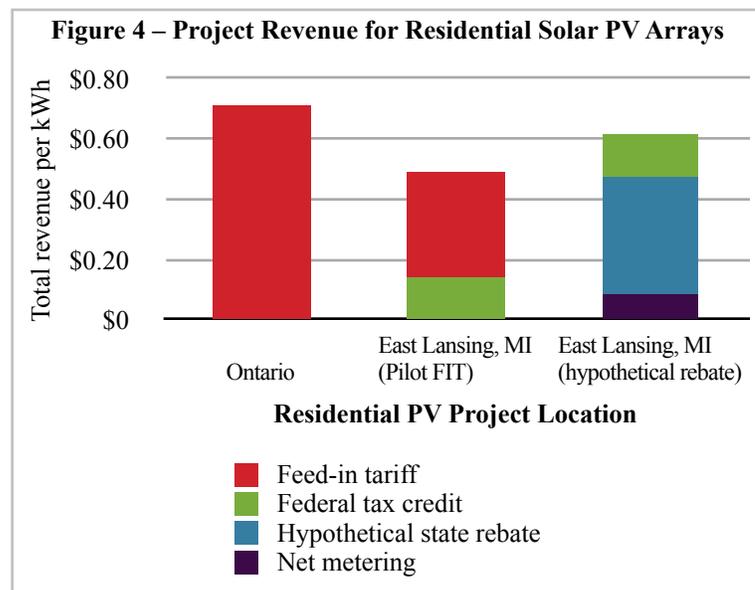
*"Yes, we are paying 80.2 cents per kilowatt-hour for small rooftop solar, a rate often cited by critics to stir up anger over the program, but let's keep it in perspective. Small solar only makes up 1 per cent of all FIT applications and its current contribution to Ontario's overall system supply is about .08 per cent – too small to register on your bi-monthly bill.*

*Yet this .08 per cent is bringing economic activity and skills development to all corners of the province and allowing homeowners, communities and aboriginal groups to participate directly in the greening of Ontario's energy system."<sup>14</sup>*

It's hard to draw direct comparisons to American renewable energy policies, because incentives are split between utilities, states and the federal government. However, commercial wind power projects in the United States require a similar price of 11 cents per kWh to be profitable (with 4 cents coming from federal tax incentives and accelerated depreciation and the remainder from utility power purchase agreements).

Residential solar photovoltaic (PV) projects in East Lansing, MI – with similar solar resources to Toronto – require 70 cents per kWh, with federal incentives providing 15 percent of project revenue. The local utility, Consumers Energy, recently offered a pilot feed-in tariff program with a price of 65 cents per kWh, although that dropped quickly to 52.5 cents as program subscriptions immediately passed the 250 kW price-drop threshold. Consumers Energy only offered a 12-year contract, compared to the 20 years guaranteed in the Ontario FIT Program.

**Figure 4** illustrates the difference between project financing for a residential solar PV program in Toronto, Ontario, and East Lansing, MI. Both projects require 70 cents per kWh over 20 years to provide an 8% inflation-adjusted return on investment. The Consumers's Energy FIT expires after 12 years, after which time we assume the project will take net metering. The FIT price of 52.5 cents per kWh has been adjusted to reflect this shift, for a 20-year average of 35 cents. A hypothetical project using a (\$4.00 per Watt) state rebate instead of a FIT has also been included, although state solar rebates of this magnitude generally run out of funds quickly and is unlikely to be enacted in Michigan.



It should be noted that there are several differences the chart cannot capture. For one, the Ontario FIT Program has no budget or size cap, unlike the Consumers Energy pilot FIT (with a program cap of just 2 MW) or typical utility rebates (with a fixed budget). For another, the federal tax credit for solar energy in the U.S. is only useful for individuals who have sufficient tax liability. A U.S. family of four with the median family income of \$44,000 would require 12 years to successfully absorb the tax credit on a 5 kW residential solar array, but tax law only gives them 5-6 years (until 2016, when the entire tax credit may expire as it has in the past). In other words, U.S. incentives are less generous and less certain than the FIT Program.

*“A U.S. family of four with the median family income of \$44,000 would require 12 years to successfully absorb the tax credit on a 5 kW residential solar array, but tax law only gives them 5-6 years (until 2016, when the entire tax credit may expire as it has in the past). In other words, U.S. incentives are less generous and less certain than the FIT Program.”*

### FIT Program Ratepayer Cost

The feed-in tariff is paid for with incremental increases in the cost of electricity, but calculating the cost of the FIT Program is complicated because the program supports generation by many different technologies and the prices paid vary by project size. Additionally, while the Ontario Power Authority provides data on the number of projects contracted by technology, they do not provide this data by size tranche. Therefore, we had to estimate the proportion of contracted MW in each size tranche to arrive at a size-weighted price per kWh by technology (generally by using a price closer to the lowest size tranche).<sup>15</sup> **Table 3** estimates the expected payments for electricity generation by technology based on these estimates (and does not factor in price inflation).

**Table 3 – Estimated FIT Program Annual Payments**

Technology	Contracted Amount (MW)	Size-weighted price (cents per kWh)	Annual payments (per year)
Biogas	20	11.5	\$18,100,000
Biogas (on-farm)	3	19	\$4,500,000
Biomass	18	13.2	\$18,700,000
Landfill	15	10.5	\$12,400,000
PV Ground	567	50	\$305,500,000
PV Rooftop	165	60	\$106,700,000
Hydroelectric	188	12.5	\$92,600,000
Wind On-shore	1169	13.5	\$414,700,000
Wind Off-shore	300	19	\$174,800,000
<b>TOTAL</b>	2,445		<b>\$1,150,000,000</b>

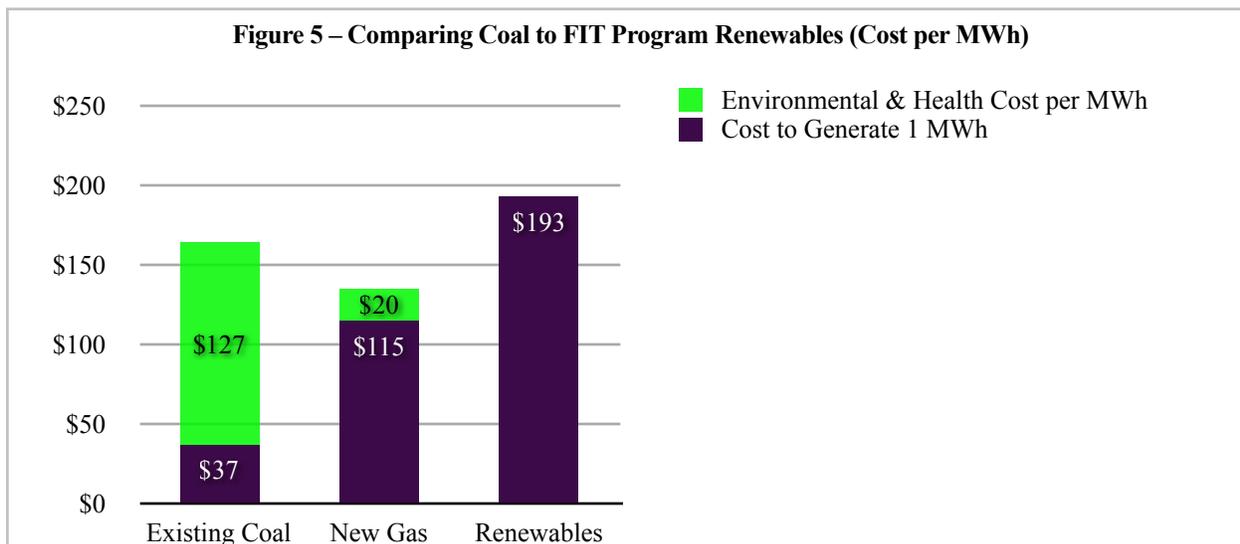
## Net Cost of FIT

The \$1.15 billion per year is the gross cost of the FIT program, but it is more useful to compare the cost of the FIT Program to the cost of delivering electricity in alternative ways. Currently the price of residential retail electricity is about 7 cents per kWh in Ontario, lower than all but 5 U.S. states. The cost to operate its existing coal plants, at current coal prices, is \$37 per MWh (3.7 cents per kWh), compared to the costs of the FIT program, which across all technologies averages \$193 per MWh (19.3 cents per kWh).<sup>16</sup>

However, since Ontario plans to close its four remaining coal-fired power plants, which account for 21% of Ontario's existing electricity capacity (31,000 MW) and 19% of the total electricity production (31 of 163 TWh), the FIT Program costs (\$193 per MWh) should be compared to the costs of new power generation.<sup>17</sup> The California Energy Commission estimates that a new gas-fired combined cycle power plant (a traditional replacement for coal power) has a levelized cost of operation of \$115 per MWh.<sup>18</sup>

However, the cost of operating a coal- or gas-fired power plant is higher when environmental externalities are included and the Ontario program is driven in part by environmental considerations. The four Ontario coal power plants (and a fifth retired in 2005) were responsible for emitting 30,000,000 metric tons of carbon dioxide, 0.32 metric tons of mercury, 116,000 metric tons of sulfur dioxide and 31,000 metric tons of nitrous oxides in 2005.<sup>19</sup> One Canadian study calculated the health and environmental impacts of coal power at \$127 per MWh (and \$20 per MWh for gas), increasing the operation cost to \$164 per MWh.<sup>20</sup> A study in the U.S. came up with a smaller figures for coal and natural gas power plant externalities, \$32 and \$16 per MWh, respectively, but did not include the cost of greenhouse gas emissions.<sup>21</sup>

**Figure 5** illustrates the difference in the cost of existing coal, new gas, and renewable energy power plants. Put in the context of new gas generation, the FIT's marginal cost to ratepayers – not considering environmental costs – is \$78 per MWh or \$465 million per year.



There is one significant omission from the chart: renewable energy systems are typically variable whereas coal power plants provide ongoing baseload power. However, the relative values are difficult to calculate, especially when some renewables (e.g. solar) provide the most power at times of peak demand, a time when the most expensive power plants would typically need to be operated.

Even though the FIT Program has a higher cost per MWh for power than existing electricity sources, the cost differential is much smaller when compared to building comparable fossil fuel generation. Furthermore, the environmental and health benefits may make new coal more expensive than new renewable energy brought online because of the FIT Program. Finally, the feed-in tariff program will likely have a lower cost over time as the contract prices decrease to reflect falling prices of new renewable power, as they have in Germany's feed-in tariff program.

## “Ontario First” Economic Provisions

While the Ontario feed-in tariff is a robust renewable energy policy in its own right, it is also an economic development program. Ontario has focused on the renewable energy sector as a major driver of future economic development in the same way as in previous years governments have targeted the information sector, health sector, or the automobile sector.

Three provisions distinguish Ontario’s program from other feed-in tariffs around the world:

- 1) domestic content requirements
- 2) bonus payments for community-based projects
- 3) fast-tracking for distributed generation.

These policies help increase the economic impact and jobs created by the renewable energy program and spread the ownership of renewable energy more widely.

### Domestic Content Requirements

The key link between Ontario’s clean energy push and economic development is the domestic content provision for wind and solar powered projects. For both FIT programs, a certain percentage of each wind project over 10 kW and every solar PV project must contain a minimum percentage of in-province generated value (**Table 4**). The domestic content provisions are designed to ensure a greater economic impact from each dollar spent through the feed-in tariff program.

**Table 4 – Domestic Content Requirements for Projects in Ontario’s FIT Programs**

Project Technology	Project Size	Date	Domestic Content
Wind	> 10 kW	prior to 2012	25%
		2012 and after	50%
Solar PV	< 10 kW	prior to 2011	40%
		2011 and after	60%
Solar PV	> 10 kW	prior to 2011	50%
		2011 and after	60%

To develop workable domestic content requirements, Ontario has had to intensively examine the various components of the value-added chain.

The domestic content requirement for solar PV projects is broken out into several components, and **Table 5** illustrates the activity and the percent of the domestic content requirement that various materials or labor can meet.<sup>22</sup> To make matters more complex, there are three different standards for domestic content: one for the microFIT, one for crystalline solar PV in the FIT Program and one for thin film solar PV in the FIT Program.<sup>23</sup>

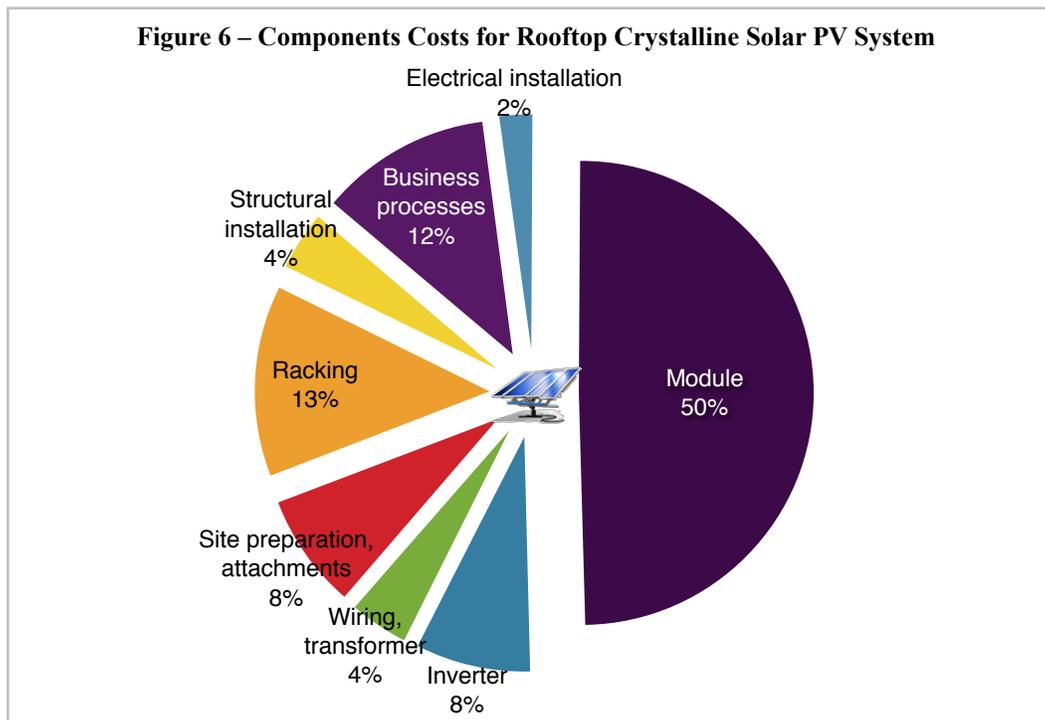
**Table 5 – Qualifying Percentages of Solar PV Domestic Content for Labor and Materials**

Activity	Qualifying Percentage		
	microFIT	FIT Crystalline PV	FIT Thin Film PV
Silicon for PV cells	10%	11%	n/a
Silicon ingots and wafers	12%	13%	n/a
PV cells	10%	11%	n/a
Thin Film cells	n/a	n/a	35%
Modules	13%	15%	10%
Inverter	9%	8%	8%
Mounting systems	9%	11%	10%
Other wiring or electrical	10%	9%	9%
Labor services	27%	18% (on-site only)	24%
Consulting services	n/a	4%	4%

To summarize, 45-50% of qualifying domestic content is in the solar modules themselves, 22-28% is labor and consulting, 8-9% is the inverter, and the remaining 19-20% is electrical and system mounting. In other words, if each PV module was locally produced from Ontario PV cells and silicon (or thin film cells), then the module plus labor would be sufficient to meet the 60% domestic content requirement.

*“If each PV module was locally produced from Ontario PV cells and silicon (or thin film cells), then the module plus labor would be sufficient to meet the 60% domestic content requirement.”*

For comparison, **Figure 6** illustrates a breakdown of system costs for a rooftop crystalline solar PV system.<sup>24</sup> For most of the domestic content provisions, the qualifying percentages are relatively close to the cost of that system component as a percentage of the total system cost.

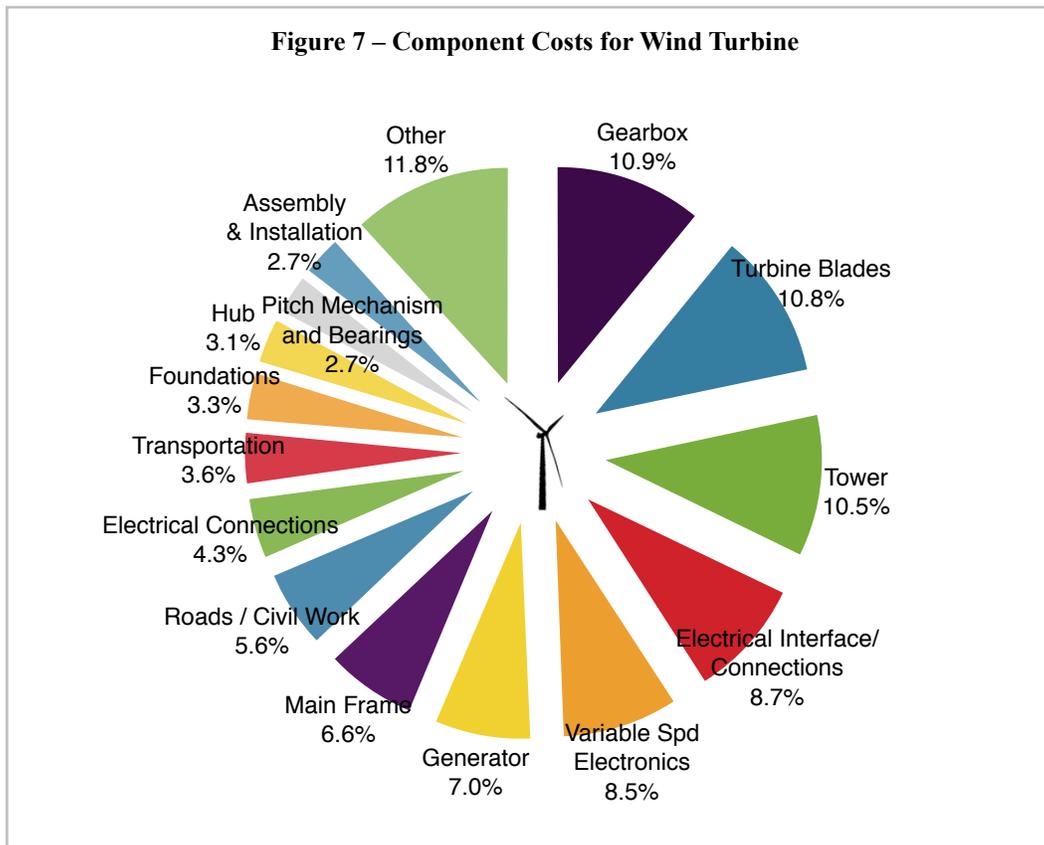


The domestic content rules also specify qualifying percentages for various components of a wind power system.

**Table 6 – Qualifying Percentages of Wind Power Domestic Content for Labor and Materials**

Qualifying Percentage	Activity
16%	Turbine blades
15%	Construction costs and on-site labor
11%	Gearbox
10%	Grid connection transformers
9%	Steel
7%	Yaw system
5%	Power converter
5%	Consulting services performed by Ontario individuals
4%	Towers
3% or less (each)	Pitch system; generator and brake; hub & hub casing; control panel; nacelle frame; nacelle shell; pad mount or transformers; heat exchanger; drive shaft

Similar to the solar PV domestic content rules, the percentages assigned for various domestic content are similar to the relative cost of that component for the entire wind turbine.<sup>25</sup> The component costs for a typical utility scale wind turbine are shown below.<sup>26</sup>



## Community Project Adders

The FIT Program's second unique provision encourages community-based projects by awarding them two additional incentives. This provision was included in part to have as broad a "buy in" for renewable energy as possible and in part because there is a more beneficial local economic impact from community-based projects. The National Renewable Energy Laboratory has verified that wind projects with 100% local ownership generate twice the long-term jobs and one to three times the economic impact of absentee owned wind projects.<sup>27</sup>

Community projects have reduced security payments at three project development milestones. These security deposits range from \$10 to \$50 per kW. A 10 MW wind project, for example, would have to provide a deposit of \$100,000 to secure its application to the FIT program, returned when a contract has been signed; \$200,000 upon contract approval, returned when the project begins commercial operation; and \$100,000 with notice to proceed, returned when the project begins commercial operation. This is in comparison to a total project cost of \$18-20 million.

The same size project owned by an Aboriginal or community group would have security deposits of just \$50,000 (\$5 per kW) for each stage.

Community projects also are paid a higher price for their electricity. **Table 7** illustrates the maximum price adder for a community-based project across the various renewable technologies.

**Table 7 - Maximum FIT Price Adder for Community-Based Projects (cents per kWh)**

	Wind	Solar PV (ground-mounted)	Water-power	Biogas	Biomass	Landfill Gas
<i>Base Rate</i>	13.5	44.3	13.1	16.0	13.8	11.1
<b>Price Adder for Aboriginal Projects</b>	1.5	1.5	0.9	0.6	0.6	0.6
<b>Price Adder for Community Projects</b>	1	1	0.6	0.4	0.4	0.4

The prices are relative to the amount of local ownership. For every 1 percent equity ownership, the project receives 2 percent of the price adder. So a project with 10% local ownership – the minimum to qualify – receives 20% of the maximum price adder. A project with 50% local ownership receives the full bonus.<sup>28</sup>

There's significant variability in the value of the price bonus relative to the base feed-in tariff rate. For Aboriginal-owned wind projects, the price adder increases the tariff rate by over 10% (**Table 7**). For community solar projects, the price increase is only 2%.

Regardless of the size of the incentive, the bonus rates are having the desired effect: community projects are being developed. There are a total of 67 contracted projects with Aboriginal or community ownership with a total capacity of 384 MW.<sup>29</sup> This makes Aboriginal and community-based projects about 15 percent of the overall 2,445 MW in the FIT Program in October 2010.

For comparison, Minnesota leads the United States in community wind development, with approximately 10 percent of operating and under construction projects being community-owned (e.g greater than 50% local ownership).

*“For Aboriginal-owned wind projects, the price adder increases the tariff rate by over 10%...For community solar projects, the price increase is only 2%.*

*Community projects are being developed... with a total capacity of 384 MW.*”

## Distributed Generation

Ontario's strategy is not only to maximize local ownership but also distributed generation. The two objectives obviously overlap. Distributed generation is encouraged by fast-tracking the permitting and interconnection process. Smaller projects in the FIT program that connect to the low-voltage grid have a streamlined process for grid interconnection and approval, called "capacity allocation-exempt" projects (**Table 8**). These projects fall into two categories: projects connecting at less than 15 kilo-volts (kV) that are smaller than 250 kW or projects connecting at higher voltages that are 500 kW or smaller.<sup>30</sup>

**Table 8 – Size and Grid Connection Requirements for “Capacity Allocation-Exempt” Projects**

Connection Voltage	Project Size
Less than 15 kV	< 250 kW
15 kV or greater	< 500 kW

The transmission of electricity is generally divided into three categories:

- Transmission – for moving bulk electricity over distances (110 kV and up).
- Sub-transmission – for moving electricity over short distances (33 to 132 kV).
- Distribution – for bringing power to homes and businesses (3.3 to 25 kV).

Thus, projects connecting at voltages under 15 kV could connect virtually anywhere because they will be on the distribution system and likely very close to where the electricity will be consumed. Projects connecting at higher voltages will likely be on the distribution or sub-transmission system (not transmission, because of the time and cost restraints for small projects).

The only significant requirement in addition to grid connection voltage and size is that such projects must specify their grid connection point in their application.<sup>31</sup>

The advantages for these “capacity allocation-exempt” projects include:

- no requirement for application security (a refundable deposit of \$5 to \$20 per kW capacity).
- not subject to transmission and distribution availability tests.
- not subject to economic connection test, FIT reserve or FIT production line (waiting lists for transmission upgrades).
- can have an earlier milestone date for completion (and qualify for lower domestic content requirements).

Achieving this exempt status has a clear value. “In terms of capacity, as of 12 October over 54% of all pending FIT applications (PV, Wind, Hydro, Biofuel), including 23% of pending PV FIT applications, are on-hold pending Transmission availability assessments.”<sup>32</sup>

While the Capacity Allocation-Exempt projects do not have to have local ownership, their small size means that many community-based or Aboriginal projects will likely receive this status.

**“Over 54% of all pending FIT applications (PV, Wind, Hydro, Biofuel), including 23% of pending PV FIT applications, are on-hold pending Transmission availability assessments.”**

## Evaluating the Cost of Clean Energy Job Creation

Previous sections estimated the net cost of Ontario's FIT program. Here we will examine the job creation impacts of that program.

### New Industry

The domestic content requirements have generated a stampede of proposed new manufacturing facilities in Ontario to meet demand for locally produced inverters and solar modules. A total of 1 to 1.3 gigawatts in manufacturing capacity has been announced since the introduction of the 2009 FIT Program, with several additional manufacturers promising to produce inverters, trackers or racking equipment inside of Ontario.

**Table 9 – Proposed Manufacturing Plants Since FIT Program Introduction** <sup>33</sup>

Manufacturer	Component	Initial Capacity (goal)	Jobs (planned)	Online
Melitron	inverters	4 MW (10 MW)	80	2011
Magnetek	inverters			2010
SMA Solar	inverters		100-200	
Fronius Canada	inverters	50 MW	100	
Canadian Solar	modules	200 MW	500	2011
Opsun	modules	50 MW		2011
ATS Automation / Photowatt	modules	100 MW		2011
Heliene Canada	modules	50 MW	45	2010
Solar Source Corp.	modules	30 MW	145	2011
Siliken Group	modules	50 MW	150	2010
Canasia Solar	modules	50 MW (200 MW)	100 (500)	2011
Quantum/Asola/Evergreen	modules	30 MW		
Silfab SpA	modules	60 MW (120 MW)	70-110 (200)	2011
Solar Semiconductor	modules	150 MW	200	2012
Unconquered Sun Technology	modules	6 MW	50	2010
Solgate	modules	exp. from 6 to 25 MW	30 (total)	2010
Samco/Sunedison	racking		15-18	2011
Everbrite Solar	thin film modules	120 MW		2013
Sustainable Energy & Bosch	thin film modules & inverters	70 MW	750	2011
Mecasolar	trackers		25	2011
Siemens AG	turbine blades		300	
Samsung C&T Corp	turbine towers		300	
		<b>Total Jobs</b>	<b>2,360 - 2,993*</b>	

\*Jobs from the turbine parts plants are not included in the total because they are counted elsewhere.

Not all of the proposed solar manufacturing facilities will actually be built, and some may actually cannibalize others. For example, a new polysilicon refining plant is on the list of new arrivals. Without the locally produced silicon, projects would need a local module and inverter on top of local labor. With the polysilicon, a project could probably get by without a locally made inverter or mounting system.<sup>34</sup>

Also, the ramp up in capacity may exceed the long-term demand for Ontario-made solar modules and inverters within the province. Local demand will exceed supply until 2012, but thereafter there is a projected oversupply of locally produced modules for the Ontario market.<sup>35</sup> However, these domestic manufacturers should also be able to serve the international market. Indeed, many of them have already announced that intention.

## New Jobs

The overall job creation goal of the FIT Program is to generate 50,000 new direct and indirect jobs in Ontario.<sup>36</sup> There are essentially two ways the program develops jobs. First, it attracts new manufacturers who will hire workers to produce the necessary materials to build renewable energy systems that comply with the FIT Program's domestic content requirements. Second, it creates construction, installation, operations and maintenance jobs in the renewable energy sector.

**Table 9** reveals that the province has manufacturing plants with plans to create 2,300 to 3,000 jobs and several other promised new facilities without job estimates. Filling in job estimates for these facilities, the total number of new manufacturing jobs is likely between 2,700 and 3,200 new manufacturing jobs, if all the plants are built as promised.

One study of job creation from solar PV manufacturing suggests a total (direct and indirect) employment boost of 10 jobs per MW during PV production. Because most of the module manufacturers coming to Ontario will bring 1-2 jobs per MW (a direct job), this suggests a multiplier effect of 5-10 jobs for every manufacturing job.<sup>37</sup> Thus, a conservative estimate of the total jobs created (directly and indirectly) from new manufacturing plants assumes that half of the expected manufacturing jobs materialize (1,500) and that they support, indirectly, an additional 6,000 jobs, for a total of 7,500 jobs (a multiplier of five).

*“A conservative estimate of the total jobs created (directly and indirectly) from new manufacturing plants assumes that half of the expected manufacturing jobs materialize (1,500) and that they support, indirectly, an additional 6,000 jobs, for a total of 7,500 jobs.”*

The construction, operations, and maintenance of new renewable energy projects makes the second piece of the jobs puzzle. In April 2010, the Ontario Power Authority said the 2,445 MW of renewable energy under contract would create 20,000 direct and indirect jobs.<sup>38</sup> In a November project update, the program had executed contracts for more than 1,200 projects, accounting for 2,620 MW.<sup>39</sup> So the jobs number may be even higher.

But the FIT Program isn't solely responsible for all of the new jobs from renewable energy projects. The province signed a deal with South Korea-based Samsung group to invest \$6.8 billion in wind and solar projects totaling 2,500 MW by 2016.<sup>40</sup> The projects will receive the feed-in tariff payments, will have transmission capacity set aside, and will be eligible for \$437 million in bonus incentives if its efforts succeed in creating 16,000 jobs. The incentives would cost a typical ratepayer an additional \$1.60 per year for 25 years.<sup>41</sup>

Some of those 16,000 jobs come from four new manufacturing plants in the Samsung agreement, two for wind towers and blades and two for solar modules and inverters.<sup>42</sup> The Siemens turbine blade plant in **Table 9** is the first of these four facilities.

**Table 10** attempts to summarize the job creation from the FIT Program thus far. The results are impressive, with the contracted projects, the Samsung deal, and the expected development of manufacturing plants getting Ontario over 85 percent of the way to its goal of 50,000 jobs from the FIT Program. Overall, the 43,500 jobs would come in support of 5,000 MW of renewable power, or around 9 jobs per MW.

**Table 10 – Expected Job Creation from FIT Program**

	<b>Direct Jobs</b>	<b>Direct + Indirect Jobs</b>
Contracted FIT Projects	–	20,000
Samsung Deal	–	16,000
Proposed Mfg. Plants	1,500	<u>7,500</u>
	<b>TOTAL</b>	<b>43,500</b>

These estimates are in line with actual data from Germany where more than 300,000 jobs have been created in the renewable energy industry from 2000 to October, 2010.<sup>43</sup> These jobs were created in the development of more than 8,700 MW of solar power and 20,000 MW of wind power from 2000-09, for a job per MW ratio of ten to one.

### Cost per Job

With over 40,000 jobs on the way, Ontario's clean energy program appears to have had remarkable success in generating employment. One question is the cost per job created and how that cost compares to job creation programs south of the border.

For the manufacturing jobs, the cost is largely absorbed as part of the FIT Program, as the manufacturers have been attracted by the prospect of a new, sizable market for solar and wind power. Thus, the 20,000 jobs expected from the FIT Program can be measured against the cost of the program. The 2,445 MW under contract in mid-2010 have an expected annual cost of \$1.15 billion in electricity payments. The marginal cost of the program (compared to equivalent capacity from combined cycle natural gas) is \$465 million. Thus, the cost of the 20,000 jobs (in net present value over the 20 years of the program) is approximately \$5.8 billion, or \$290,000 per job.<sup>44</sup>

However, the province has additional incentives for attracting investment by manufacturing companies. In March 2008, Ontario launched the Next Generation of Jobs Fund to provide \$1.15 billion to attract clean energy companies.<sup>45</sup> Specifically, the fund exists “to help companies with a mission of helping the environment, by doing such things as reducing pollution, saving energy, or making transportation more efficient.”<sup>46</sup>

The Samsung deal (with its over \$400 million in employment incentives) was financed through the Next Generation of Jobs Fund. The cost of these jobs is significantly less than for the FIT Program overall, with \$437 million in incentives for 16,000 jobs coming out to \$27,000 per job. However, it's just as accurate



Photo credit: Journal of Commerce

to say that the 16,000 jobs from the Samsung deal should be part of the calculation for the FIT Program job costs. Merging the two provides a cost per job of \$173,000 for 36,000 jobs.

Other solar manufacturers have been getting incentives from the Fund as well. 6N Silicon, owner of Calisolar, received \$8 million from the Fund.<sup>47</sup> We were unable to discover how many of the proposed manufacturing plants listed in **Table 9** were recipients of subsidies through the Jobs Fund.

**Table 11** illustrates the cost per job of the FIT Program, dividing the 43,500 total jobs over the \$6 billion FIT program cost and \$437 million Samsung incentive.

**Table 11 – Cost per Job of FIT Program Job Creation**

	Direct + Indirect Jobs	Cost per job
Contracted FIT Projects	20,000	\$290,000
Samsung Deal	16,000	\$27,000
Proposed Mfg. Plants	<u>7,500</u>	<u>n/a</u>
	<b>43,500</b>	<b>\$143,000</b>

Compare the cost per job of \$143,000 with the cost of new solar manufacturing jobs in the United States. A recent *New York Times* story examined a core of new solar manufacturing facilities being built in Ohio and Michigan. Five new or expanding manufacturing facilities in the region netted an average of \$635,000 per job in federal and state tax incentives for 770 new jobs.<sup>48</sup>

The chief economist and senior economic advisor to the vice president says the U.S. economic stimulus program cost \$92,000 per job created or saved.<sup>49</sup> Recent case studies of economic subsidies by Good Jobs First found that per job subsidies for manufacturing and research facilities ranged from \$4,000 to \$1.2 million; one analysis found an average subsidy for renewable energy manufacturing jobs of \$61,000.<sup>50</sup> Studies of both Minnesota and Maine in the late 1990s found the states spent more than the federal standard for subsidized jobs (many of which paid below the market wage).<sup>51</sup>

Ontario's program also seems to be generating jobs at higher wages, on average, than U.S. job creation programs. One study by a Southwest U.S. economic development agency put the average salary in solar manufacturing at \$70,000 per year.<sup>52</sup> Other estimates show lower, but still robust salaries of \$40,000 to \$50,000 per year for line workers and a solar-industry average of almost \$60,000.<sup>53</sup> Salaries for solar installers are \$30,000 to \$40,000 per year.<sup>54</sup>

*“The bottom line is that...critics of the plan seem to think that electricity policy alone is what determines the survival of Ontario industry.*

*...Historically there have always been U.S. states and Canadian provinces with lower — in some cases much lower — electricity rates. Have we seen a mass exodus of industry into Quebec, or Manitoba, or Wyoming? No, because electricity rates are one of many factors that are weighed by companies. Ontario is still very much competitive with many of the states that count, including Michigan and Pennsylvania, and we're far cheaper than New York State, New Jersey and California. The claim that our industries are going to pick up and run is scaremongering.”*

*Tyler Hamilton, Columnist for the Toronto Star*

## A Comment on Canadian vs. U.S. Program Costs

While the cost of the Ontario program may raise concerns among U.S. policy-makers, it's important to note that the marginal cost of a FIT Program in the U.S. would almost certainly be lower. For one, the solar and wind resources of nearly every state are better than Ontario, so the payment rates for a U.S. FIT Program would be lower. Furthermore, retail electricity prices in 45 states are higher than Ontario's, so the cost differential between retail electricity prices and (lower) FIT payment prices would be even smaller.

*“A FIT Program in Colorado could provide investors the same return with a solar price 33% lower, and the program's cost would be further offset by the fact that Colorado's residential retail electricity costs 2.5 cents more per kWh than Ontario's.”*

For example, a FIT Program in Colorado could provide investors the same return with a solar price 33% lower, and the program's cost would be further offset by the fact that Colorado's residential retail electricity costs 2.5 cents more per kWh than Ontario's.

## Trade Implications

Although Ontario's feed-in tariff domestic content requirements are popular within the province and represent a well-thought out mechanism for maximizing the economic benefit to the same community that will bear the increased electricity costs, they are not popular with Ontario's international trading partners. Japan – joined by the United States and European Union – has brought a complaint against the Ontario FIT Program in the World Trade Organization (WTO) arguing that the domestic content provision is an unfair discrimination against overseas-made products.

Japan's complaint to the WTO identifies three ways in which the country believes the Ontario FIT Program violates international trade law. First, the General Agreement on Tariffs and Trade (GATT) of 1994 indicates that “foreign and domestic producers ought to be treated on an equal footing.”<sup>55</sup> So the domestic content provisions, by favoring domestic producers, violate the GATT.

Japan's second argument is that Article 2.1 of the Agreement on Trade-Related Investment Measures requires that any investment strategy by the Canadian government be consistent with the GATT. This Agreement specifically mentions the investment strategy that requires “the purchase or use by an enterprise of products of domestic origin or from any domestic source [. . .] specified in terms of a proportion of volume or value of its local production.”<sup>56</sup>

Japan finally points to Article 3.1(b) of the Agreement on Subsidies and Countervailing Measures because the feed-in tariff payments are based on the use of domestic rather than imported goods.<sup>57</sup>

The outcome of these complaints may determine whether states or countries can create an integrated program that marries economic development and environmental objectives.

However, the wheels of the international trade resolution machinery grind slowly. Even if Canada loses its case on behalf of Ontario's feed-in tariff domestic content provisions, the entire process could take years to decide. During that time, Ontario can continue to operate the program and enforce its domestic content provisions.

If Canada does finally lose, Ontario still does not have to change its ways. The WTO process would merely allow Japan to apply compensatory tariffs on Canadian goods in retribution for the Ontario feed-in tariff provisions. Alternatively, Ontario could modify its program (though not entirely strip out policies

favoring local content) and start another round of international negotiations and World Trade Organization actions. Previous world trade disputes are illustrative:

### ***The Great Banana Trade War: 17 Years and Counting***

*For many years, European countries provided guaranteed markets for bananas from their former colonies in Africa, the Caribbean, and Pacific Islands (ACP states). The deals gave these export-dependent countries stability they could not otherwise expect in the global banana market, and there was an agreement among European countries not to challenge these sweetheart deals. In 1993, European countries added restrictions to banana imports from nations not in the preferential trade agreements.<sup>58</sup>*

*The restrictions were challenged by a number of Latin American countries, who received a favorable ruling from the GATT panel in 1993 and 1994. But European countries garnered enough votes among GATT members to overrule the panel's decision.*

*In the mid-1990s, international banana corporations Chiquita and Dole applied pressure (and money) to their representatives in the United States Congress to get the U.S. involved. In 1997, the WTO ruled that preferential access, quotas, and tariffs that favored these ACP states were all legitimate, but that the import-licensing system also used to favor the former colonies' bananas was not.*

*Europe refused to budge, so in March 1999 the United States slapped tariffs on a number of imports from European countries.<sup>59</sup> Europe finally agreed to modify their licensing provisions in 2001, allowing 17% of banana imports to be licensed more openly, but still reserving 83% of licenses for historic importers. By then, eight years had elapsed since the import restrictions had been in place.*

*The new quota system was set to expire in 2006, but rather than let its colonies lose their preferential market, in 2006 the EU imposed an import duty of 176 euro per ton of bananas from Latin America.<sup>60</sup> As of 2009, the dispute is still ongoing.<sup>61</sup>*

One analysis suggests that although international trade agreements would seem to clearly prohibit Ontario's program, the legality is murky. China had its own domestic content requirements for wind power from 2005-09, although the nation's "developing country" status makes it an exception. It's also allowable for governments to set preferences for government procurement under the GATT (as the Canadian province of Quebec has done for local energy for years), so if the feed-in tariff is considered a government procurement program, it may be exempt from the typical trade rules.<sup>62</sup> In general, government procurement seems to be exempt from many of the anti-protectionist rules of free trade agreements.

### **Domestic Preference/Domestic Content in the U.S.**

Although the United States has signed on to the WTO complaint against Ontario, several U.S. states have renewable energy policies that are in some respects comparable to Ontario's. Some have renewable portfolio standards (RPS) that encourage the development of in-state renewable energy projects. Ohio's 12.5% by 2025 standard requires that half of the standard's renewable energy (6.25%) come from in-state projects. In Missouri, projects built in the state get a 1.25 multiplier for RPS compliance (measured by renewable energy credits, or RECs). In Michigan, projects built with Michigan-based equipment or a Michigan workforce receive a 1.1 multiplier apiece, but only for the RECs generated in the first three years of the project. In Colorado, community-based projects get a 1.5 multiplier toward RPS compliance.

Illinois has an interesting twist on their RPS. Utilities must use in-state sources for the first 6% of their RPS compliance, subject to a cost effectiveness test (the projects must not be more than 0.42 cents per kWh more expensive than out-of-state alternatives). If in-state resources fail the cost-effectiveness test, then utilities must favor power from adjacent states before going further afield. This policy is effective until the end of 2011. After 2011, utilities must prioritize in-state or adjacent state production, subject to a similar cost-effectiveness test.

One U.S. state has faced an international lawsuit over its favoring local projects. Massachusetts was sued by energy supplier TransCanada over its RPS solar carve out – for in-state solar sources under 2 MW – and the 2008 Green Communities Act that ordered “retail electric providers to solicit to solicit long-term electricity contracts from renewable generators located within Massachusetts.”<sup>63</sup> So far, the lawsuit has resulted in a partial settlement; the commonwealth agreed to grandfather in renewable supply contracts signed prior to 2010 for solar compliance.<sup>64</sup> This ruling will effectively water down the solar carve out by 35-45% in the short term, but the effect will shrink over the next few years as the solar renewable energy credit contracts are re-signed.<sup>65</sup> The state temporarily suspended but did not agree to change its procurement requirement, although the utilities have already re-issued their request for proposals for renewables and are allowing proposals from out-of-state generators.

In general, the legal precedent for domestic preference rules in state policy is the *Pike v. Bruce Church, Inc* case. If the law “discriminates” against out-of-state products, then it has very little chance of being upheld in court. In particular, “discrimination simply means differential treatment of in-state and out-of-state economic interests that benefits the former and **burdens the latter**” [emphasis mine].<sup>66</sup>

On the other hand, policies that provide benefit to local content without discriminating against out-of-state producers (such as production incentives for in-state producers) are upheld “unless the burden imposed on [interstate] commerce is clearly excessive in relation to the putative local benefits.”<sup>67</sup>

The two exceptions to the discrimination rule involve public entities. A publicly owned manufacturing plant, for example, can favor in-state suppliers. Similarly, a state can favor public entities over private ones, provided that private entities are treated the same regardless of location.<sup>68</sup>

The legal precedents regarding domestic preference could mean that Ontario’s domestic content rules would only be upheld in a U.S. state if the purchasing utility was a public entity (such as a municipal utility) or a state-owned power company (as is the case in Nebraska).

While states cannot set domestic content standards, a U.S. state could legally provide a bonus payment to producers who meet certain domestic content thresholds, much like the payment adders Ontario provides to community-based producers.<sup>69</sup> In fact, Washington state already provides a multiplier to its renewable energy incentive if the energy producer uses in-state materials for the construction of their facility. Thus a feed-in tariff that gave a price based on domestic content, as part of an economic development strategy, might pass muster.

*“While states cannot set domestic content standards, a U.S. state could legally provide a bonus payment to producers who meet certain domestic content thresholds, much like the payment adders Ontario provides to community-based producers.”* ”

## Conclusion

Ontario's feed-in tariff policy provides a robust regime for encouraging renewable electricity generation while maximizing the local economic benefits of this new power generation. The domestic content provision ensures that projects will have significantly higher local value-added than would otherwise happen, encouraging more renewable energy industries to locate and hire in Ontario. The community project price adders will also increase the jobs and economic impact of the renewable energy industry, by encouraging the development of projects that provide more jobs and more economic impact per MW than absentee owned projects. Finally, the feed-in tariff distributed generation policy makes it easier for small-scale projects to get on the grid and contribute to clean energy and economic goals swiftly.

The province's policy seems to be an effective job strategy, with a cost per job comparable or lower than seen in American job subsidy programs. But Ontario is getting both high wage jobs and an abundant supply of clean energy, not just subsidizing job creation.

The international trade dispute over the domestic content provision is unlikely to have a significant impact soon. Canada has remained adamant that Ontario's feed-in tariff complies with the country's international trade agreements and ultimately, the World Trade Organization has no power to compel the province or country to change its program. Even if the province were willing to modify its program to avoid retaliatory tariffs, the adjudication process could stretch for years, allowing Ontario to meet many of its clean energy and economic goals long before an international agreement and any reduction in the domestic content provisions is reached.

Ultimately, Ontario's feed-in tariff program is doubly robust, because even in the absence of the domestic content provisions, the local ownership price adders will result in greater than usual economic impact from renewable energy development than with absentee owned projects.

Ontario's FIT Program has brought a surge of jobs and economic development. And given the uncertainty of the international trade dispute, it's unlikely that development will slow in the foreseeable future.

*“Ontario's Green Energy Act represents North America's most ambitious and far reaching enabling legislation and will place Ontario as a world leader in renewable energy development, industrial innovation and climate protection.”*

*Dr. Hermann Scheer, architect of the German feed-in tariff*

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- <sup>3</sup> Prices in this piece are given in U.S. dollars, although it's essentially interchangeable with the Canadian dollar. The exchange rate on Nov. 11, 2010 was 1 US dollar = 1.0057 Canadian dollar.
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- <sup>15</sup> *The following capacity factors were used to calculate the approximate output of contracted FIT Program projects:*  
Biogas, biomass, landfill: 90%  
PV: 12.3%  
Hydro: 45%  
Wind (onshore): 30%  
Wind (offshore): 35%
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- Note: I believe the units on the chart for CO2 emissions are incorrect, given that the typical CO2 emission rate for a coal-fired power plant is 2 lbs/kWh. Instead of Mg, the units should have been Gg.*
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