



# Measuring energy conservation on Nova Scotia (NS) farms: A 2004 to 2011 comparison



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## ABSTRACT

Many jurisdictions, including Nova Scotia (NS), have implemented policies and programs around energy. The NS government has targeted energy efficiency and more renewable energy as two main policy areas. The NS Department of Agriculture has taken initiative to provide support to implement energy conservation, energy efficiency and renewable energy opportunities in recent years but have these programs and policies been effective? A baseline energy use survey was conducted in 2005 and responses from mail surveys in 2012 ( $n = 273$ , 11.4% response rate) were used to measure the change in NS farm energy use data reported for 2004 and 2011. There have been significant reductions in energy use on NS farms. On average, NS farmers spent \$8790 on energy expenses in 2011 compared to \$11,228 in 2004. Adjusting for inflation, this is a 32% decrease, despite energy commodity pricing increases beyond the inflation rate. This is likely due to a decrease in energy use and a shift from gasoline use to diesel use. By the end of 2012, 36.0% of NS farmers (more than 860) had received some level of support to evaluate their energy options. This includes 410 energy audits compared to only 36 by the end of 2005.

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## 1. Introduction

Energy conservation, energy efficiency and renewable energy have been worldwide topics of discussion for years [1]. There is a need to move away from fossil-fuel-based energy, reduce primary energy consumption while maintaining or increasing energy service, and use sustainable energy sources [2]. Many jurisdictions have implemented policies and programs around energy [3].

The Government of Nova Scotia has developed policies to promote energy conservation and renewable energy. These policies help reduce greenhouse gas (GHG) emissions and improve energy sustainability. Nova Scotia's Environmental Goals and Sustainable Prosperity Act (EGPSA) was created in 2007 with 21 goals in the following areas: ecosystem protection, air emissions, renewable energy, water quality, contaminated sites, solid waste, sustainable purchasing, and energy-efficient buildings [4]. Nova Scotia's 2009 Energy Strategy vision is a sustainable energy future [5]. The strategy lists increased energy efficiency and more renewable

energy as two main policies for NS [5].

The NS Department of Agriculture has taken initiative to provide support to implement energy conservation, energy efficiency, and renewable energy opportunities on farms. Mitigating energy price increases through conservation methods can help NS farmers remain competitive. A Farm Energy Specialist extension position was available to NS farmers from 2007 to 2013. Also, under Growing Forward, a five-year program that ended in 2013, programs were created to target energy sustainability on farms [6]. Growing Forward 2, which ends in 2018, has continued to support energy sustainability on farms [7].

Have these programs and policies been effective? A baseline energy use survey was conducted in 2004 [8]. That study indicated that the agricultural community was keenly interested in energy conservation methods and renewable energy options [9]. However, have NS farmers implemented any improvements? Has there been any change? Or is the agricultural sector on a similar increasing energy use and GHG emissions trend as they had been on from 1990 to 2004 [10]. Since 2004, there has been little follow-up and measurement of energy use in agriculture. Therefore, the purpose of this study was to measure the change in NS farm energy use from 2004 to 2011 in order to see whether reductions had occurred. This

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### Nomenclature

cwt	100 lb of milk produced
CPI	Consumer Price Index
EGSPA	Environmental Goals and Sustainable Prosperity Act
GHG	Greenhouse Gas
GFR	Gross Farm Receipts
kWh	kilowatt hour
L	Litre
NAICS	North American Industry Classification System
NS	Nova Scotia
NSDA	Nova Scotia Department of Agriculture
NSFA	Nova Scotia Federation of Agriculture
n	number of responses

study was part of a larger survey designed to gather information on criteria used for on-farm energy decision-making.

## 2. Method

A mail-out survey of 2393 members of the Nova Scotia Federation of Agriculture (NSFA) was conducted in April 2012 and repeated in November 2012. The NSFA mail list was used as the sample frame. This is considered to be representative of the entire registered farm population since all registered farms are NSFA members [11].

The survey was divided into five sections (A to E), each with a unique objective. The first section (A) was designed to gather demographic information such as farm type, farmer age, and income as well as basic information on energy use and energy concerns. The second section (B) gathered information on energy conservation and energy efficiency options used on the farm and the decision-making criteria used to choose these options. Questions were asked on what energy options were used on the farm, reasons for implementing or looking at alternatives, who influenced the decisions made, where respondents looked for information, and obstacles they may have encountered. The third section (C) was identical to section B except it was about alternative energy options and farmers were asked what energy source they had replaced, offset, or supplemented. The fourth section (D) was about future changes. Questions were asked about what energy conservation/efficiency and renewable energy options farmers were interested in using, what would influence their decisions to implement, when they planned on retiring, and their retirement plans for the farm. The fifth and final section (E) was a place for comments and ideas.

This paper presents the results from the first section (A), and compares them with results of a similar survey done in 2005 [8].

### 2.1. Survey design

There were three demographic variables: farm type, farmer age, and farm size. Farmers were asked to indicate the percentage of their gross farm receipts by commodity out of 20 choices that best described their operation. This was done to mimic the farm registration process and allowed for the categorization of results based on commodity. Farmers were also asked to indicate their farm size based on nine interval categories of gross farm receipts (GFR).

Farmers were then asked to indicate the total amount of money spent by energy source during 2011. The challenge with this question was that some respondents included farmhouses, and others excluded them, so results may reflect residential and

business expenses. Also, wood used as a heat source on the farm is often undervalued as an energy source.

Farmers were asked to rank their three main concerns with respect to energy usage including: cost to operate (energy/fuel bills), power reliability (power outages), availability of energy sources, cost to purchase new efficient equipment, equipment reliability, environmental concern, self-sufficiency, and other.

Farmers were asked if they had some level of support to evaluate their energy options including: an energy audit with report, farm visit by a professional, an equipment-specific review (e.g. lighting), and information provided by a professional.

The survey was pre-tested by six volunteers to make sure it was clear, unambiguous and could be completed in a relatively short time (30 minutes).

### 2.2. Survey sampling, administration and response

Surveys were mailed in April 2012 to all NSFA registered members. This was repeated in November 2012 due to a low return rate from the initial mailing.

All surveys included a cover letter and a stamped, self-addressed envelope. The cover letter explained the purpose of the survey and the risks and benefits of participation. It also included contact information and a submission deadline. A reminder notice was sent via mail in the NSFA newsletter and via email in the NSFA e-news within three weeks of the initial mailing.

All surveys were anonymous, since the names and addresses of respondents were not included in the survey returns. The initial survey was included in the mailing of the April 2012 NSFA Newsletter; the second survey was a stand-alone mail-out sent in November 2012.

For the initial mailing, a total of 118 surveys were returned during a 62-day time frame (4.9% return rate). 16 envelopes were returned with uncompleted or missing surveys; farmers were asked to return the survey blank if they were no longer farming. Therefore, the total number of usable surveys was 102. From the second mailing, a total of 250 surveys were returned during a 42-day time frame (10.5% return rate). If the farmer had previously completed the survey in the first mail out, or was no longer farming, the farmer was asked to indicate this and return the survey blank. 79 surveys were returned uncompleted: 35 were returned from those no longer farming, 32 had previously completed the survey, 11 were blank with a note that the survey did not apply, and one survey was blank. Therefore, the total number of usable surveys was 171. When combined, there were 273 usable surveys.

Response rate varied among farm types (Table 1), with an overall response rate of 11.4%. This was lower than expected based on a previous survey with a 32% response rate [8]. Typical mail questionnaires receive anywhere from 10% to 50% response rates [12]. The highest response rates were from maple, dairy and vegetable farmers; 22.2%, 21.6% and 19.6% respectively. The lowest response rates were from strawberry, fur and beef farmers; 0%, 6.9% and 7.7% respectively. It is worth noting that strawberry farms are the second smallest commodity group with only 20 registered farms while beef farms are the largest commodity group with 575 registered farms. Response rate also increased as farm size (GFR) increased (Table 1).

### 2.3. Data analysis

For analysis, farm types were grouped using the North American Industry Classification System (NAICS) [13]. The categories included: (i) beef, (ii) dairy, (iii) hog, (iv) poultry/egg, (v) sheep/goat, (vi) other animal (honey, bees, fur, horse), (vii) oilseed and

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