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Harvesting Clean Energy on Ontario Farms

A Transatlantic Comparison

Kristi **Anderson** Arne **Jungjohann** Tim **Weis**

Edited by the Climate Action Network Canada and the Heinrich Böll Stiftung
Washington DC, June 2011

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Editor: Graham Saul; Arne Jungjohann
Design: Anna Milena Jurca
Images: iStockphoto (page 1, 9, 11, 28, 31, 48); Andrea_44 (page 1 Canada Farm)/ CC BY 2.0); Grant MacDonald/ CC BY-NC 2.0 (page 33); Roberta Franchuk, The Pembina Institute (page 44)

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ACKNOWLEDGEMENTS

The authors would like the following people for their comments and guidance: David Hahn (National Farmers Union Local 316), Torben Hennigs (Heinrich Böll Foundation North America), Tony McQuail (Meeting Place Organic Farm), Dr. Rob Nicol (Ontario Agricultural College), Dr. Tim Rennie (University of Guelph), Graham Saul (Climate Action Network Canada), Ann Slater (National Farmers Union Ontario), Paul Slomp (National Farmers Union Ontario), John Williamson (Frontenac Federation of Agriculture & SWITCH Kingston).

The authors would like to thank The United Church of Canada for their guidance and their generous financial contribution to this project. In light of the global food crisis, The United Church of Canada calls for actions addressing the root causes of hunger and food insecurity. These include fair food distribution, sustainable farming practices, and greater public investment in small farms.

Transatlantic Climate Bridge

This report and its release would not have been possible without funding from the Transatlantic Climate Bridge, an initiative of the German Ministry for Foreign Affairs to connect and support those working to address the challenges of climate change, energy security, and economic growth at the local, the state, and the federal level in Canada and Germany.

AGRICULTURE AND RENEWABLES: MANY SYNERGIES

The renewable energy and agriculture sectors have clear, and underexplored, synergies. Vast areas of farmland can be used for wind installations without impacting agricultural yields, and the crops themselves can be used as a source of power or heat generation and fuel supply. Even farm byproducts like animal waste can be converted to biogas and used for heat and electricity generation. Farm-based power generation can be utilized onsite or sold to utilities, while non-electric products (like biofuels, biogas) can be sold to distributors. These options allow the farms to either reduce their own energy costs or receive an income for the products they produce.

Renewables also offer benefits beyond the farm—both to the surrounding rural community as well as to the nation. Renewable energy from farms can aid in developing and strengthening local economies in two ways. First, supplemental services and product providers will emerge in response to renewable energy development in the community, in turn creating jobs[1] and income. Second, revenue flowing to the farm from renewables can be spent locally. Renewables also con-

1 Renewable energy projects create jobs directly related to the construction, operation and maintenance of an installation, as well as indirect jobs that provide associated services and products. For example, biomass studies show that for each job created constructing a biofuel or biopower facility, another four jobs are indirectly created in other linked sectors. For more information see: (Grebner, D., Perez-Verdin, G.,Henderson, J. And Londo, A. (2009). Bioenergy from Woody Biomass, Potential for Economic Development, and the Need for Extension. Journal of Extension: 47 (6): 6FEA7.)

tribute to the country as a whole, achieving national goals of energy security and independence, as well as pollution reduction.

Agriculture is increasingly a focus for innovative strategies to reduce greenhouse gas emissions. Not only are agricultural harvests threatened by a rapidly changing climate, globally, the energy sector is the only sector producing more greenhouse gas (GHG) emissions than agriculture.[2] Agricultural activities are responsible for 5% of the total GHG emissions in Ontario with the majority coming from nitrous oxide (55%), methane (33%), and carbon dioxide (12%). Manure management is the source of 15% of the GHGs from agricultural operations. Enteric fermentation (methane released from cows during digestion) comprises 32% of total GHGs from agriculture, and soils make up the remaining 53% of GHG emissions from agriculture in Ontario.

The active participation by farmers in clean energy development is one of the reasons for the success Germany has had as it transitions to a cleaner energy system.

Therefore, policymakers are increasingly interested in working with farmers and agricultural organizations to encourage more climate-friendly strategies for existing farming practices, and to enable farmers' investment in low-carbon energy.

Ontario has recently taken major strides to move itself to the forefront of clean energy developments in North America. However, in comparison to Germany, one of the leaders in clean energy development, Ontario farmers have so far only begun to participate in this field. As this paper shows, German farmers have led numerous investments in wind and solar power as well as biogas. This active participation by farmers in clean energy development has been argued as being one of the reasons for the success Germany has had as it transitions to a cleaner energy system. These strategies provide lessons for Ontario policy makers and beyond.

This paper explores lessons learned at the intersection of renewable energy and agriculture on both sides of the Atlantic. The paper provides an overview of renewable energy on farms and discusses the drivers for deployment in Germany and in Ontario. It also compares the German experience to Ontario and offers suggestions for which drivers in Germany may benefit Canadian farmers. Finally, the paper offers some suggestions for further research and action to help Canadian farmers become "energy farmers" in the 21st century.

2 United Nations Environment Programme: Agriculture, Agro-biodiversity and Climate Change. Found at http://www.un.org/ecosoc/docs/pdfs/agriculture.pdf

GERMANY

The German Agriculture Sector: Small and Family-Owned Farms

The German agricultural sector, including forestry and fisheries, accounts for 2.2% of employment in Germany and 1.0% of the gross national product (GNP). In 2005, the revenue in this sector equaled €45 billion annually.[3] The average size of a German farm is 119 acres — smaller than the average farm in Ontario (168 acres). Farms in eastern Germany, however, are on average bigger than their Canadian counterparts. Farms in western Germany average 82 acres on average, while their post-socialist eastern German counterparts cover, on average, 457 acres.[4] Both small-size farms with less than 5 acres and large-size farms with more than 247 acres are common.[5] By 2007, there were nearly 374,500 farms operating in Germany,[6] of which 31,000 are considered large farms. More than 90% of German farms are family owned.[7]

3 Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz. Statistisches Jahrbuch 2009. Found at http://berichte.bmelv-statistik.de/SJT-1000100-0000.pdf

4 East Germany began the unification process having corporate farms that were much larger in scale than the private-owned farms in West Germany. See Koester, U. (1999). The evolving farm structure in East Germany. University of Kiel. Paper presentation: Second World Bank EU Accession Workshop in the Rural Sector, Warsaw Poland.

5 For the purpose of this paper, the following classifications will be used for Germany's farm sizes: Small-size farms - ≤2 hectares (5 acres); Large-size farms – ≥100 hectares (247 acres).

6 Federal Statistical Office of Germany (2010): Strukturen landwirtschaftlicher Betriebe. Found at http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Statistiken/LandForstwirtschaft/StrukturenLandwirtschaftlicherBetriebe/Aktuell,templateId=renderPrint.psml

The German Renewable Energy Market: A World Leader in Investments

The German renewable energy sector is an international leader[8] and one of the most important industries in Germany.

During the past decade, Germany has fundamentally transformed the way it produces electricity: from 2000 to 2010, it increased its share of renewable electricity from 5% to 17%. The country has consistently met its legislated targets ahead of schedule and appears poised to outdo itself again in the next few years. The previous target of 30% renewable electricity by 2020 has recently been updated by Germany's official National Renewable Energy Action Plan[9] (NREAP). The NREAP reveals that the country expects to actually generate 38% of its electricity from renewables by 2020.

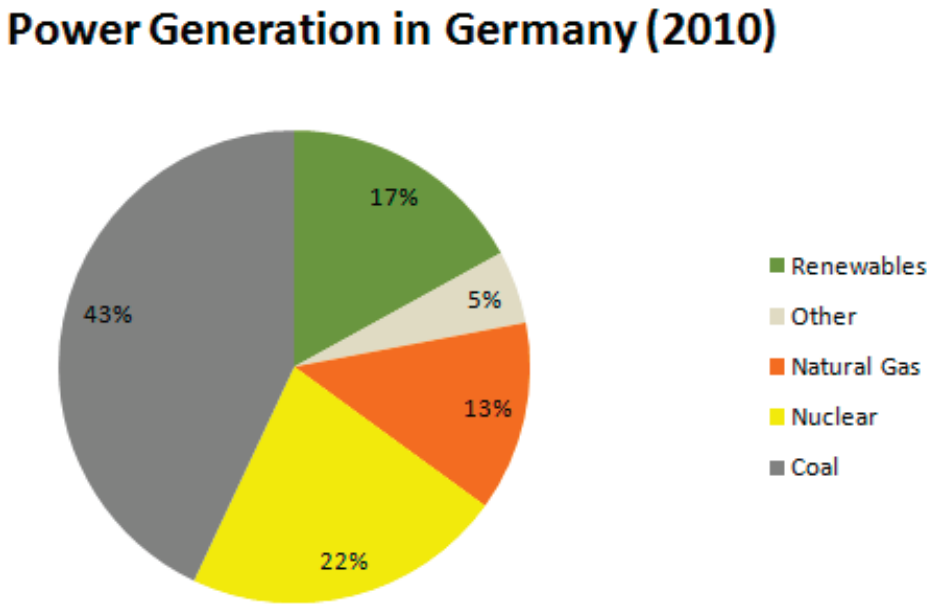

Figure 1: Energy Generation in Germany in 2010. Source: AG Energiebilanzen: Stromerzeugung nach Energieträgern.[10]

Wind energy (onshore) is the key pillar of renewables, with around a 6% share of the total electricity supply. In recent years, clear increases were recorded for electricity generation from biogas and the photovoltaic sector. Solar power almost doubled its contribution from 2009 to 2010, covering around 2% of total electricity demand.

7 Benoist, György; Marquer, Pol: Struktur der Landwirtschaft in Deutschland 2005. Found at http://www.eds-destatis.de/de/downloads/sif/sf_07_005.pdf

8 REN 21: Renewables 2010 Global Status Report. July 2010. Found at http://www.ren21.net/Portals/97/documents/GSR/REN21_GSR_2010_full_revised%20Sept2010.pdf

9 German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety: National renewable energy action plan. 2010. Found at http://www.bmu.de/english/renewable_energy/downloads/doc/46291.php

10 AG Energiebilanzen: Stromerzeugung nach Energietraegern. 2010. Found at http://www.ag-energiebilanzen.de/viewpage.php?idpage=65

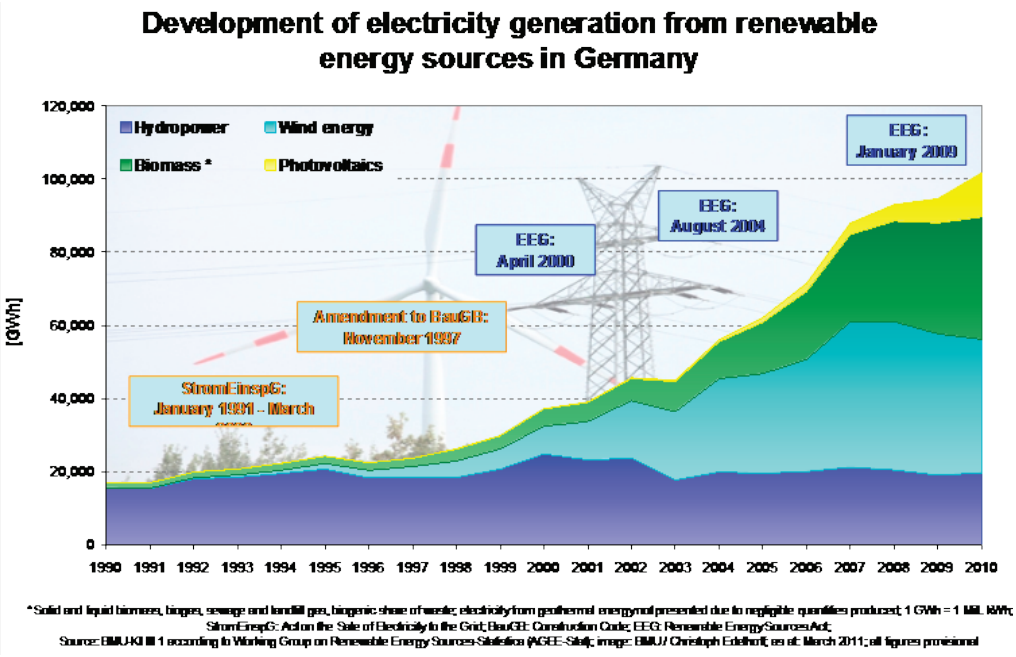

Figure 2: Electricity generation from renewables in Germany. Source: German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety 2011.[11]

The renewables' share in total final energy consumption for heat rose and fuel consumption rose, too. Overall, in 2010 renewables covered around 11% of Germany's total final energy consumption for electricity, heat and fuels. This is significantly higher than the previous year (2009: 10.4%) and is remarkable because energy consumption was considerably higher than in 2009, due to both the economic recovery and the cold weather. Renewables also increased their contribution to climate protection. In 2010, around 120 million tons of greenhouse gases were avoided through the use of renewable energies.

Alongside this, renewable energies also gained importance as an economic factor. Initial estimates show that, at around €26 billion, investments in renewable energy installations were around one quarter higher than the previous year. In 2007, Germany exported nearly €8.5 billion ($11.9 billion CAD) in renewable energy technology, which is more than all of Ontario's agri-food industry exports in 2010 ($9.3 billion CAD). Germany's share of the world market for wind energy turbines and components is nearly 30%. Germany is also among the global top 5 countries in installed capacity of photovoltaic systems, and biogas. Between 2005 and 2020, the renewable energy industry aims to invest a total of €200 billion in new generation (€17.7 billion invested in 2009 alone, even with recession) to achieve a 47% share in the power sector. By 2020, the industry is expected to employ 500,000 people.[12]

11 German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2011: Development of renewable energy sources in Germany in 2010 - Graphics and tables. Slide 12. Found at http://www.erneuerbare-energien.de/inhalt/39831/

12 Germany's Renewable Energy Agency Information Platform. Found at http://www.unendlich-viel-energie.de/en/economy/current-facts-and-figures.html

Like Ontario, Germany is low in fossil fuel resources, and so it depends on imports, especially oil, hard coal, natural gas, and uranium. The deployment of renewable energy in electricity production replaces fossil fuel imports. In 2010, the avoided fossil fuel imports were estimated to be €4.2 billion. These savings almost completely added up to the incremental costs caused by the EEG supply remuneration. Given other economic benefits such as avoided external costs and new jobs, renewable energies are already today an economic benefit for Germany. Within the next years, the financial benefits for renewable energies will far outweigh the costs as the figure below shows.

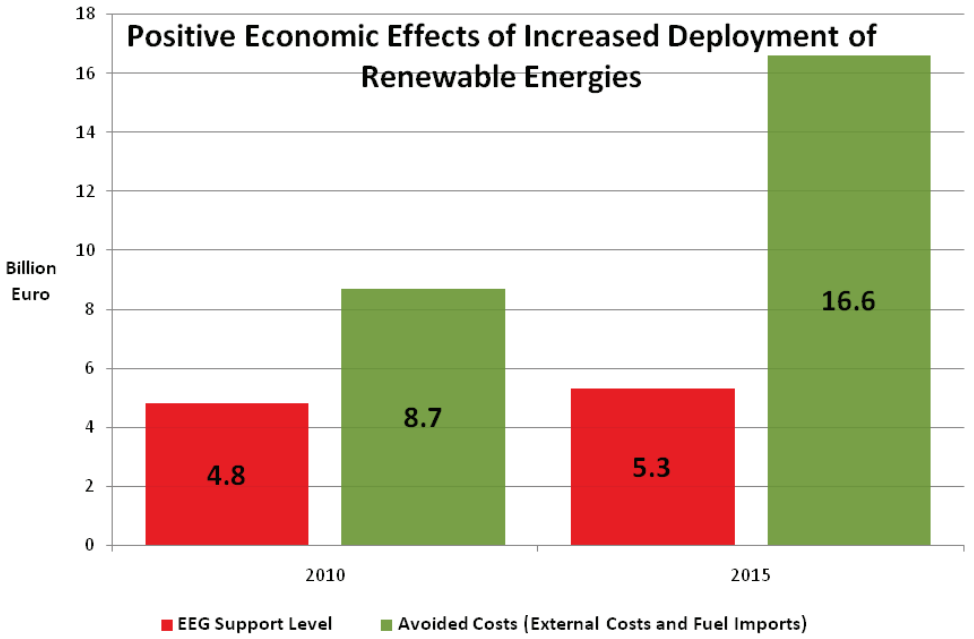

Figure 3: Economic impacts of renewable energies in Germany. Data source: German Renewable Energy Agency.[13]

The strong growth of renewable energies creates a lot of new and additional jobs. Latest estimates show there are now around 370,000 jobs in the sector compared to less than 25,000 in the coal industry (from mining to the power plant). This is an increase of around 8% compared to the previous year, and well over twice the number of jobs in 2004 (160,500).[14] Current scenarios show that in just ten years, renewables can cover 40% of Germany's electricity supply. An increase of 12 terawatt hours (TWh) per year is considered realistic (1 terawatt hour = 1 billion kWh).[15]

13 German Renewable Energy Agency 2011: Renewable energies are good business. Found at http://www.unendlich-viel-energie.de/en/details/browse/2/article/226/renewable-energies-are-good-business.html

14 German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety: Gross employment from renewable energy in Germany in 2010. March 2011. Found at http://www.bmu.de/english/renewable_energy/downloads/doc/47242.php

15 German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety: Renewable energies are standing firm in the economic crisis (March 24, 2010). Found at http://www.bmu.de/english/current_press_releases/pm/45816.php

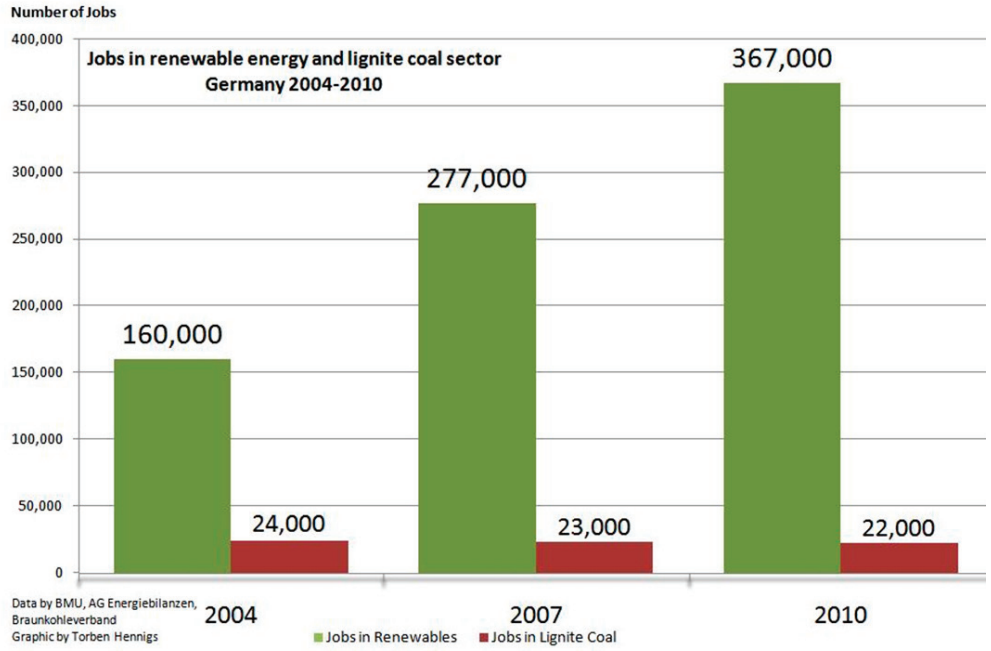

Figure 4: Jobs in the German renewable and coal sector in 2004-20010. Data sources: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety[16] and Statistik der Kohlenwirtschaft[17]

German Renewable Policy

Renewable Energy Sources Act (EEG)

The most important policy to promote electricity production from renewable sources in Germany is the Renewable Energy Sources Act (EEG)[18] which was first enacted in April 2000, and was revised in July 2004, in June 2008, and again in January 2009. The law offers fixed payments (feed-in tariffs) for every kWh of renewable electricity supplied to the national grid. One of its key components is that renewable energy producers have a guaranteed access to feed-in their electricity to the grid. In combination with the 20-year-long fixed rates, this provides a very high investment certainty. There are different rates according to renewable energy source, conversion technique and plant size. For example, tariffs for wind energy vary by resource intensity. For less windy sites, the rates are higher, thus making these sites economic viable. The objective is twofold: to lessen development pressure on the windiest sites by enabling development in other, less windy sites; and to provide siting flexibility. This element has been successful. While development still favors the windiest regions, development is not solely concentrated in the windiest

16 Federal Ministry for the Environment, Nature Conservation and Nuclear Safety 2011: Erneuerbare Energien 2010, p. 16. Found at http://www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/ee_in_zahlen_2010_bf.pdf

17 Statistik der Kohlewirtschaft e. V. 2010: Der Kohlebergbau in der Energiewirtschaft der Bundesrepublik Deutschland im Jahre 2009, p. 23. Found at http://www.kohlenstatistik.de/download/Komplett_Kohlenwirtschaft.pdf

18 German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety: Renewable Energy Sources Act (EEG) 2009. Found at http://www.erneuerbare-energien.de/inhalt/42934/20026

regions. Nearly 60% of German wind development is now in the interior of the country and has moved away from the coastline.[19]

There also additional bonus tariffs to incentivize wood and other renewable resources that have been specifically cultivated for energy production (the "biomass bonus"), for CHP plants ("cogeneration bonus") and for the use of innovative technologies ("innovation bonus").[20] The 2004 revision of the EEG's tariff scheme, which focused specifically on bioenergy, led to a massive increase in the amounts of electricity produced from biomass. As a result of declining world market prices for solar modules, rates for photovoltaics were cut in 2009 and 2010 in double-digit percentages. The Renewable Energy Act (EEG) is reviewed every two years. The main recommendations of the 2011 draft review are: (1) increase rates for off-shore wind and lower rates for onshore wind, (2) reward renewable energy battery and storage technologies, and (3) grid improvements. In addition, rates for biogas from energy crops such as corn should be lowered; rates for producing biogas form manure, and food and biomass residuals should be increased.[21]

Feed-in tariffs for wind energy vary by resource intensity. For less windy sites, the rates are higher, thus making these sites economic viable.

Market Incentive Program for Renewable Energy

Despite its positive environmental effects, bioenergy has only slowly developed in the German market in recent years. Therefore, the federal government and the states decided to accelerate its market introduction by various promotions. Beginning in 2000, the government has been supporting the purchase of biomass plants (e.g. central heating units using logs or wood pellets, biomass power stations and biogas plants) through its Market Incentive Program (Marktanreizprogramm, MAP). This promotional program has been an impressive stimulus. By mid-2006, a total of 70,846 small biomass plants (< 100kW) were subsidized at a total cost of €126.5 million, creating a total investment of €1 billion. A loan program by the "Kreditanstalt für Wiederaufbau" (Credit Institute for Reconstruction) has assisted with 1,239 biogas plants, 1,185 biomass heating stations and 60 biomass CHP plants since it first started, representing a total investment volume of €725.5 million. In 2008, the German government made nearly €350 million available for MAP to promote renewables-generated heat. This amount has been increased to as nearly €500 million for the period of 2009 to 2012.[22]

Agricultural Investment Support Program

Numerous biogas and biomass plants have been built in the agricultural sectors due to the Agricultural Investment Support Program (AFP) of the joint program on "Improving the Structure of Agriculture and Coastal Protection" (GAK). The federal government provides 60% of the funding for GAK measures. GAK also provides for bioenergy advisory services, which are currently under review to determine how best to expand their scope.

19 Gipe, Paul (2011): Model Advanced Renewable Tariff Policy. Found at http://www.wind-works.org/FeedLaws/USA/Model/ModelAdvancedRenewableTariffLegislation.html#Tariff%20Differentiation%20by%20Resource%20Intensity

20 Farrell, J. (2009). Driving the Economy with Renewable Energy Policy that Works. Heinrich Böll Foundation, North America. Found at http://www.boell.de/climate-transatlantic/index-129.html

21 German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety (2011): Entwurf. Erfahrungsbericht 2011 zum Erneuerbare-Energien-Gesetz. Found at http://www.bmu.de/erneuerbare_energien/downloads/doc/47342.php

22 Dena: German Market Incentive Program. Found at http://www.biogaspartner.de/index.php?id=10178&L=1

Renewables on German Farms: A Growing Business

There are many ways in which farms have taken advantage of Germany's rapid renewable energy growth. Renewables on farms have been driven by several factors including highly effective national renewable energy policies and an overall robust policy framework, supportive farm cooperatives and agriculture lobbies, rural community engagement, and financial institutions knowledgeable in financing farm-based renewable energy projects. This section will discuss the various farm-based renewable energy technologies such as biogas, wind, and solar power in Germany, as well as the factors that have promoted their growth over the last few years.

German Farmers: Driving Wind and PV Investments

By the end of 2009, 21,164 wind turbines with a total capacity of 25,777MW had been installed in Germany.[23] These turbines generated 39.5TWh, or 7.58% of Germany's net electricity consumption.[24] Nearly one third of Germany's wind capacity was built by local landowners or residents. According to Greg Pahl, a Vermont-based journalist, "individual German investors have installed as much as 4,000MW of wind-generating capacity, an investment of over $4.8 billion. About 200,000 people in Germany own shares of a local wind turbine".[25]

Farmers have been particularly active in wind farm investment and ownership, and have participated in wind energy development projects throughout Germany. Wind development has been active in locations that are not particularly favorable for crops or livestock, but which have strong wind resources such as the northern states of Schleswig-Holstein, Lower Saxony, and Mecklenburg-Vorpommern. In the year 2007, almost 40% of electricity consumption (roughly 5,200 gigawatt hours (GWh)) in Schleswig-Holstein was generated by wind turbines. In 2010, more than 50% of the state's power came from wind and biogas.[26] For 2020, the state government predicts wind power capacity in Schleswig-Holstein will not only meet 100% of its own demand but will also generate power for surrounding states.

Individual farmers and local cooperatives owned the large majority of German wind power in the 1990s, peaking at approximately 75% of the 6,000 MW installed by 2000.[27] Although the share of community-owned systems has declined as other investors have entered the market (i.e. to 45% of the market by 2005),[28] farmers remain important players in the German wind industry. Many farmers in Germany also earn additional income by leasing property to wind investors.

23 World Wind Energy Report, 2009. Found at www.wwindea.org/home/images/stories/worldwindenergyreport2009_s.pdf

24 German Wind Energy Association (BWE): Wind in Germany. Found at http://www.wind-energie.de/en/wind-energy-in-germany/

25 Pahl, G. (July 2008). Mother Earth: Community Supported Wind Power. Found at http://www.motherearthnews.com/Renewable-Energy/2008-06-01/Community-Supported-Wind-Power.aspx

26 Habeck, R. (2011): Schleswig-Holstein: German Energy Politics in the Making. Found at http://www.boell.de/climate-transatlantic/index-238.html

27 Bolinger, M. (2001). Community wind power ownership schemes in Europe and their relevance to the United States. Berkeley, CA: Lawrence Berkely Livermore National Laboratory

28 Toke, D. (2005). Community wind power in Europe an in the UK. Wind Engineering: 29(3): pp. 301-308.

A significant number of German farmers have also installed photovoltaic (PV) systems on the rooftops of their barns and in their fields. As a result, German farmers have emerged as an important driver of the global PV market. A survey by the German solar energy association BSW-Solar found that there is over 22GW of PV potential just from the roofs (barns, etc) on farms.[29] Between 2005 and 2008, farmers installed on average 200-250MW of PV per year, or approximately 20% of the German PV market. In comparison, Ontario's total installed solar PV capacity was less than 2MW in 2008. By 2010, however, the province shot to the top of solar PV markets in North America, exceeding even California. Ontario installed 168MW of solar photovoltaic (PV) systems in 2010,[30] bringing total installed solar PV capacity to 215MW.[31]

Most recently, Germany has seen a tremendous growth in photovoltaics. The rapid growth has made international headlines in 2010. In the course of the year total installed capacity rose by around 7,400MW — nearly 75% — to 17,320MW (2009: 9,914MW). Photovoltaics generated 12 billion kWh, around 82% more than in the previous year. This gave photovoltaics a 2% share in total electricity consumption.[32]

Installed capacity and energy supply from photovoltaic installations in Germany

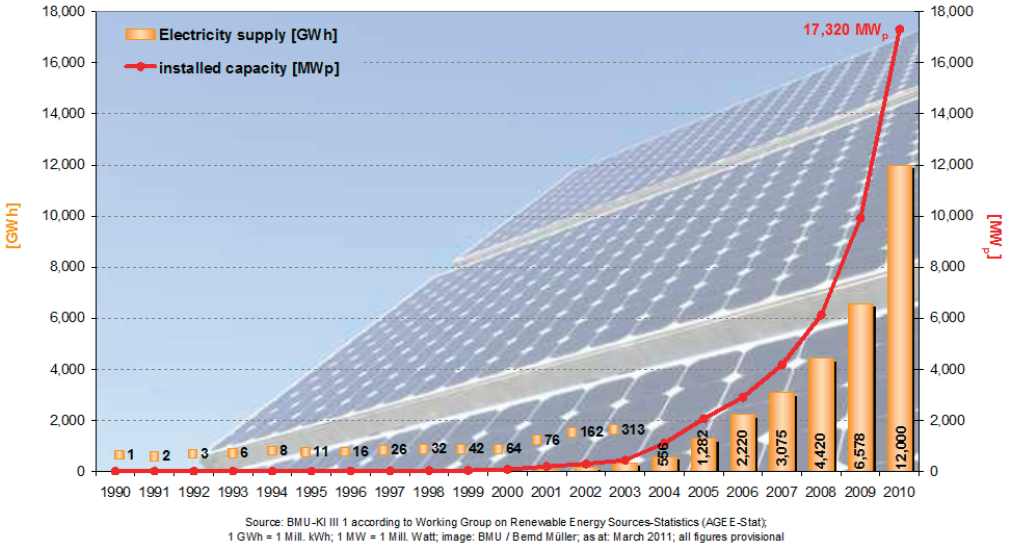

Figure 5: Photovoltaic installations in Germany 1990 - 2010. Source: German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2011.[33]

29 Photovoltaik & Solar: News sum Thema Photovoltaik und eneuerbare Energien. Found at http://www.photovoltaik-tipps.de/studie-zur-photovoltaik-der-landwirtschaft-1392

30 Note: Ontario reports solar PV capacity in AC ratings, whereas DC is the standard used elsewhere. The reported amount installed in Ontario was 143 MW(AC), which is equivalent to 168 MW (DC).

31 Gipe, P., Ontario Leaps to Second in North American Solar PV for 2010: Now Ranks Only Behind California, 2011. Found at http://www.wind-works.org/FeedLaws/Canada/OntarioLeaptoSecondinNorthAmericanSolarPV.html(accessed May 24, 2011)

32 German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety: Renewable energy sources 2010. March 2011. Found at http://www.bmu.de/english/renewable_energy/downloads/doc/47293.php

33 German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2011: Development of renewable energy sources in Germany in 2010 - Graphics and tables. Slide 20. Found at http://www.erneuerbare-energien.de/inhalt/39831/

On a global perspective, Germany has become the primary driver of PV installations with 3.8GW added in 2009 (about 54% of the global market) and 7.4 GW in 2010. This was far above Spain's prior world record-breaking addition of 2.4GW in 2008, and brought Germany's capacity to 12GW by the end of 2010. With that Germany has played a major role in advancing PV and driving down costs in almost half over the last five years.[34]

While PV and wind have both been success stories on German farms, the most impressive developments in Germany can be found in bio-based renewables.

Biogas in Germany: The New Kid on the Block

In 2009, renewable energy resources produced from agriculture occupied almost 5 million acres in Germany, which was approximately 17% of the arable land. Almost half of all crops are canola for biodiesel (2.3 million acres) followed by crops for biogas, such as corn (1.3 million acres), sugar (from beets) and starch combined (560,000 acres).[35]

Farmers face many water and air quality hazards and odor issues when processing livestock waste. One way to alleviate some of these concerns is by converting the livestock waste to biogas. This can be accomplished through anaerobic digesters, which are systems that use bacteria to decompose manure in an anaerobic environment. Methane is naturally produced in this process.

Germany is the leading European biogas producer.

Biogas is an important fuel in Germany and farmers actively cultivate crops for use in anaerobic digesters. As international experts observe, some German farmers have seen strong income revenues from biogas energy sales with a long term certainty.[36] As the Renewable Energy Act rewards the biogas energy production for 20 years, farmers become less dependent from the food commodity price roller coaster. The use of cultivated crops for biogas is a distinct difference from other countries where biogas is primarily generated only from organic waste streams.

As a result of this strategy, Germany is the leading European biogas producer, alone accounting for half of European primary energy output in biogas and half of biogas-sourced electricity output (both in 2009). It is also the top European per capita producer (51.5 tons of oil equivalents for 1000 inhabitants).[37] Recent data by the German government concludes an electricity production of biogas of around 12.8 billion kWh in 2010. Together with other biogenic energy sources – solid and liquid biomass, biogas, landfill and sewage gas, as well as the biogenic share of waste – around 33.5 billion kWh were supplied from Germany's biomass in 2010.[38] This equals a 5.5% share in overall electricity consumption in 2010. Germany is not about to call it a day there, as the number of installations should

34 REN 21: Renewables 2010 Global Status Report. July 2010. Found at http://www.ren21.net/Portals/97/documents/GSR/REN21_GSR_2010_full_revised%20Sept2010.pdf

35 Fachagentur Nachwachsende Rohstoffe e.V.: Cultivation of renewable resources in Germany. Found at http://www.fnr-server.de/cms35/uploads/media/Table.pdf

36 Wisconsin Bioenergy Initiative: The Biogas Opportunity in Wisconsin. Madison 2011. Page 31.

37 Observ'ER: Biogas Barometer. November 2010. Page 111. Found at http://www.eurobserv-er.org/downloads.asp

38 German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety: Renewable energy sources 2010. March 2011. Found at http://www.bmu.de/english/renewable_energy/downloads/doc/47293.php

rise. According to the German biogas association (Fachverband Biogas e.V.), the country will have about 6,800 methanisation plants by the end of 2011, known in Canada as anaerobic digesters. This accumulates to 2,560MW of electrical capacity and a power production of 17.1 million KWh. The value of investments revolves around €4.7 billion annually. The association reckons that the sector has created 16,000 jobs in 2009 and that this number should rise up to 20,000 in 2010. As an international leader, exports become more important for the industry. For 2011, the association assumes a share of exports in turnover to rise to 23% (coming from only 10% in 2009).[39]

Feed-In Tariff is Driving Biogas Investments

This exceptionally lively growth in the German biogas industry is a result of the recently amended renewable feed-in tariff (see Renewable Energy Sources Act (EEG) in the Appendix), the same policy that has spurred other renewable electricity generation. The policy's focus is not technology neutral; it incentivizes innovative technologies in all sizes of installations. To compensate for the higher costs of small-scale installations, rates for small scale installations are higher. Similarly, systems that utilize agricultural waste receive a bonus payment in order to encourage farm participation. This way, both small and large scale operations are profitable, leading to new investments across the country. Without this diverse approach, there would not likely be many biogas plants in states where smaller farm sizes are typical, such as in Bavaria in the South of the country (see figure 6).

Biogas systems that utilize agricultural waste receive a bonus payment in order to encourage farm participation.

In 2009, the basic rate applied was €0.12 for the smallest methanisation biogas (excluding wastewater plant biogas), dropping down for larger installations to less than €0.08. Premiums were added if energy crops are used, if at least 30% of manure is used, for cogeneration, if the waste is sourced from landscaping and environmental maintenance, and if non-methane hydrocarbon emissions are reduced. For landfill and wastewater biogas much smaller rates are provided. With the next amendment of the Renewable Energy Act it can be expected that these premiums will be tightened and incentives will be increased to use less energy crops, but more manure and biomass waste.

The payments combined with premiums are due to decrease by 1% per annum for new contracts and are guaranteed for 20 years. Since an incentive law giving biomethane suppliers priority to the grid came into force in February 2008, Germany has also started feeding biomethane into the natural gas grid. The law also transfers responsibility for a major part of the associated costs to the grid operators instead of being borne by the biomethane suppliers. The outcome has been outstanding growth in biomethane injection. According to the German energy agency, DENA, Germany already had 35 enrichment plants in 2009 feeding 190 million Nm3 (Normal cubic metres) of biomethane. A further thirty have been connected to the grid during 2010 raising biomethane production to 380 million Nm3. The German Biomass Research Centre (DBFZ) puts Germany's biomethane output potential at between 11.5 and 13.9 Mtoe per annum which needs to be compared with its natural gas consumption of 76.6 Mtoe per annum.

39 Fachverband Biogas eV: Biogas Branchenzahlen 2010. 2011.

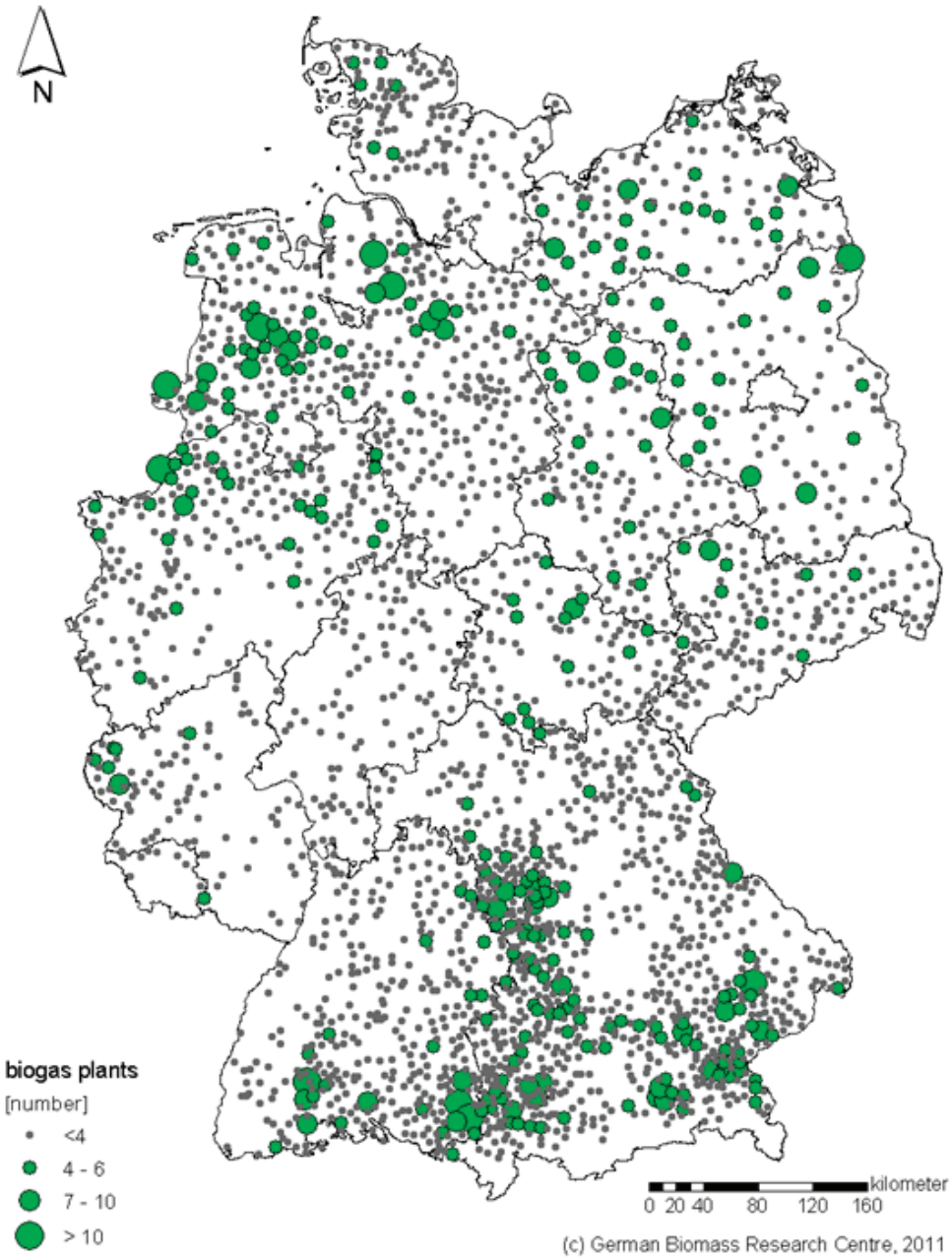

Figure 6: Distribution of Biogas Plants in Germany in 2010. Source: German Biomass Research Centre, 2011.[40]

Germany is relying on natural gas imports (e.g., from Russia) for its energy supply, both in the power and the heating sector. Energy security would be strengthened by relying more on domestic alternatives. The Institute for Applied Ecology estimates that a pan-European biogas-strategy could substitute natural gas imports

40 This figure was provided by the German Biogas Research Centre. An older version has been published here: Monitoring zur Wirkung des Erneuerbare-Energien-Gesetz (EEG) auf die Entwicklung der Stromerzeugung aus Biomasse, p. 28. 2010. Found at http://www.dbfz.de/web/fileadmin/user_upload/Userupload_Neu/3330002_Stromerzeugung_aus_Biomasse_3_Zwischenbericht_Kapitel_1-5_fuer_Veroeffentlichung_final.pdf

from Russia completely by 2020 with an economic benefit to the EU of more than €20 billion.[41] Thus, Germany is pursuing the strategy to incentivize biogas not only for electricity generation, but also for heating purposes. Accordingly, after enriching they inject biomethane (purified biogas) into the natural gas grid, which presents a number of advantages. When it is impossible to recover heat nearby, the biomethane energy value can be directly adapted to the consumer's need and thus be used to the full. The methanisation plant must be equipped with an enriching unit to convert biogas into biomethane for this solution.[42] This boom in construction includes small plants (≤190 kilowatt (kW)) that are experiencing a renaissance due to a bonus payment for farm wastes, as well as larger plants that are being designed to inject their processed biomethane directly into natural gas pipelines (referred to as Renewable Natural Gas or RNG).

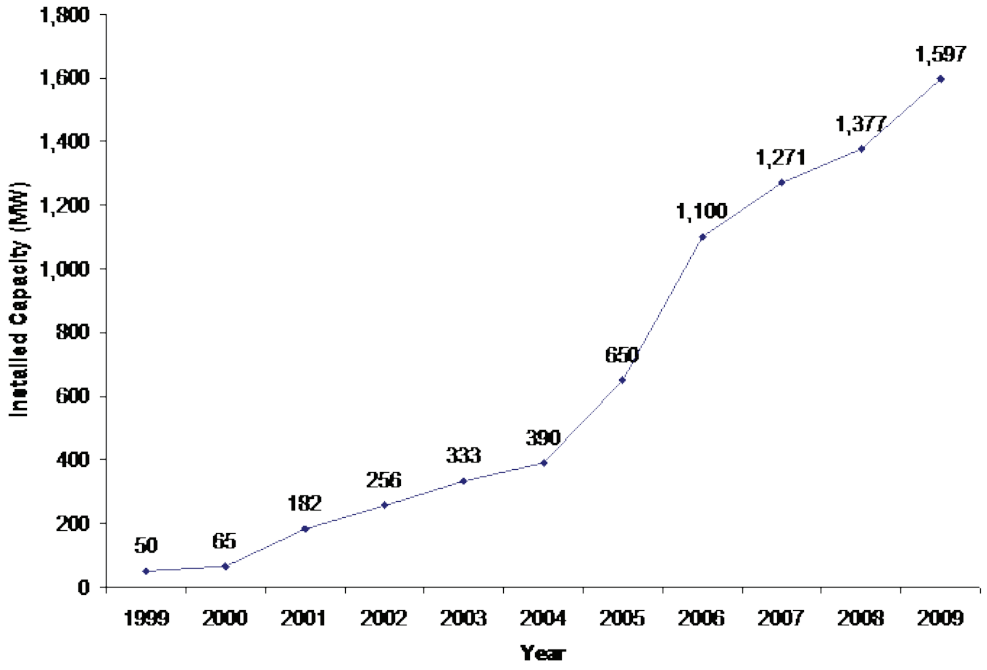

Figure 7: Installed electric capacity from biogas power plants in Germany, November 2009.[43]

Biomass Sustainability: Germany Moves Toward More Standards

A major expansion of bioenergy could create risks and undesirable impacts. Non-sustainable bioenergy strategies would likely contribute more GHG emissions, exacerbate food-security problems, and drive land-use conflicts. As biomass demand in developed countries could be supplied both with domestic and international biomass, these risks have global implications.[44] In Germany, the increasing use of

41 Öko-Institut: Möglichkeiten einer europäischen Lösung einer Biogaseinspeisungsstrategie. (January 2007). Darmstadt. Found at http://www.oeko.de/oekodoc/314/2007-005-de.pdf

42 Observ'ER: Biogas Barometer. November 2010. Page 111. Found at, http://www.eurobserv-er.org/downloads.asp

43 German Biogas Association: Dokumente Biogas. Found at http://www.naturetec-igw.de/downloads/Dokumente/09-11-10_BIOGAS_PK_At_Branchenzahlen_komplett.pdf

44 German Advisory Council on Global Change: World in Transition – Future Bioenergy and Sustainable Land Use Summary. (2008). p. 11. Found at http://www.wbgu.de/fileadmin/templates/dateien/veroeffentlichungen/

biomass as a resource for renewable energy production is one of several reasons for continued degradation of ecosystems.[45]

For solid biomass, the EU Commission suggested voluntary standards to EU Member States in February 2010.[46] The recommendations relate to a general prohibition on the use of biomass from land converted from forest, other high carbon stock areas and highly biodiverse areas. Additionally, the Commission recommends that biomass be used efficiently, creating GHG savings of at least 35% (rising to 50% in 2017 and 60% in 2018 for new installations) compared to the EU's fossil energy mix.

In Germany, however, sustainability standards for solid biomass are required starting in 2011 on the national level. The Biomass Electricity Sustainability Ordinance defines the basic requirements for the sustainability of liquid biomass and the conditions to receive feed in tariffs for bioenergy under Germany's Renewable Energy Law.[47] Similar to the standards on biofuels, it defines rules for the management of agricultural land as well as GHG emissions. In order to prove compliance with the ordinance, certification systems by environmental consultants will be used. In January 2010, the Federal Agency for Agriculture and Food approved the "International Sustainability & Carbon Certification System" (ISCC) as the first system to certify the sustainability requirements of the ordinance.[48]

Social, Political and Economic Dimensions of Farm-Based Renewables in Germany

The remarkable growth of renewable energies in Germany and in particular the increasing role of farmers engaging in renewable energy production has several reasons. They are a mix of a long term comprehensive policy framework; social catalysts like rural cooperatives, banks, and machinery syndicates; and political catalysts such as 100% renewable energy communities and broad support by all parties across the political spectrum. The following chapter describes how these different factors (beyond the often cited feed-in tariff) provide a strong environment for renewable energies and a high investment certainty for farmers.

hauptgutachten/jg2008/wbgu_jg2008_kurz_engl.pdf

45 German Advisory Council on the Environment: Land Use, Nature Conversation and Agricultural Policies in Germany. Chapter of the Environmental Report. (2008). Volume 2. Found at http://www.umweltrat.de/cln_137/SharedDocs/Downloads/EN/01_Environmental_Reports/2008_Environmental_Report_Vol_2_selected_chapters.html

46 EU Commission: Report to the Council and the European Parliament on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling. SEC.(2010) 65. (February 25, 2010). Found at http://ec.europa.eu/energy/renewables/transparency_platform/doc/2010_report/com_2010_0011_3_report.pdf

47 German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety: Ordinance on Requirements Pertaining to Sustainable Production of Bioliquids for Electricity Production. (July 27, 2009). Found at http://www.erneuerbare-energien.de/inhalt/44655/40712/

48 Ecologic Institute: Die Biomassestrom-Nachhaltigkeitsverordnung (BioSt-NachV): Eine kurze Einführung für

Germany's Energy Policy: A Robust Climate and Energy Strategy

In Germany, laws such as the Renewable Energy Sources Act (EEG) (i.e. the feed-in tariff) have driven the expansion of on-farm renewable electricity and bioenergy. Support for bioelectricity, bioheat and biomethane continues on the federal and state level. In addition to legislation, the German Federal Government is supporting the deployment of bioenergy through various research, development and market introduction programs. All of these policies are embedded in the national climate and energy strategy. This strategy includes emission reduction and sector-specific renewable energy targets, including:

- the contribution of renewables to the electricity supply is expected to increase to a share of at least 38% by 2020 of overall consumption,
- the contribution of renewables to heat supply is to be increased to 14%, and
- the share of biofuels in overall fuel consumption is to be 7% of net GHG reductions by 2020.[49]

With the nuclear accident in Fukushima, the German government announced a quick phase out of the remaining nuclear power.

All recent climate-related policies are bundled in Germany's climate and energy package called the Meseberg Program.[50] The package includes 14 laws and ordinances and seven other measures, involving all Ministries that are relevant for climate and energy (e.g. Environment, Economy, Transport, Agriculture, and Research).[51]

With the nuclear accident in Fukushima, Japan, in March 2011, the German government announced a quick phase out of the remaining nuclear power. To replace these capacities, the Merkel government announced several initiatives which will boost renewable energy production even further (see Conclusion on page 28).

In addition to this national approach, Germany's strategy is embedded in an overall EU strategy that formulates targets and a policy framework for the EU member states.[52] Pertinent renewable energy policies are listed in the appendix.

The German Agriculture Lobby: Advocating for Aggressive Renewable Energy Policies

Over the years, the Federation of German Farmers (Deutscher Bauernverband) has become an advocate of ambitious renewable energy growth in Germany. In the

AnlagenbetreiberInnen. Berlin 2009. Found at http://ecologic.eu/3229

49 Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety: The Renewable Energy Sources Act entered into force on 1 August 2004. Found at http://www.bmu.de/english/renewable_energy/doc/6465.php

50 Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety: Report on implementation of the key elements of an integrated energy and climate program adopted in the closed meeting of the Cabinet on 23/24 August 2007 in Meseberg. Found at http://www.erneuerbare-energien.de/inhalt/41258/20026

51 German Missions in the United States: Transatlantic Climate Bridge. Page 8. Found at http://www.germany.info/Vertretung/usa/en/09__Press__InFocus__Interviews/03__Infocus/03__ClimateBridge/Downloads/Roadmap__DD,property=Daten.pdf

52 German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety: EU Directive on the promotion of the use of energy from renewable sources. Found at http://www.erneuerbare-energien.de/

2009 debate on Germany's energy and climate package, the Federation has recommended fast and substantive amendments to improve investment security for biogas installations. It also suggested specific incentives for small and medium-sized installations.[53] In the discussion on cutting feed-in tariff rates for photovoltaics, the Federation of German Farmers warned of quick and unexpected cuts. It advocated that integrated PV-solutions like modules on rooftops (e.g. barns) become eligible for higher rates.[54]

In preparation for the UN climate summit in Copenhagen in December 2009, the Federation of German Farmers developed a position paper on agriculture and climate protection. It suggested that the German farm and forestry sector be part of the solution to protect the climate, and highlighted the potentials for farmers to become energy producers with bioenergy. In addition, the federation also outlined the negative impact that climate change would have on farmland and the high costs climate change would impose on German farmers.[55] The Federation has advocated for strategic elements to adapt to climate change and possible contributions by the agriculture and forest sector to mitigate climate change, such as with renewable energy.[56]

The proactive position of the German farm lobby towards climate change does not mean traditional conflicts with environmental groups have disappeared. The farm lobby is being criticized for not fully taking into account the ecological impact of biofuels, and the GHG impact of meat consumption and energy-intensive farm practices. Overall, agriculture contributes to 11% of GHG emissions in Germany. Recent analysis shows that there is considerable potential for increased mitigation efforts in this sector which could deliver significant GHG-emission reductions.[57]

100% Renewable Regions: Villages and Municipalities Play an Important Role in Rural Areas

While large cities like Hamburg and Munich have recently embraced a larger expansion of local renewable energy generation, far more ambitious goals have been pursued in rural towns and villages. Until recently, the idea to power a city or wider area with 100% renewable energies seemed unrealistic. This has changed. Today more than 100 cities, villages, and municipalities pursue to power their energy needs by 100% renewable energies. These areas and people are not going back to the roots, but they are driven by a fascination for high tech equipment, for strengthening the local economy, for ending the dependency of energy imports both

inhalt/45419/20026

53 Deutscher Bauernverband: Entschließung des Präsidiums des Deutschen Bauernverbandes zum Energie- und Klimapaket der Bundesregierung. (January 19, 2008). Found at http://www.bauernverband.de/mediaarchiv/grab_pic.php?id=70801

54 Deutscher Bauernverband: Fotovoltaik – Forderung muss an den Wettbewerb angepasst werden. (January 11, 2010). Found at, http://www.bauernverband.de/index.php?redid=152813&mid=327382

55 Deutscher Bauernverband: Agriculture and Climate Protection. Found at http://www.bauernverband.de/?redid=205683

56 Deutscher Bauernverband: KLIMA-REPORT der Land- und Forstwirtschaft. (November 2007). Found at http://www.bauernverband.de/mediaarchiv/grab_pic.php?id=70044

from abroad and big utilities, and for doing something good for the environment by getting away from coal and nuclear power.

Municipalities have a number of options to influence and foster the development of renewable energy production. After setting up a network of regional expertise, they can provide direct stimulus by renting their property for the construction of plants, by streamlining permitting, or by owning and operating their own renewable energy facilities. The popularity of the idea to shift the energy supply of rural areas toward 100% renewable is growing across Germany and is actively supported by the German Association of Towns and Municipalities. An annual congress promotes the idea of *100% renewable regions*.[58]

In 2010 alone, the additional turnover from renewable energies for rural areas was more than 10 billion Euros, most coming from solar and wind.

There are multiple incentives for municipalities to engage in the development of renewable energy projects. First, the production of bioenergy within the German policy framework leads to economic advantages. Biogas, solar and wind plants can compete with fossil fuels once a supportive policy framework is put in place; at the same time, municipalities that use biomass can save on the costs that otherwise would be imposed for waste disposal. Second, there are opportunities for enhanced economic development through the creation of regional business clusters. Farmers are able to utilize all of their products to a significantly higher degree, experts can participate in planning and constructing the facilities, and local craftsmen benefit from the facilities' maintenance needs. Finally, regional energy generation insulates towns and villages from rising global energy prices and volatility.[59] Though not easy to measure, studies on existing projects show that the economic benefits of these strategies are positive. Depending on size and kind of technology, the economic benefits (e.g. municipal value creation effects) range from €12.3 million for a 5MW photovoltaic solar park to €36.8 million for a 5MW wood-fired power station over the course of 20 years. In 2010 alone, the additional turnover from renewable energies for rural areas was more than €10 billion, most coming from solar and wind. This has brought in the same year an additional €840 million of tax revenue on the municipal level.[60]

One would assume that the dominant energy producers such as E.ON, RWE, Vattenfall and EnBW would also play part in this development. However, despite their ongoing attempts to brand themselves as powerful partners in the transformation to a low carbon economy, the traditional utilities have done very little to actually boost this process. As a recent study indicates, merely 4% of Germany's overall capacity in renewable energy over the last decade has been realized by the traditional utilities. The vast majority has instead been put up by smaller and regional utilities, municipal services, farmers, cooperatives such as citizen-owned wind parks, and other private investors.[61]

57 Ecologic Institute: Climate change mitigation in German agriculture. Found at http://ecologic.eu/3217

58 For the annual congress in September 2010, see http://www.100-ee-kongress.de/

59 Agentur fuer Erneuerbare Energien: Erneuerbare-Energien-Projekte in Kommunen Erfolgreiche Planung und Umsetzung. 2. Ueberarbeitete Auflage 2008. (German only). Found at http://www.100-ee-kongress.de/fileadmin/content/print_kommunal-erneuerbar_02_web_Doppelseiten.pdf

60 German Renewable Energy Agency: Value creation for local communities through renewable energies. 2010. Found at http://www.unendlich-viel-energie.de/en/details/article/523/renews-special-value-creation-for-local-communities.html

61 Institut für ökologische Wirtschaftsforschung (2011): Investitionen der vier großen Energiekonzerne in Erneuerbare Energien. Found at http://www.ioew.de/no_cache/projekt/Investitionen_der_vier_grossen_

Community Ownership and Catalysts of Change: Maschinenringe, Banks, and Energy Coops

An important facilitator of investment trends of farmers are the "Maschinenringe"—loosely translated as "machinery syndicate". Maschinenringe are cooperatives that help farmers to buy their machinery. In recent years, these coops have increasingly expanded their business from standard farm machinery to renewable energy. The role of the Maschinenringe, of which there are over 250,[62] is two-fold in the PV market. First, it advises farmers on the size of the investment for a PV installation. Second, it aggregates the orders of several farmers for PV systems as a way to lower investment costs through bulk purchases. Germany's Maschinenringe Association was quite active in PV from 2003-2008. In that time period they facilitated the installation of over 1,000 PV roof-mounted installations on farms. All of these systems were purchased and owned by the farmers.

For most banks, participation of farmers in projects is a sign of solid, and even conservative, financial calculation and therefore a low-risk for the bank. For this reason, banks tend to readily offer credit lines and loans to farmers. Banks specializing on the farm sector, such as the Agriculture Pension Bank ("Landwirtschaftliche Rentenbank"), have observed higher demand from their farm clients to invest in renewable energy projects. In 2008, the bank increased its renewable energy portfolio to 955 projects with a total volume of €104 million. This is an increase of 60% from 2007. The Deutsche Ausgleichsbank (DtA), a public-private bank that merged in 2003 with KfW, debt-financed roughly 90% of all German wind projects (63% to limited partnerships, and 12% to general partnerships of sole proprietors).[63] The banks expect demand to continue growing in the future.[64]

With a high share of local ownership, the regional economic impact increases up to threefold as does the acceptance of these energy projects.

One catalyst that has most recently developed is energy cooperatives. Rural areas and farmers know this business model from agriculture coops. The idea is simple. Farmers on their own would not invest in big energy projects for 20 years. It would constrain their flexibility and capital for traditional agriculture business. Energy cooperatives offer villages, their citizens and farmers the option to participate for 20 years in these investments, e.g. in shares of 2,000 Euro. This way, the coop can attract a lot of capital for an investment in a wind park on fields that are leased by surrounding farmers, a biogas plant that is fueled by biomass from the region, or photovoltaics that are put up on the village's church or supermarket rooftop. Even conservative calculated projects often have profits of 5.5% per year and more.[65]

With a high share of local ownership in these projects, the regional economic impact increases up to threefold (in comparison to absentee owned) as does the acceptance of these projects. A survey conducted of two towns in Germany, both with local wind projects, but only one that was locally owned, highlights this.

Energiekonzerne_in_Erneuerbare_Energien_Update_2010/

62 Photovoltaik & Solar: News zum Thema Photovoltaik und eneuerbare Energien. Found at http://www.photovoltaik-tipps.de/studie-zur-photovoltaik-der-landwirtschaft-1392

63 Bolinger, M. (2001). Community Wind Power Ownership Schemes in Europe and their Relevance to the United States. Berkeley National Lab Report: LBNL-48357. Found at http://eetd.lbl.gov/ea/EMS/reports/48357.pdf

64 Solar News.de: Strong demand for photovoltaics financing. (October 30, 2008). Found at http://www.solarenergie.com/news/news.php?newsid=1876&PHPSESSID=b2mojuiv46b6rnetdqbg6smrll4dkj81

65 Wieg, A.: Saubere Zinsen. Wie eine Energiegenossenschaft lokale Photovoltaikanlagen initiiert.

With local ownership of the wind project, 45% of residents had a positive view toward more wind energy. In the town with an absentee-owned project, only 16% of residents had a positive view of expanding wind power; a majority had a negative view.[66]

Broad Support Across the Political Spectrum

Across the political spectrum, there is a strong consensus on the need to address climate change. By now, all major German parties support an industrial transformation towards a low-carbon economy. Constituent groups from both the progressive (e.g. renewable energy industry) and the conservative side (e.g. farm community) benefit from this approach. There is an understanding that strong environmental policies drive ecological modernization and create new market opportunities.[67] Germany as an export-oriented country is able to sell the solutions to a carbon-constrained and high-energy price world. However, as long as the public perceived a trade-off between environmental regulation and industrial competitiveness, it was difficult for an economic powerhouse like Germany to fundamentally turn towards a low-carbon economy.

Genossenschaftsforum 1/2009.

66 Farrell, John (2011): Community Ownership Boosts Support for Renewables. Found at http://energyselfreliantstates.org/content/community-ownership-boosts-support-renewables

67 Hey, Christian: The German Paradox: Climate Leader and Green Car Laggard. In: Institute for European

Interestingly, the original design of Germany's feed-in tariff has been implemented in the early 1990s by a center right government of Christian Democrats and the pro business Liberals. It was driven by Bavarian hydro mill owners whose interest was to sell electricity to the grid. Thus, the Electricity Feed-In Act (*Stromeinspeisegesetz*, StrEG) was an initial effective step towards the broad launch of renewable energies in 1991. It forced companies in the not yet liberalised electricity market to provide access to the grid for power generated by hydroelectricity plants, wind turbines, solar energy and biogas plants, and pay legally defined prices for it. Ten years later, the Renewable Energy Act (EEG) took over from the StrEG. It stipulated cost-covering remuneration, to make economic operation possible for all renewable systems of electricity generation.[68] The EEG, however, was introduced by a center-left coalition of Social Democrats and the Greens. This Renewable Energy Act (EEG) was passed in 2000 by the governing and opposition parties. In contrast to highly controversial projects such as the nuclear phase-out and environmental tax reform, the Renewable Energy Act has been supported by a broad parliamentary coalition ever since.

Strong environmental policies drive ecological modernization and create new market opportunities.

Besides the obvious economic success of renewable energies there is for sure another reason why all German parties support this legislation: popularity. In a poll conducted by the renowned German pollsters at the Forsa institute in early 2010, a stunning 95% of all Germans named renewables as their favorite source of energy. It is little surprising to find coal (3%) and nuclear energy (6%) at the lower end of this scale, but even natural gas is far away from the renewables' popularity with only 9%. 78% of all replied that it would be very or even extremely important to expand renewable energy.[69] This strong support of renewable energy is one way to explain Germany's broad approach in transforming its energy system.

Conclusion and Outlook for Germany

German farmers have seized the opportunity to become energy entrepreneurs. They have made a concerted effort to invest in renewable energy, and have gained national recognition as a result. Farm lobbies such as the Federation of German Farmers have generally not opposed climate legislation, but have rather fought for more ambitious energy policy to develop renewable resources. A survey of the Federation of German Farmers shows that farmers plan to invest significantly in renewable energy. Even in the face of the difficult economy and declining food prices, farmers planned to invest €3.5 billion towards renewable energy in 2010, accounting for 59% of their overall investment of €5.9 billion.[70]

Why are German farmers doing this? The reason is simple: for countries like Germany that have to import large shares of their energy, local energy gen-

Studies: The New Climate Policies of the European Union. Brussels 2010. Page 211.

68 German Renewable Energy Agency: A Success Story: Twenty Years of Support for Electricity from Renewable Energies in Germany. 2010. Found at http://www.unendlich-viel-energie.de/en/details/article/523/the-renewable-energy-sources-act.html

69 Forsa, 2/2010: „Erneuerbare Energien" 2009. Found at http://www.unendlich-viel-energie.de/fileadmin/content/Panorama/Meinungen/Forsa-Umfrage_Akzeptanz_2010/FORSA-Akzeptanz%20EE_Einauswertung%20Bundeslaender.pdf

70 Deutscher Bauernverband: Landwirte wollen mehr in erneuerbare Energien investieren. Press release

eration adds an additional layer of protection for the country's energy security. Financial support for renewable energy in Germany has been stable, especially when compared to the volatility of farm commodity prices. Therefore, renewable energy is a relatively safe investment for farmers. In addition, farmers strengthen their standing with the public by improving the environment and reducing energy imports from abroad.[71]

Renewable energy is a safe investment for German farmers.

Germany will continue to transform to an economy based almost completely on renewable energies. A series of recent studies show that in Germany and Europe a complete or nearly complete shift of the power supply to renewables could be achieved.[72] In September 2010, the conservative government under Chancellor Merkel released its energy concept, which outlines the government's plan to increase the share of renewable electricity to at least 38% in 2020 and to 80% by 2050.[73] After the nuclear accident in Japanese Fukushima in March 2011, the German government announced an accelerated phase out of the remaining 17 nuclear power stations. In return, the deployment of energy efficiency and renewable energies is expected to increase again sharper than previously planned.

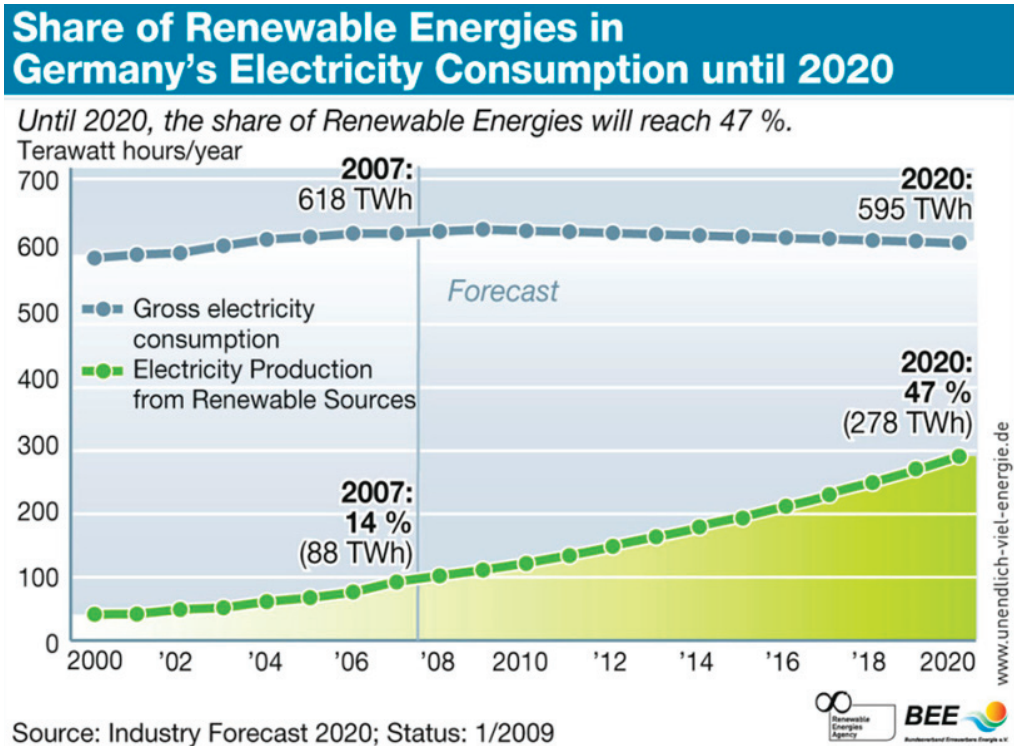

Figure 8: Prediction of share of renewable energy in Germany's electricity consumption 2000-2020. Source: Renewable Industry Association BEE. 2009.

November 12, 2009.

71 Mashinenring: Der Landwirt bringt die Energie. Found at http://www.maschinenring.at/default.asp?id=86906&medium=MR_00E

72 German Advisory Council on the Environment: Pathways towards a 100 % renewable electricity system. January 2011. Page 2. Found at ttp://www.umweltrat.de/SharedDocs/Downloads/EN/02_Special_Reports/2011_01__Pathways_Chapter10_ProvisionalTranslation.html

73 German Federal Ministry of Economics and Technology; German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety (2010): Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply. Found at http://www.bmu.de/files/english/pdf/application/pdf/energiekonzept_

Renewable energy advocates have argued for a long time that the old nuclear power plants had been a bottleneck for greater investment in efficiency and renewables. With the announced nuclear phase out, investors are lining up to put more renewable energy and high-efficiency natural gas plants in place. Overall, CO_2 emissions will not rise as the energy sector has to comply with the European Emissions Trading System (ETS) and the associated emissions cap. So the question is not if Germany will phase out nuclear power, but how quickly. And how can those capacities be replaced with renewable energies?

Wind and solar power will expand the most rapidly under the German renewable energy strategy. Although Germany has received criticism for supporting comparatively high-cost photovoltaic (PV) systems, the government remains committed to growing its PV markets and it seems likely that PV will be competitive with retail electricity within the next two to three years. The official projections are that PV will expand to more than 50,000 MW by 2020.

Most electricity grids have not been built to accommodate the scale of intermittent energy generation (e.g. wind and solar) envisioned in Germany. The government has identified several initiatives to reorganize the grid, including maximizing existing storage options and rolling out innovative battery technologies; relying increasingly on flexible power plants, such as biomass, biogas, and natural gas, that can more readily balance intermittent wind and solar generation; the widespread introduction of smart meters and smart grid technologies, and expanding existing electricity grid infrastructure, including the construction of transmission superhighways that can move electricity between the north of the country, where wind is plentiful, and the south, where the solar resource is stronger.

Rather than viewing the restructuring of the current grid as an insurmountable obstacle, Germany views the challenge as an opportunity for necessary innovation to support an affordable, clean, and more decentralized energy system in the

future. As Germany's Minister of Environment Dr. Norbert Röttgen stated in 2010: "It is economically nonsensical to pursue two strategies at the same time, for both a centralized and a decentralized energy supply system, since both strategies would involve enormous investment requirements. I am convinced that the investment in renewable energies is the economically more promising project."[74]

The future of the German electricity industry will require a rethinking of the way energy is bought, sold and transmitted. In developing the energy concept[75] and in presenting its recent six-point plan for accelerated transition, the Merkel government has identified several key initiatives to reorganize the grid, including:

- Maximizing existing storage options and rolling out innovative new battery technologies
- Relying increasingly on flexible power plants, such as biomass, biogas, and natural gas, that can more readily balance intermittent wind and solar generation
- Strengthening and expanding existing electricity grid infrastructure, including the construction of transmission super-highways that can move electricity between the north of the country, where wind is plentiful, and the south, where the solar resource is stronger.
- Widespread introduction of smart meters and smart grid technologies
- Accelerated energy efficiency deployment

Germany is aggressively pursuing a transition away from both nuclear power and from conventional fossil fuels and will likely reap the benefits of this strategy before other countries. German farmers are actively taking part in this development.

Germany is aggressively pursuing a transition away from both nuclear power and from conventional fossil fuels and will likely encounter the challenges – and reap the benefits – of this strategy before other countries. German farmers are actively taking part in this development. The farm sector will continue to invest in renewable energies. They give the agriculture sector and rural areas new options and can help ensure job creation and added value. With strong political backing, effective community and cooperative involvement, and national recognition of the importance of renewables on farms, the agriculture sector in Germany will continue to boost the financial security of its farmers, strengthen rural communities and contribute to national goals of increased energy independence and fighting climate change.

bundesregierung_en.pdf

74 German Renewable Energy Agency: Renews Special Renewable Energies and Baseload Power Plants: Are They Compatible? June 2010. Page 7. Found at http://www.unendlich-viel-energie.de/uploads/media/35_Renews_Spezial_Renewable_Energies_and_Baseload_Power_Plants-1.pdf

75 German Federal Ministry of Economics and Technology; German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety (2010): Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply. Found at http://www.bmu.de/files/english/pdf/application/pdf/energiekonzept_

ONTARIO

Opportunities for Ontario's Farmers Agriculture Sector

As of 2006, the most recent agriculture census in Canada, Ontario had over 57,000 farms which encompass 5.7 million ha (14 million acres) including area owned, leased or used through other arrangements.[76] The total farm area owned by Ontario farmers is 3.9 million ha (9.6 million acres).[77] This translates into an average farm size of 68 ha or 168 acres. The average farm size in Germany (119 acres) is smaller than in Ontario.[78] In 2006, there were a total of 82,410 farm operators in Ontario, representing less than 1% of the province's total population of 12.2 million residents.

Electricity Generation in Ontario

Nuclear energy continues to provide the majority of electricity in Ontario, while the supply of coal-fired generation is decreasing and is to be completely phased out. In 2009, Ontario introduced a renewable energy "Feed-in Tariff" (FIT) that is mod-

76 Statistics Canada, 2006 Census of Agriculture, Farm Data and Farm Operator Data, catalogue no. 95-629-XWE. http://www.statcan.gc.ca/pub/95-629-x/1/4123823-eng.htm#

77 Ibid.

78 Eurostat (2007): Agricultural Statistics. Data 1995-2005: p.34. http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-ED-07-001/EN/KS-07-001-EN.PDF

eled after Germany's. As a result of this, electricity generation from renewable sources will assist in making up the gap in supply that would have resulted when the coal-fired generating facilities are retired in 2014. Over the next 15 years, Ontario will need to rebuild or retire almost every nuclear reactor in the province. Unlike Germany, Ontario has decided to rebuild most of its nuclear fleet and possibly add a new plant in Darlington, keeping nuclear energy at approximately 50% of Ontario's supply for the foreseeable future.

Figure 9 shows the proportion of total electricity generation supplied by each generation source in Ontario for the year 2010. Total electricity demand for 2010 was 142 TWh.

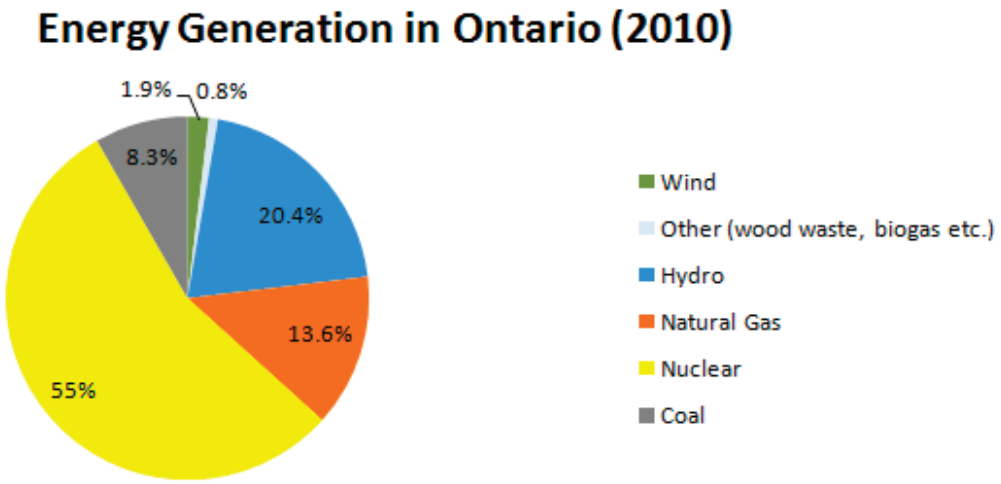

Figure 9: Energy Generation in Ontario 2010. Source: Independent Electric System Operator.[79]

There has been tremendous interest in the FIT. Applications for FIT contracts to add renewable energy capacity to the Ontario grid have exceeded recent estimates from the Ontario Power Authority (OPA) that show over 5,800MW of wind and solar generating capacity will be contracted, under construction or in operation by the end of 2012 with 10,700MW projected by 2018[80], capable of generating the same amount of electricity as a new nuclear plant annually. Applications to the FIT program have already exceeded the projection for 2018. Ontario's microFIT program is geared towards individuals installing solar panels on their own properties, and has already attracted over 25,000 Ontarians to sign up, for a total of 227 MW[81] of new solar systems.[82]

Figure 10 compares the scenario outlined by the Ontario Power Authority, which makes a projection for the proportion of energy that will come from renewable and non-renewable sources in 2030.[83] The OPA estimate assumes continua-

79 Independent Electric System Operator, Supply Overview, 2011. http://www.ieso.ca/imoweb/media/md_supply.asp (accessed May 2, 2011).

80 Independent Electric System Operator,"The Electricity Insider", February, 2011. http://www.ieso.ca/imoweb/pubs/electricity_insider/EI_v2-i1.pdf (accessed May 2, 2011).

81 Not including applications that have been withdrawn or rejected.

82 Ibid.

83 Ontario, Ontario's Long-Term Energy Plan: Building Our Clean Energy Future, 2010. http://www.mei.gov.on.ca/en/pdf/MEI_LTEP_en.pdf (accessed May 2, 2011).

tion of the FIT but uses a very conservative estimate of the level of uptake of the FIT. Interest in the FIT has already exceeded long-term estimates. If this rate of uptake can be sustained into the future, renewables could account for over 60% of the electricity generated in Ontario by 2030.

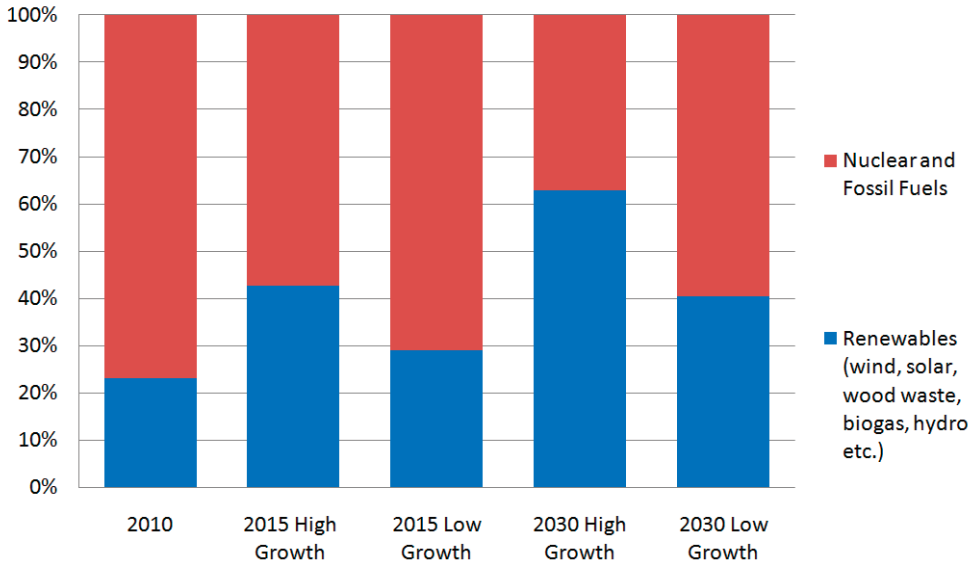

Figure 10: Comparison of electricity generation estimates with low and high rates of uptake of the FIT. Sources: Calculation based on FIT Contract rates and data from IESO[84] and OPA[85]

Federal Incentives for Renewables

The federal government has introduced various programs to help spur investment in renewables, each with varying success in Ontario. Programs range from tax exemptions, to subsidies, loans, and direct investment. A key program for wind energy which was available until March 2011 was the ecoENERGY for renewable energy program, which built upon the Wind Power Production Incentive. This program which provided a 1 cent/kWh subsidy for renewable energy generation was rapidly taken up in provinces where the industry could readily respond to such an incentive.

Provincial Incentives for Renewables

The Feed-in Tariff (FIT) that was introduced under the Green Energy and Economy Act (GEA) has proven to have been the most successful program in Canada for encouraging rapid investment in renewable electricity generation. The GEA was implemented by the government of Ontario in order to help phase out coal use

The Feed-in Tariff (FIT) that was introduced under the Green Energy and Economy Act (GEA) has proven to have been the most successful program in Canada for encouraging rapid investment in renewable electricity generation.

84 Independent Electric System Operator, Supply Overview, 2011. http://www.ieso.ca/imoweb/media/md_supply.asp (accessed May 2, 2011).

85 Ontario Power Authority, Bi-weekly FIT and MicroFIT Report: Data as of April 29th, 2011. http://fit.powerauthority.on.ca/sites/default/files/Bi-Weekly%20FIT%20and%20microFIT%20Report%20April%2029%2C%202011.pdf (accessed May 2, 2011).

entirely and to minimize the province's long-term dependence on imported fossil fuels. Prior to the FIT, Ontario had experimented with a smaller initiative entitled the Renewable Energy Standard Offer Program. This program was introduced in November 2006 and ran until it was replaced by the Feed-in Tariff under the Green Energy Act (GEA) in October 2009. The RESOP provided a standard pricing regime for small projects and simplified eligibility, contracting and other rules. Project sizes were capped at 10 MW and projects were restricted to distribution grid access. Eligible fuel sources included wind, solar PV, renewable biomass, biogas, biofuel, landfill gas or water.[86]

The rate paid for water, biomass and wind energy under the RESOP was a base price of 11.08 cents per kWh, pegged to inflation, with an on-peak rate adder of 3.52 cents per kWh (for water and biomass only). The rate for solar PV was originally introduced at this same base price but was later increased to 42 cents per kWh.[87]

The FIT diverged from the RESOP in a number of ways. It offers range of prices for electricity from different technologies based on the cost of power production from those systems.[88] FIT projects are not restricted to connection on the distribution grid, but can also be connected to the transmission grid. In fact, the GEA gives priority to the connection of FIT projects onto the grid. The GEA also includes incentives for power produced during peak times. Projects will earn the posted FIT price multiplied by 1.35 during peak periods, and the FIT price multiplied by 0.9 during off-peak periods. The posted "contract" price is a calculated return and assumes a 75% operational capacity. Through good planning, biogas systems should be able to capture virtually all on-peak hours, potentially earning more than the posted contract price.[89]

FIT contract prices were established by incorporating the cost of purchasing, financing, building and maintaining a project as well as a reasonable rate of return on investment over the contract period. Different rates have been set for each technology type and for project size categories based on different costs associated with these projects, allowing developers to earn the same reasonable rate of return on their investment. FIT contract prices will be reviewed every two years to ensure the rates reflect technological advances and other factors that may lead to changes in costs. Changes in prices related to the two-year review will only apply to new projects.[90]

86 Ontario Power Authority, Ontario's Renewable Energy Standard Offer Program, (Toronto, ON: OPA, 2008). http://archive.powerauthority.on.ca/sop/Storage/78/7348_OPA_RESOPbro_Jul16.pdf (accessed May 5, 2011).

87 Ontario Power Authority, Ontario's Standard Offer Program, 2009. http://archive.powerauthority.on.ca/sop/ (accessed May 5, 2011).

88 Ontario Ministry of Agriculture, Food and Rural Affairs, Ontario Biogas System Update: Feed-In Tariff, Green Energy Act and Regulated Mixed Anaerobic Digestion Facility Rules, 2011. http://www.omafra.gov.on.ca/english/engineer/facts/fit_prog.htm (accessed May 9, 2011).

89 Ontario Ministry of Agriculture, Food and Rural Affairs, Ontario Biogas System Update: Feed-In Tariff, Green Energy Act and Regulated Mixed Anaerobic Digestion Facility Rules, 2011. http://www.omafra.gov.on.ca/english/engineer/facts/fit_prog.htm (accessed May 9, 2011).

90 Ontario Power Authority, Pricing and Payment, 2010. http://microfit.powerauthority.on.ca/pricing-and-payment (accessed June 7, 2011).

The FIT also provides a "community adder", which pays eligible applicants up to an additional 1 cent per kWh.[91] Applicants who are eligible for the community adder include one or more individuals resident in Ontario, includes farmers. If a farmer owns more than 50% of the controlling interest in a wind turbine or a wind farm of multiple turbines, they will qualify for the full community wind adder.[92] More details are provided under the section, "Community-based Ownership".

Community groups also qualify for reduced security payments. Projects for which a community group has a 50% interest are eligible for reduced application security ($5 per kW, regardless of the renewable fuel type).[93]

Economic Growth

The growth in clean and renewable sources of energy that is arising following the enactment of the Green Energy Act is expected to create 50,000 direct and indirect jobs across the province in the first three years alone in smart grid and transmission and distribution upgrades, renewable energy and conservation.[94] Between 2003 and 2010, Ontario signed 16,000 contracts under the RESOP and the FIT representing 2,400MW. In total, these contracts are projected to create approximately 20,000 direct and indirect clean energy jobs.[95] Further investment in clean energy production and manufacturing is anticipated with the growth of the industry. A stable business environment and an expectation of growing demand for renewable energy equipment are essential to attracting local and global investment for manufacturing.

A stable business environment and an expectation of growing demand for renewable energy equipment are essential to attracting local and global investment for manufacturing.

Colleges in Ontario are recognizing that there will be a need for skilled labour to respond to the needs of a growing renewable energy industry. Thirty-five new programs have been introduced across Ontario over the past three years to respond to the interest in sustainable energy trades. The programs produce employees who are ready for innovations in everything from green business management to alternative energy technology. The goal of the colleges is to accelerate the green economy by helping Ontario companies find "made in Ontario" solutions to their green challenges – from energy management to waste and toxins reduction, and by addressing many specialized barriers facing green entrepreneurs – technology, marketing, skills, regulation.[96]

91 Ontario Sustainable Energy Association, Renewable Energy World – Ontario will pay farmers 14.5 cents per kWh for their wind generation, 2011. http://www.ontario-sea.org/Page.asp?PageID=122&ContentID=2352 (accessed May 3, 2011).

92 Ontario Sustainable Energy Association, Renewable Energy World – Ontario will pay farmers 14.5 cents per kWh for their wind generation, 2011. http://www.ontario-sea.org/Page.asp?PageID=122&ContentID=2352 (accessed May 3, 2011).

93 Ontario Power Authority, Community Participation, 2010. http://fit.powerauthority.on.ca/community-participation (accessed June 6, 2010).

94 Ontario, Ontario's Long-Term Energy Plan: Building Our Clean Energy Future, 2010. http://www.mei.gov.on.ca/en/pdf/MEI_LTEP_en.pdf (accessed May 2, 2011).

95 Ibid.

96 Colleges Ontario, Colleges Driving a Sustainable Future: New Careers for a Clean Economy, 2010. http://www.collegesontario.org/research/sustainability_report_oct2010.pdf (accessed May 13, 2011).

The solar industry in Canada currently employs between 2,000 and 3,000 people.[97] The Canadian Solar Industry Association estimates that 15 jobs are created in manufacturing, installation and other fields, for every megawatt of solar installed. Installing the over 1,300MW of solar contracts already signed could result in more than 20,000 jobs being created.

Wind Energy in Ontario

Successful wind energy development is based on locating turbines in the areas where the wind resource is greatest. Because the energy generated is based on the cube of the wind speed, slight changes in wind speed can make a large difference in the energy that can be generated and the resulting revenue. The cost of generation from wind turbines in windy areas is significantly lower than in less windy locations. The map in Figure 11 depicts the average spring wind speed at 80 metres above ground level for Ontario. Stronger winds indicate where the best locations for future development are in the province, and where transmission lines are accessible will be where much of the wind development is likely to occur. More details can be found at the Ontario Ministry of Natural Resources' Renewable Energy Atlas including wind resources and water resources, as well as useful planning information such as land use, bat hibernacula, and administrative boundaries.[98]

The wind industry in Ontario is predicted to install 5.6GW of wind energy capacity, create 80,000 person-years of employment, attract $16.4 billion of private investment and contribute $1.1 billion of revenue.

Investment in wind energy generating assets has grown steadily in Ontario since 2006. Wind generation output has grown almost 5 fold between 2006 and 2011 in Ontario. Figure 12 illustrates the effect that energy policy has on the development of renewable energy resources. As discussed above, in the absence of a conductive business environment provincially, the federal incentive did little to attract investment in renewable energy to Ontario on their own until they were paired with government-issued requests for proposals (RFP) which allowed the industry to grow slowly in a stepwise pattern. Although there was some further uptake of the RESOP, interest was limited due to size limits on the program. With the replacement of the RESOP by the FIT, wind energy capacity has steadily grown, and based on the contracts that have been issued under the FIT (2,150 MW)[99], estimates for growth in the coming years are more than double what has been installed to date (1,650)[100].

Over the period of 2011 to 2018, the wind industry in Ontario is predicted to install over 5.6 GW of wind energy capacity, create over 80,000 person-years of employment, attract $16.4 billion of private investment and contribute more than $1.1 billion of revenue to municipalities and landowners.[101]

97 Saunders, C., "Solar energy: a hot new harvest," The Globe and Mail, April 21, 2010. http://www.theglobeandmail.com/report-on-business/solar-energy-a-hot-new-harvest/article1542027/ (accessed May 3, 2011).

98 Ontario Ministry of Natural Resources, Renewable Energy Atlas, 2010. http://www.lio.ontario.ca/imf-ows/imf.jsp?site=renew_en (accessed May 4, 2011).

99 Ontario Power Authority, Bi-weekly FIT and MicroFIT Report: Data as of April 29th, 2011. http://fit.powerauthority.on.ca/sites/default/files/Bi-Weekly%20FIT%20and%20microFIT%20Report%20April%2029%2C%202011.pdf (accessed May 2, 2011).

100 Canadian Wind Energy Association, Map of Installations, 2011. http://www.canwea.ca/farms/wind-farms_e.php (accessed May 11, 2011).

101 ClearSky Advisors Inc., The Economic Impacts of the Wind Energy Sector in Ontario 2011 – 2018, 2011.

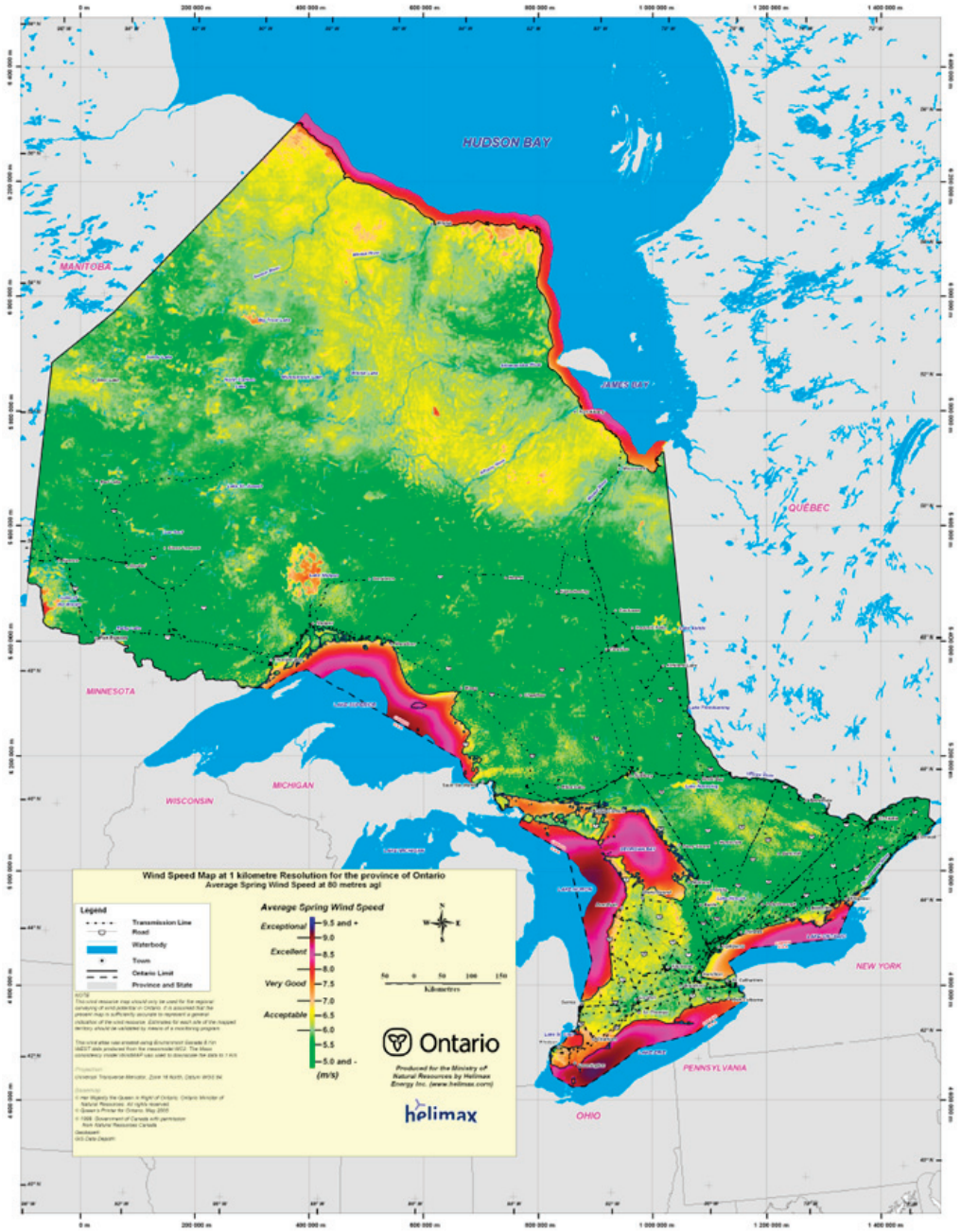

Figure 11: Average Spring Wind Speed at 80 metre heights in Ontario. Source: Ontario Ministry of Natural Resources[102]

102 Ontario Ministry of Natural Resources, Wind speed map at 1 kilometre resolution for the province of Ontario, Average Spring Wind Speed at 80 metres agl, Helimax, 2005. http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@renewable/documents/document/mnr_e002300.pdf (accessed May 4, 2011).

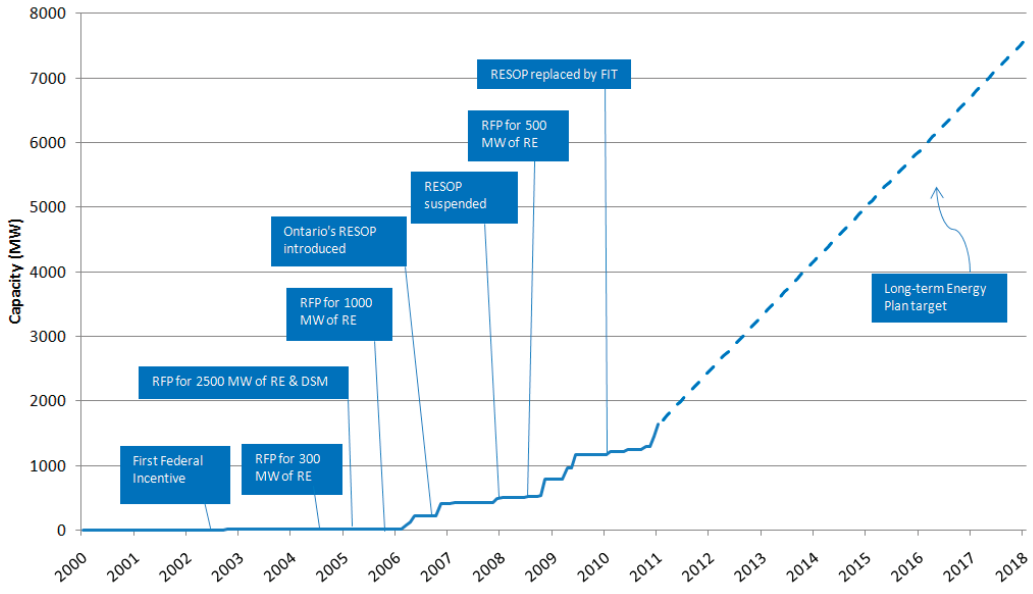

Figure 12: Growth in wind energy capacity in Ontario and estimated growth based on FIT contracts. Sources: CanWEA[103], OPA[104] and Ontario Ministry of Energy[105]

Biogas Industry in Ontario

Ontario is becoming a leader in Canada in biogas production and there is potential for further growth in the industry. At least 20 biogas facilities were expected to be operating in 2010 on farms and at, or near food processing plants in Ontario.[106]

Benefits to on-farm biogas production include reduction of odours and contamination of water when manure is used as a feedstock, generation of heat and electricity, reduction of greenhouse gases generated by the farm operation, and production of a valuable digestate (biofertilizer) that can be used in place of chemical fertilizer (further reducing GHG emissions from farms).[107] The digestate has a preferable nutrient mix to manure and is also safer for application since pathogens such as E. coli bacteria are reduced considerably in most biogas production processes, typically by up to 99%.[108]

103 Canadian Wind Energy Association, Map of Installations, 2011. http://www.canwea.ca/farms/wind-farms_e.php (accessed May 11, 2011).

104 Ontario Power Authority, Bi-weekly FIT and MicroFIT Report: Data as of April 29th, 2011. http://fit.powerauthority.on.ca/sites/default/files/Bi-Weekly%20FIT%20and%20microFIT%20Report%20April%2029%2C%202011.pdf (accessed May 2, 2011).

105 Ontario Ministry of Energy, Ontario's Long Term Energy Plan: Building Our Clean Energy Future, 2010. http://www.mei.gov.on.ca/en/pdf/MEI_LTEP_en.pdf (accessed June 10, 2011).

106 Ontario Ministry of Agriculture, Food and Rural Affairs, Biogas (Anaerobic Digestion), 2011. http://www.omafra.gov.on.ca/english/engineer/ge_bib/biogas.htm#1 (accessed May 9, 2011).

107 Government of Canada, Renewable Energy Policies for Remote and Rural Communities, Energy Policy Assessment - Final Report, 2009. http://www.rural.gc.ca/RURAL/display-afficher.do?id=1290792790023&lang=eng (accessed June 7, 2011).

108 Government of Oregon. 2009. Biogas Technology. Available at http://www.oregon.gov/ENERGY/RENEW/Biomass/biogas.shtml (accessed July 28, 2009).

Another source of material for biogas systems is food-based inputs, including food processing byproducts, 'plate food waste' (from homes, institutions, restaurants) and off-specification or out-of-date food products.[109] Based on estimates of diverting 50% of food-based inputs could support 40MW to 305MW of continuous electrical capacity.[110] Additionally, approximately 33,000 tonnes/day of manure from all over the province could be effectively diverted into biogas systems. This would result in the production of 820MW of continuous electrical power.

Further production is possible using crop residues. In Ontario, 615,000 oven-dry-tonnes (odt) of wheat straw and 1.9 million odt of corn stover are available annually, taking into account the proportion of materials that is retained for soil amendment and animal bedding. Although corn stover represents a larger feedstock pool than cereal straw, collection and transportation systems for stover require further development before this residue source can be widely utilized.[111] Full integration of the available crop residue into biogas systems could support around 175MW of electricity capacity development.

On-farm biogas production reduces odours and contamination, generates heat and electricity, reduces greenhouse gases, and produces valuable digestate (biofertilizer) .

Farm-based biogas is most commonly combusted in an internal combustion system for electricity generation while making use of the heat produced in the process. Overall energy conversion efficiency is in the range of 70-82% with 30-42% of energy typically available as electricity and approximately 40% of the energy available as surplus heat. Unless a host for the heat can be found that requires ongoing heat, not all of the heat produced can be used. In Ontario, there is no clear process for selling heat.[112]

Geography is a factor in the use of heat since heat hosts like district heating systems need to be located in close proximity to biogas facilities. The distance between the biogas source and heat production can be bridged by upgrading biogas so that it can be put into the natural gas pipeline system. Biogas needs to be refined to remove hydrogen sulfide, moisture and other impurities. This process has not yet been demonstrated in Ontario.[113]

Ontario Power Authority does not distinguish among the various types of bioenergy projects for which applications to the FIT have been submitted. There are six bioenergy projects operating that have been assigned contracts under the FIT, representing 8MW of electricity. There are currently 36 projects that have been granted contracts and are currently under development, representing 48MW

109 Ontario Ministry of Agriculture, Food and Rural Affairs, Food-Based Inputs for Biogas Systems in Ontario: How Much is Out There?, 2011. http://www.omafra.gov.on.ca/english/engineer/facts/food_input.htm (accessed May 9, 2011).

110 Ontario Ministry of Agriculture, Food and Rural Affairs, Food-Based Inputs for Biogas Systems in Ontario: How Much is Out There?, 2011. http://www.omafra.gov.on.ca/english/engineer/facts/food_input.htm (accessed May 9, 2011).

111 Helwig, T. et al., Agricultural Biomass Residue Inventories and Conversion Systems for Energy Production in Eastern Canada (Ste. Anne de Bellevue, QC: Natural Resources Canada, 2002). http://www.reap-canada.com/online_library/feedstock_biomass/7-Agricultural%20Biomass%20Residue%20Inventories%20and%20Conversion...Samson%20et%20al.%202002.pdf (accessed May 19, 2011).

112 Ontario Ministry of Agriculture, Food and Rural Affairs, Considerations and Opportunities for Building a Farm-Based Anaerobic Digester System in Ontario, 2011. http://www.omafra.gov.on.ca/english/engineer/facts/consider.htm (accessed May 9, 2011).

113 Ontario Ministry of Agriculture, Food and Rural Affairs, Considerations and Opportunities for Building a Farm-Based Anaerobic Digester System in Ontario, 2011. http://www.omafra.gov.on.ca/english/engineer/facts/consider.htm (accessed May 9, 2011).

of energy. Another 101 applications have been submitted for bioenergy projects under the FIT, representing 287MW of electricity.[114]

Solar Energy in Ontario

Worldwide, the solar energy sector is growing rapidly. Installation of PV capacity in 2009 was up nine-fold over 2008.[115] Much of this growth is due to international FIT programs similar to Ontario's. Ontario's FIT defines different rates for solar PV projects based on the size of the system and whether it is rooftop or ground-mounted.[116] Although these rates are significantly higher than the average cost of electricity, solar PV is market competitive at peak demand. The FIT rates have been set to include a modest profit of about 10% annual return. This has attracted numerous individuals in Ontario to invest in solar PV, as shown by the number of applications submitted for the FIT (5,467 applications) and the microFIT (28,411 applications).

The Green Energy Act has established bi-annual rate reviews to account for the continually declining cost of solar PV due to rapidly expanding production capacity and innovations in design leading to greater efficiency of PV module operation. The Canadian Solar Industries Association forecasts PV project costs to drop by more than 50% by 2025.

The FIT rates for solar PV are higher than for other technologies because of the high costs to buy solar PV systems.[117] However, recent advances in solar PV technologies have drastically reduced the cost of systems.

A recent review of the microFIT ground-mounted solar price category resulted in reduction in the rate. The rate incorporates cost inputs and project configurations, including operating and maintenance costs for ground-mounted solar tracking systems. Although solar tracking systems have a higher up front cost, they yield higher electricity generation, improving project economics. As with all other technologies included in the microFIT, each price category was set to meet an approximate 11% return on investment and between a 9- and 11-year payback.[118]

Community-based Ownership

Numerous benefits of community ownership of renewable energy resources have been identified where this ownership model has been embraced. Community-based

114 Ontario Power Authority, Bi-Weekly FIT and microFIT Report, Data as of April 29th, 2011. http://fit.powerauthority.on.ca/sites/default/files/Bi-Weekly%20FIT%20and%20microFIT%20Report%20April%2029%2C%202011.pdf (accessed May 9, 2011).

115 Canadian Solar Industries Association, Solar Vision 2025, 2011. http://www.cansia.ca/node/6512 (accessed May 13, 2011).

116 Ontario Power Authority, Solar PV Quick Facts Table, 2011. http://fit.powerauthority.on.ca/quick-facts-table-0 (accessed May 13, 2011).

117 Ontario Power Authority, Pricing and Payment, 2010. http://microfit.powerauthority.on.ca/pricing-and-payment(accessed June 7, 2011).

118 Ontario Power Authority, Ground-mounted solar finalized price announcement, 2010. http://microfit.powerauthority.on.ca/ground-mounted-solar-finalized-price-announcement (accessed June 7, 2011).

ownership can lead to greater job creation, higher pay and increased local economic development since a greater proportion of income is retained in the community. Community ownership also offers opportunities for First Nations.[119]

The FIT community adder encourages communities and aboriginal groups to develop renewable energy projects. The additional amount is paid in recognition that it is more costly and challenging for these groups to establish projects compared to corporations that develop renewable energy as part of their core business. Figure 13 provides the community adder rates and eligible amount based on level of community control. The price adders vary by technology and decline with reduced involvement of the community.[120]

Renewable fuel	Maximum community price adder (¢/kWh)
Wind	1.0
Solar PV (ground mounted)	1.0
Water	0.6
Biogas	0.4
Biomass	0.4
Landfill gas	0.4

Level of community control	Eligible amount of price adder
50%-100%	full
40%-49%	80%-98%
25%-39%	50%-78%
10%-24%	20%-48%
<10%	0

Figure 13: FIT Community Adder Rates and Eligibility. Source: Ontario Power Authority[121]

Community control refers to the level of ownership of a project by "community investment members". There are four categories of community investment members: one or more individuals Resident in Ontario; a Registered Charity with its head office in Ontario; a Not-For-Profit Organization with its head office in Ontario; and a "co-operative corporation", as defined in the Co-operative Corporations Act (Ontario), all of whose members are Resident in Ontario.

The microFIT program was established specifically to encourage homeowners, farmers, farm co-operatives, First Nations, small businesses and institutions such as schools, to own and develop small renewable projects. However, commercial aggregators-businesses that lease land or rooftops from individuals for multiple renewable energy projects also found opportunities to benefit from the microFIT program. A recent review of the program resulted in a decision to disallow commercial aggregators from participating in the microFIT program, ensuring the program is focused on its original purpose.[122]

An important barrier that continues to confront community power development is obtaining funding for the early high-risk stages of project development.

119 Pukwis Energy Co-op, Locally-Owned Wind Projects, http://windfallcentre.ca/pukwis/index.php?st=1&s=Community_Wind_Power&p=Economic_Benefits (accessed May 4, 2011).

120 Ontario Power Authority, Price Adder, 2010. http://fit.powerauthority.on.ca/price-adder (accessed May 4, 2010).

121 Ibid.

122 Ontario Power Authority, Ground-mounted solar finalized price announcement, 2010. http://microfit.powerauthority.on.ca/ground-mounted-solar-finalized-price-announcement (accessed June 7, 2011).

In Ontario, the Community Power Fund has been established to support community organizations in the early stages of project development through grants, loans and investment equity. This non-profit corporation was founded with initial funds provided by the Ontario government. The Community Power Fund supports early stages of project development with grants for community-based renewable energy projects.[123]

The Community Power Fund also co-manages the Community Energy Partnerships Program which provides grants of up to $200,000 to support community power projects in Ontario. The Community Power Fund website (www.cpfund.ca) provides links to other sources of funding for community power.[124]

Locally-owned wind projects can create up to ten times more economic activity in the local community than large developments owned by companies from outside of the community and region.

Community ownership results in more equitable distribution of revenues among citizenship, with the benefits spread more widely across Ontario and a greater proportion of revenues remaining in Ontario, including local and provincial tax revenue. Local ownership also engages citizens in creating a more sustainable energy system.[125]

Locally-owned wind projects can create up to ten times more economic activity in the local community than large developments owned by companies from outside of the community and region.[126] Such benefits likely extend to other forms of locally-owned or locally-developed renewable energy production.[127]

123 Community Power Fund, http://www.cpfund.ca/about-the-fund.html (accessed June 7, 2011).

124 Community Power Fund, http://www.cpfund.ca/about-the-fund.html (accessed June 7, 2011).

125 Pukwis Energy Co-op, Locally-Owned Wind Projects, http://windfallcentre.ca/pukwis/index.php?st=1&s=Community_Wind_Power&p=Economic_Benefits (accessed May 4, 2011).

126 Welsh, Teresa. 2005. Small Packages, Big Benefits. Iowa Policy Project. Available at http://www.cpfund.ca/pdf/iowa-policy-project.pdf (accessed July 28, 2009).

127 Bailie, A. et al., Renewable Energy Policies for Remote and Rural Communities: Energy Policy Assessment, (Drayton Valley, AB: The Pembina Institute, 2009). http://www.rural.gc.ca/RURAL/display-afficher.do?id=1290792790023&lang=eng (accessed June 7, 2011).

Feed-in tariffs with differentiated tariffs based on project size and technology provide the flexibility to support multiple types of ownership models and technologies. The government implementing the FIT will need to work closely with communities to ensure that the tariff design is aligned with community and regional objectives.[128]

In an economic study of a 100MW wind farm in New Brunswick, the authors concluded that it is clear that the main economic impact of a 100MW wind farm is through the ownership of a wind farm.[129]

The authors of the report use a hypothetical wind farm to illustrate the effect that local ownership has on retention of benefits locally. Three scenarios for the 100MW wind farm were evaluated: 0% ownership by in-province investors, 30% ownership, and 100% ownership by investors located within the province of New Brunswick. The table below shows the resulting economic benefit in the province.

	Degree of in-province ownership		
	0%	30%	100%
Total profits	$200 million	$200 million	$200 million
Profits retained in New Brundwick	$0	$60 million	$200 million
Profits flowing outside of New Brunswick	$200 million	$140 million	$0

Figure 14: Benefit retained locally based on local ownership level. Source: Gagnon, Y., et al., 2009[130]

The authors also evaluated job creation during the construction and operations phase of the 100MW hypothetical wind farm. Based on case studies from across Canada, the authors estimated that the construction phase alone of a generic 100MW wind farm would generate 81 person-years of direct employment in the province. The operations and maintenance phase would generate 9 direct jobs on a yearly basis. In addition, for each $1 million of expenditures on wind power, another 2.7 indirect jobs are created, thus a 100MW wind farm would result in 92 person-years of indirect employment during the construction phase and 4 indirect jobs would be generated on a yearly basis during the operations and maintenance phase.[131]

128 Bailie, A. et al.,Renewable Energy Policies for Remote and Rural Communities: Energy Policy Assessment, (Drayton Valley, AB: The Pembina Institute, 2009). http://www.rural.gc.ca/RURAL/display-afficher.do?id=1290792790023&lang=eng (accessed June 7, 2011).

129 Gagnon, Y., et al., Economic Impact of a 100 MW Wind Farm Project in New Brunswick, Universite de Moncton, 2009.

130 Gagnon, Y., et al., Economic Impact of a 100 MW Wind Farm Project in New Brunswick, Universite de Moncton, 2009.

131 Gagnon, Y., et al., Economic Impact of a 100 MW Wind Farm Project in New Brunswick, Universite de Moncton, 2009.

Rural Interest in Renewable Energy

Agricultural producers are looking for ways to improve revenues and ensure that they can pass on the family farm to their children. They are also seeking opportunities to reduce their environmental impact. In a 2009 survey of 1,172 producers and agribusinesses from across Canada, 60% responded that they were considering new ways to find financial value by reducing their environmental impact. Of these respondents, 37% are considering the use of renewable energy sources in their operation.[132]

The prospect of installing renewable energy generating equipment is especially attractive to tobacco farmers in Ontario who have suffered from declining demand for their product. Many of the farms consist of 100 acres or less, limiting the kinds of crops that could generate sufficient revenue to sustain the farms. Farmers are seeing wind and solar energy as a potential revenue source. Joe Botscheller of the group, Farmers for Economic Opportunity points out that, "Harvesting the sun and the wind will provide a steady income and hopefully helps sustain the rural communities in this area as well." The group has started discussing the idea of small-scale power generation at town hall meetings. Botscheller suggests that adding solar power cannot save the family farm on its own but that it is a step in the right direction. He has invested in a 7.6m^2 array that will be located where his tobacco drying shed once was. Installations of this sort require an investment of $60,000-90,000 but can generate returns of 15-20% annually, generating an extra $1,100 per month for 20 years.[133]

Harvesting the sun and the wind will provide a steady income and hopefully helps sustain the rural communities in this area as well.

Rent payments for wind developments in Ontario range from $1,250 to $5,000 per turbine or royalties ranging from 1.75% to 3% of gross revenues from the turbine or turbines on the landowner's property. Various factors affect the level of compensation paid to landowners such as annual energy output, the power purchase agreement (or FIT contract rate), and the value of the property to the project.[134]

Farmers can take advantage of crop residues and manure for bioenergy production. Once the equipment is in place, biogas produced from manure can add $4,000-$5,000 per month of income. Depending on the crop, one to four tonnes per acre of residues may be produced (straw, corn stover). At a price of $80-110/tonne, sale of this agricultural residue can add more than $200 of gross income per acre to a farm. The Ontario Federation of Agriculture is currently organizing a new cooperative to buy, process and sell agricultural residue as pellets to Ontario Power Generation in conjunction with 10 other groups in the farming community and some non-farm groups. This is a pilot project being used to test interest in pellet production and the business case for selling pellets.[135]

132 Agriculture and Agri-Food Canada, "Government of Canada Delivers Energy Loans for Farmers", news release, February 22, 2010. http://www.agr.gc.ca/cb/index_e.php?s1=n&s2=2010&page=n100222 (accessed May 3, 2011).

133 Saunders, C., "Solar energy: a hot new harvest," The Globe and Mail, April 21, 2010. http://www.theglobeandmail.com/report-on-business/solar-energy-a-hot-new-harvest/article1542027/ (accessed May 3, 2011).

134 Gipe, P. and J. Murphy, Ontario Landowner's Guide to Wind Energy (Toronto, ON: Ontario Sustainable Energy Association, 2005). http://www.canwea.ca/pdf/OSEA-2005-r1.pdf (accessed May 2, 2011).

135 Ted Cowan, Researcher, Ontario Federation of Agriculture, http://www.webcastcanada.ca/ofa-video/ted-apr09.htm (accessed May 2, 2011).

Ontario - Germany Comparisons

Feed-in Tariff

Ontario's feed-in tariff was modelled after Germany's groundbreaking FIT policy. Successful renewable energy programs can be judged on a number of criteria.

There has been widespread uptake of Germany's FIT by individuals and community cooperatives without such an incentive. In fact up to 50% of German wind turbines are owned by local communities and co-op. In order to try to replicate these successes, Ontario's FIT also includes a bonus payments or adders for social benefits such as community development.

However, while many community projects have begun they still face additional barriers such as access to financing and so in Ontario the majority of large-scale projects are privately developed.

In terms of fostering renewable energy growth, Ontario's FIT is a significant improvement over the previous renewable energy policy which provided a Standard Offer Contract. Drawbacks to that program included a project limit of 10MW, a standard tariff for all technologies except solar and tariffs based on avoided cost. Although this program helped in developing the capacity in the province, it was not ambitious enough on its own to drive major levels of development or investments.[136] The FIT introduced as part of the Green Energy Act (GEA) has shown that the introduction of a progressive, groundbreaking program can attract significant investment into renewable energy. As of April 29th, 2011, 3,058MW of renewable energy projects are under development, 13MW are in commercial operation and contracts have been offered for a further 404MW.

The FIT introduced as part of the Green Energy Act (GEA) has shown that the introduction of a progressive, groundbreaking program can attract significant investment into renewable energy.

	Germany	Ontario
Program and project size is not capped	√	√
20 year or longer contract term	√	√
Several technologies included	√	√
Tariffs are based on the cost of generation rather than avoided cost	√	√
Tariffs are differentiated by technology	√	√
Tariffs are differentiated by size or application for each technology	√	√
Tariffs are differentiated by resource intensity for wind energy	√	X
Tariffs are indexed to inflation	X	√

Figure 15: FIT comparison between Germany and Ontario. Source: World Future Council[137]

136 Gipe, P. Grading North American Feed-in Tariffs (Washington, DC: World Future Council, 2010). http://www.worldfuturecouncil.org/fileadmin/user_upload/PDF/Grading_N.Am._FITs_Report.pdf (accessed May 19, 2011).

137 Ibid.

Lessons from Germany that can be Applied to Ontario's Emerging Clean Energy Sector

An Aging Grid Presents an Opportunity for Innovation

Germany views the challenge of building the grid to accommodate the scale of intermittent energy generation envisioned in Germany as an opportunity for necessary innovation to support an affordable, clean, and more decentralized energy system in the future.

Phasing Out Non-Renewable Energy Increases Opportunities for Investors

Germany is aggressively pursuing a transition away from both nuclear power and from conventional fossil fuels and will likely reap the benefits of this strategy before other countries. German farmers are actively taking part in this development. With the announced nuclear phase out, investors are lining up to put more renewable energy and high-efficiency natural gas plants in place.

Farmers are Embracing Climate Legislation

Farm lobbies such as the Federation of German Farmers have generally not opposed climate legislation, but have rather fought for more ambitious energy policy to develop renewable resources, recognizing that they are on the front lines of having to adapt to a changing climate. The Federation has advocated for strategic elements to adapt to climate change and possible contributions by the agriculture and forest sector to mitigate climate change, such as with renewable energy.

Farmers Have the Capacity to Drive a Low-Carbon Economy
Agriculture is increasingly a focus for innovative strategies to reduce greenhouse gas emissions. Not only are agricultural harvests threatened by a rapidly changing climate, globally, the energy sector is the only sector producing more greenhouse gas (GHG) emissions than agriculture. Therefore, policymakers are increasingly interested in working with farmers and agricultural organizations to encourage more climate-friendly strategies for existing farming practices, and to enable farmers' investment in low-carbon energy. German farmers have led numerous investments in wind and solar power as well as biogas. This active participation by farmers in clean energy development has been argued as being one of the reasons for the success Germany has had as it transitions to a cleaner energy system.

The Local Economy Benefits from Farmer-Owned Renewable Energy
Renewables offer benefits to the surrounding rural community beyond the farm. Renewable energy from farms can aid in developing and strengthening local economies in two ways. First, supplemental services and product providers will emerge in response to renewable energy development in the community, in turn creating jobs and income. Second, revenue flowing to the farm from renewables can be spent locally.

Consistent Support of Renewable Energy Opens the Door to Manufacturing and Export Opportunities and Creates Jobs
In 2007, Germany exported nearly €8.5 billion in renewable energy technology. Germany's share of the world market for wind energy turbines and components is nearly 30%. The strong growth of renewable energies in Germany has created a lot of new and additional jobs. Latest estimates show there are now around 370,000 jobs in the sector compared to less than 25,000 in the coal industry (from mining to the power plant). This is an increase of around 8% compared to the previous year, and well over twice the number of renewable energy jobs in 2004 (160,500).

Villages and Municipalities Play an Important Role in Rural Areas
Until recently, the idea to power a city or wider area with 100% renewable energy seemed unrealistic. This has changed. Today more than 100 cities, villages, and municipalities pursue to power their energy needs by 100% renewable energies. These communities are not going back to the roots, but they are driven by a fascination for high tech equipment, for strengthening the local economy, for ending the dependency of energy imports both from abroad and big utilities, and for doing something good for the environment by getting away from coal and nuclear power.

Energy Cooperatives are Catalysts of Change
Rural areas and farmers know this business model from agriculture cooperatives. Energy cooperatives offer villages, their citizens and farmers the option to participate for 20 years in large projects requiring significant capital. Germany also has cooperatives that help farmers to buy their machinery. These "Maschinenringe" cooperatives have now expanded their business from standard farm machinery to renewable energy. Between 2003 and 2008, they facilitated the installation of over 1,000 PV roof-mounted installations on farms. All of these systems were purchased and owned by the farmers.

Recommendations for Farmers and Farming Associations

Farmers have several reasons to participate in the green energy economy. As stewards of the land, farmers innately know the value of clean air and water, but also understand the value in using natural resources to produce societal goods. Moving away from polluting sources of electricity generation to clean sources that are continually replenished supports the land ethic held by farmers.

Each year, farmers are at the mercy of the weather. As a result, they are at the forefront of any changes to our climate. The burning of fossil fuels for electricity generation is resulting in climate change and directly affecting farmers' livelihood through extreme events that are becoming more commonplace such as floods and drought. Farmers need to adapt to these changes in order to survive. It is also in the best interest of farmers to seek alternatives to fossil fuels and encourage others to do so in an attempt to prevent worsening of dangerous climate change.

Many farmers across Canada are seeking ways to maintain a financially viable operation and keep the family farm in the family. The opportunities afforded to farmers by the Green Energy Act allow a unique opportunity for Ontario farmers to generate a stable secondary source of income that can make a difference in the ability to meet ongoing financial obligations.

1. Get in on the Action

As an individual farmer, find out what renewable energy resources you can tap into on your land and determine whether a FIT contract could be profitable for you. Farming associations can assist by providing information about renewable energy and linking members who have incorporated renewable energy into their operations with farmers who are interested in doing so.

2. Know Your Rights

As a landowner, know what opportunities and options you have if a private developer wants to use your land. Before signing options or contracts for your land make sure you understand what benefits and what risks you are undertaking. Whether you are interested in developing your own project, leasing land to a commercial developer or working with a community organization to develop a project, landowners need to educate themselves about renewable energy development. Before entering into any kind of agreement related to optioning or leasing land, a landowner should retain legal counsel to ensure that they can fully understand the legal implications of an agreement.

3. Support Green Energy

Lend your voice to the growing numbers of farmers who support green energy. Join one of the farmer advocacy organizations that support green energy or add green energy to the agenda of the organization you below to. Farming associations in Germany were vocal proponents of a feed-in tariff, recognizing the many benefits for German farmers.

4. Form a Cooperative

Cooperatives are a great vehicle to take advantage of the benefits offered by the Green Energy Act's FIT. By pooling resources, farmers can cut costs and build

larger projects yielding higher profit margins. Cooperatives are also a collective voice supporting green energy.

5. Develop Strong Community Networks
The economy of many rural towns and villages is linked to the success of farmers. In Germany, rural communities have established their own renewable energy goals. These communities recognized that the profit that flows to farmers from renewable energy activities also benefits local communities.

6. Pool Resources
Farming associations and cooperatives can help farmers manage costs and reduce the amount of time needed to research equipment by pooling orders for renewable energy equipment. German farmers have benefited from "Maschinenringe", which are cooperatives that help farmers to buy their machinery. These organizations advise farmers on the size of the investment and aggregate the orders from several farmers to lower investment costs through bulk purchases.

Recommendations for Policy Makers

Investors like to see stability and are averse to the risk posed by changes in legislation that would negatively impact their investment. Maintaining the Green Energy Act's FIT with regular, predictable review of the FIT contract rates to ensure competitive pricing will continue to attract billions of dollars of investment to Ontario, resulting in job growth, rural economic diversification and development of the necessary infrastructure to ensure greater prosperity in the future for the province of Ontario.

The FIT also affords the opportunity for greater investment at the local level which can revitalize communities through a greater proportion of the investment being retained locally, and through increased community capacity. The FIT can act as a model for other local investment vehicles that can continue to build the strength of communities but policy makers should also look for ways to enhance the FIT to encourage an even higher level of local investment.

Ontario has put in place leading edge legislation that stands out in front of all other jurisdictions in North America. Like all new policies, there are always opportunities to review, refine and improve issues of concern. Constant improvement is key in staying on the leading edge, and will require attention to technical innovation, as well as innovation in policy making. There is also an important role for the federal government to play in supporting provincial moves to cleaner energy systems.

1. Follow Through with Current Targets and Set a Visionary Renewable Energy Target
Achieving great things is rarely an accident. Having a goal to strive for crystallizes the effort required and brings people together in a common cause. Germany is on track to move from generating 5% of its electricity in 2000 from renewables to 38% by 2020. It has also committed to completely phasing out all nuclear plants by 2022. Currently, nuclear provides 22% of Germany's electricity needs.

By 2050, Germany expects to meet 80% of its electricity demand with renewable energy. Moving from 5% to 80% renewables in 45 years is an ambitious but achievable goal.

Ontario has made major strides forward through introducing the FIT. The province needs to follow through with implementing the actions required to see the FIT achieve its full potential. Understanding that it takes time to see these projects through, policy makers need to allow for implementation to take place but also seize the opportunity to go further.

Ontario has the ability to reach a goal of meeting 50% of its electricity demand with renewable energy by 2030. Setting this goal into policy will necessitate developing policies that will allow the province to meet that goal, will ensure that efforts along the way are tracked, and that achievement of the goal does not go unnoticed.

2. Provide Additional Financing for Community-Based Projects

The funds to cover capital costs for some worthy projects may be beyond the capacity of a local community to raise. Loan guarantees offered to communities and farmer cooperatives for distributed generation projects such as wind energy or biogas can bridge the financing gap.

The provincial government could assist communities with obtaining capital by establishing a government backed financial cooperative to loan funds to community projects. As a way to make funding even more widely available for community projects, the government could guarantee loans. Government loan guarantees both decrease the cost of financing and make financing more readily available to community project developers, reducing barriers to entry for community ownership of renewable power projects.

In addition, the government should provide additional ongoing funding for the Community Power Fund. The Community Power Fund was initially established with seed funding from the Ontario government as part of a coordinated policy approach to renewable power development. In order to initiate more projects, the fund will require more money to cover the initial stages of development. The prefeasibility and feasibility stages are difficult to finance elsewhere, especially for communities, so a program like this is critical for getting projects off the ground. The fund should continue as a revolving fund to help to defray initial project costs and ensure sustainable support is available for future projects.

3. Support 100% Renewable Energy Communities

One size does not fit all. If municipalities want the surrounding farmers to supply power with biogas, wind, or solar, strategies need to be developed that include many stakeholders. These processes need resources. The provincial government can support these efforts through a program of "100% Renewable Communities" that matches efforts of municipalities to develop individualized strategies. A suggested program cap is $50,000 per community.

4. Expand the Mandate and Capabilities of the Renewable Energy Facilitation Office

The Renewable Energy Facilitation Office (REFO) could provide a vital link for communities wanting to develop renewable energy projects. Because power de-

velopment is not the main occupation for community members, additional advice is required to move community projects forward. The REFO could provide tailored advice and non-financial support to community developers. Additional services that the REFO could offer include access to experts and information required during the pre-feasibility, feasibility and contract stages, technical assistance and citizen and community group training.

5. Enable Communities to Conduct Energy Planning and Provide the Resources to Support Community Energy Planning

Municipalities, regional districts and other communities can benefit from reviewing current energy demand and supply systems and planning for change in the future. Future choices are based on estimates of economic costs and environmental implications of current and potential options. Creating these plans allows decision-makers to make choices that best meet the goals of their communities.[138]

The provincial government can support Community Energy Planning by requiring local governments to complete Community Energy Plans; providing financial resources (grants) to communities to hire consultants; creating guidelines for completing the Energy Plans; and providing expert staff to help community staff to develop the plans.[139]

6. Improve Grid Access for Community-Based Projects

The Green Energy Act afforded preferential grid access to all FIT projects however the implementation of this has been restricted by delays in upgrading of grid infrastructure. More funds need to be applied to maintaining and upgrading grid infrastructure in Ontario. In the meantime, adequate grid capacity should be set aside for farmer, community and First Nation projects to be connected to the grid. Finally, specific allocations and set aside should be established for community-owned projects.

Grid access is also hampered by high connection fees and complicated grid connection procedures. Citizens and community groups could be asked to pay preferential rates for interconnection fees or delayed payments that would not be required until the project generates revenue. The grid connection procedure also needs to be simplified in order to accommodate community-based projects. The transmission system is a public system paid for by citizens of Ontario, so the citizens should be given primary access to the system.

7. Increase Research and Funding for Integration of Higher Levels of Renewables onto the Grid

Canada needs to find ways to shift from a non-renewable fuel based system to one that consists mainly of cleaner, renewable fuels. Higher levels of generation from intermittent resources such as solar and wind will necessitate development of energy storage, demand response, better forecasting, and greater levels of intercon-

138 Bailie, A. et al.,Renewable Energy Policies for Remote and Rural Communities: Energy Policy Assessment, (Drayton Valley, AB: The Pembina Institute, 2009). http://www.rural.gc.ca/RURAL/display-afficher.do?id=1290792790023&lang=eng (accessed June 7, 2011).

139 Bailie, A. et al.,Renewable Energy Policies for Remote and Rural Communities: Energy Policy Assessment, (Drayton Valley, AB: The Pembina Institute, 2009). http://www.rural.gc.ca/RURAL/display-afficher.do?id=1290792790023&lang=eng (accessed June 7, 2011).

nection. Funding for research into effective electricity storage methods as well as a tariff paid to suppliers of stored electrical energy will promote a shift to distributed energy. Ontario is a leader in developing renewables. The federal government needs to support these efforts by providing investment into research and development for renewables and electricity storage. Canada should assist the provinces in achieving a higher level of penetration of renewable energy onto the grid.

8. Strengthen Ontario's FIT by Differentiating Tariffs by Renewable Resource Intensity

Because slight differences in the wind resource make a large difference in the energy that can be generated and the resulting revenue, the cost of generation from wind turbines in windy areas is significantly lower than in less windy locations. Policy makers can create equal economic opportunity for all citizens, distribute renewable energy development geographically, and minimizes costs to ratepayers by differentiating wind tariffs by resource intensity. This type of policy avoids a massive concentration of wind turbines in windy areas and levels the accessibility of wind energy projects. Similar local resource differentiation can be made for solar PV and run-of-river hydro.

9. Require Developers to Set Aside Decommissioning Funds

Developers need to be held responsible for projects that are abandoned. The government should ensure that adequate funds are set aside throughout the life of the project by developers to cover the costs of equipment removal when a project reaches its end of life or is abandoned for other reasons. Decommissioning plans are required for a renewable energy approval but there is no requirement for revenue set aside to ensure it happens.

10. Develop a Biogas Roadmap for Ontario

Biogas has enormous potential for farmers. A roadmap could help farmers determine how best to pursue biogas installations through the identification of technological options and regional resource availability. Ontario needs to develop a roadmap to identify the best policy practices, market drivers and barriers to deployment and other important considerations such as the trade-offs between growing feedstocks specifically for biogas production or using only waste streams. Such analyses should be complemented by a perspective on how similar activities on the regional or national level could support this development.

Appendix I: Clean Energy Resources for Farmers in Ontario

Ontario Sustainable Energy Association
www.ontario-sea.org
416-977-4441
The Ontario Sustainable Energy Association offers community power services, project management, research and education, non-partisan policy work, and province-wide capacity building for sustainable energy.

National Farmers Union Ontario
www.nfuontario.ca
office@nfuontario.ca
1-888-832-9638
The National Farmers Union Ontario has developed comprehensive policies related to Family Farms and Renewable Energy. David Hahn is a farmer in Frontenac County who is a knowledgeable and experienced champion of community-based renewable energy opportunities for farmers in Ontario. He is a Director of Local 316 of the NFU. He can be contacted at dhahn@rideau.net or by phone at 613-273-5545.

Ontario Federation of Agriculture
www.ofa.on.ca
info@ofa.on.ca
Tel: 519-821-8883
The Ontario Federation of Agriculture has fact sheets and information on wind leases, solar energy, etc. for farmers. The contact person regarding green energy issues at OFA is Ted Cowan, Policy Researcher.

SWITCH Ontario
www.switchontario.ca
SWITCH connects energy efficiency, conservation, sustainable generation, and transmission businesses, organizations, institutions and individuals in a 5 county area centred on Kingston, Ontario (Prince Edward, Hastings, Lennox & Addington, Frontenac, Leeds & Grenville). Our extended network includes experts in all sorts of renewable energy, and energy savings, including an 'energy expert wiki' relevant to eastern Ontario.

Agrienergy Producers' Association of Ontario
www.apao.ca
The Agrienergy Producers' Association of Ontario contributes to renewable energy policy for biogas while influencing on-going regulatory developments. The APAO provides guidance and assistance on biogas issues to members, as well as facilitating information exchange related to anaerobic digestion and biogas, offering networking, education and outreach activities for members. They also work to produce quality technical research in the field.

Ecological Farmers of Ontario (EFO)
www.efao.ca
Email: info@efao.ca
Tel: 519-822-8606, 1-877-822-8606
The Ecological Farmers of Ontario (EFO) is a not-for-profit organization devoted to the practice and advancement of ecological agriculture. For more than 30 years, the EFAO has provided essential mentorship and training for both new and established producers (both large-scale and small scale) through programs and services delivered regionally across southern Ontario. The EFO works to help all farmers understand the causes and impacts of a changing climate and energy landscape while encouraging farmers to start planning now to reduce fossil fuel use and set achievable goals for the next 10 years. They also support the development of and greater reliance on renewable energy sources for agriculture ensuring that we include diverse systems that rely on human and animal power, not just machine technologies.

Appendix II: Climate Change, Food Security and Renewable Energy in the Global South

The adverse impacts of climate change are undermining food security in the global south. Renewable energy may have the ability to strengthen small-scale local agriculture and, by extension, food security. The following reports examine the impacts of climate change on agriculture, how farmers in the south are adapting, and the potential of clean energy to strengthen small-scale local agriculture.

Who Will Feed the World: The Production Challenge
Oxfam Canada, 26 April 2011
By Lucia Wegne, Senior development economist and independent consultant & Gine Zwart, Oxfam Novib
http://www.oxfam.ca/news-and-publications/publications-and-reports/who-will-feed-world
This report examines how to achieve the objectives of increased food production and food accessibility, while protecting the environment. "Against a background of increasing food insecurity, agriculture in developing countries must undergo a significant transformation in order to increase production and respond to climate change."

Making Integrated Food Energy Systems Work for People and Climate
Food and Agriculture Organization of the United Nations, 2010
www.fao.org/docrep/013/i2044e/i2044e.pdf
This report discusses how safe integration of food and energy production may be one of the best ways to improve national food and energy security and simultaneously reduce poverty in a climate smart way. Farming systems that combine food and energy crops present numerous benefits to poor rural communities. For example, poor farmers can use the leftovers from rice crop to produce bioenergy; other types of food and energy systems use by-products from livestock for biogas and compost production.

Green Economy: Developing Country Success Stories
United National Environment Program, 2010
www.unep.org/pdf/GreenEconomy_SuccessStories.pdf
This report illustrates a positive benefits stream from specific green projects in developing countries, including agricultural projects. For example, one section looks at the benefits accrued for farmers and those in rural areas due to Kenya's feed-in tariff (FIT) policy. Another section details the benefits of organic farming in Uganda.

Climate Change and Food Security: A Framework Document
Food and Agriculture Organization of the United Nations, 2008
110 Pages
http://www.fao.org/docrep/010/k2595e/k2595e00.htm
Climate change will affect all four dimensions of food security: food availability, food accessibility, food utilization and food systems stability. It will have an impact on human health, livelihood assets, food production and distribution channels, as well as changing purchasing power and market flows. Its impacts will be both short term, resulting from more frequent and more intense extreme weather events, and long term, caused by changing temperatures and precipitation patterns.

This document provides background information on the interrelationship between climate change and food security, and ways to deal with the new threat. It also shows the opportunities for the agriculture sector to adapt, as well as describing how it can contribute to mitigating the climate challenge.

Climate, Agriculture and Food Security: A Strategy for Change
Anne Moorhead for The Consultative Group on International Agricultural Research
Funded by the Danish International Development Agency
http://www.ccafs.cgiar.org/resources
This report discusses the cause effect relationship between climate change and agriculture and how climate change threatens food security worldwide, particularly in mid latitude and developing countries. The report then provides a framework for action and strategies for change, such as the development of pro-poor biofuels, as well as future policy needs to cope with food insecurity caused by climate change.