



Nexus Market Research, Inc.

**Investment Analysis of the CCEF  
Voluntary Market Demand Initiatives**

**Final Report  
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**Submitted to:  
The Connecticut Clean Energy Fund**

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## Executive Summary

This Investment Analysis Report focuses on the development of program effectiveness ratios, and more broadly, the development of a framework for conducting an on-going analysis of the investments made by CCEF in its voluntary market initiatives. The indicators and analytical framework developed in the Program Analysis prepared by NMR for CCEF (March 2006) anchor the development of program effectiveness ratios in this report. For the near term analyses included in this report, two outcome indicators reflecting near term program activity in the voluntary market demand are examined: ratepayer signups and cumulative clean energy (kWh) purchased through the Connecticut Clean Energy Options program, which began in April 2005. The investment analysis calculates the cost per ratepayer signup and cost per cumulative kWh, through December 2005, through the end of 2006, and through the end of 2007, marking the end of the first Strategic Plan.

Because the Connecticut Clean Energy Options program was established outside of the CCEF, only a portion of the signups for the program can be attributed to CCEF's program expenditures. To isolate the fund's impact, a Delphi analysis was undertaken, in which a panel of experts was asked to develop projections of annual program participation under two sets of assumptions – one that included CCEF's past and continued involvement in supporting clean energy purchases and one that assumed that the Clean Energy Options program was not supported by CCEF activity. In this analysis actual sign-up and other indicator performance are compared to the Delphi results that assume that no CCEF activity supported the Clean Energy Options program, allowing the effects of the CCEF programs to be the focus of the investment analysis.

CCEF's program expenditures in support of the voluntary clean energy initiatives have been divided between two partially distinct objectives – one focusing on voluntary market demand programs and the other on public awareness and education programs. Assignment of program expenditures, and assumptions made to the investment analyses, were based on CCEF budget documents and the Program Logic Model developed for CCEF by NMR.

Results are shown in the table below.

**Table ES1 – Summary of Investment Analysis**

<b>Outcome Indicator 1 – Sign-ups of Residential Ratepayers</b>			
<b>Cumulative Cost Per Net Sign-Up</b>			
	<b>Through 2005</b>	<b>Through 2006</b>	<b>Through 2007</b>
<b>Cumulative Cost per Net Sign-up</b>	\$1,581	\$442	\$201

<b>Annual Cost Per Net Sign-Up, Using Calendar Year Costs</b>			
	<b>2005</b>	<b>2006</b>	<b>2007</b>
<b>Annual Cost per Net Sign-up</b>	\$1,581	\$236	\$102

<b>Annual Cost Per Net Sign-Up, Using Fiscal Year Costs</b>			
	<b>2005</b>	<b>2006</b>	<b>2007</b>
<b>Annual Cost per Net Sign-up</b>	\$1,347	\$134	\$83

**Outcome Indicator 2 – Residential Clean Energy Purchases**

<b>Cumulative Cost Per Net Clean Energy kWh</b>			
	<b>Through 2005</b>	<b>Through 2006</b>	<b>Through 2007</b>
<b>Cumulative Cost per Net kWh</b>	\$0.7075	\$0.1083	\$0.0307

<b>Annual Cost Per Net Clean Energy kWh, Using Calendar Year Costs</b>			
	<b>2005</b>	<b>2006</b>	<b>2007</b>
<b>Annual Cost per Net kWh</b>	\$0.7075	\$0.0535	\$0.0135

<b>Annual Cost Per Net Clean Energy kWh, Using Fiscal Year Costs</b>			
	<b>2005</b>	<b>2006</b>	<b>2007</b>
<b>Annual Cost per Net kWh</b>	\$0.6029	\$0.0304	\$0.0110

**Outcome Indicator 3 – Residential Avoided CO<sub>2</sub> Emissions**

<b>Cumulative Acquisition Cost Per Net Ton of CO<sub>2</sub></b>			
	<b>Through 2005</b>	<b>Through 2006</b>	<b>Through 2007</b>
<b>Cumulative Acquisition Cost per Net Ton of CO<sub>2</sub></b>	\$1,581	\$442	\$201

<b>Annual Acquisition Cost Per Net Ton of CO<sub>2</sub>, Using Calendar Year Costs</b>			
	<b>2005</b>	<b>2006</b>	<b>2007</b>
<b>Annual Acquisition Cost Per Net Ton of CO<sub>2</sub></b>	\$1,581	\$236	\$102

<b>Annual Acquisition Cost Per Net Ton of CO<sub>2</sub>, Using Fiscal Year Costs</b>			
	<b>2005</b>	<b>2006</b>	<b>2007</b>
<b>Annual Acquisition Cost Per Net Ton of CO<sub>2</sub></b>	\$1,347	\$134	\$83

The results shown generally fall within ranges of program expectations. However, it must be noted that they are highly sensitive to the assumptions included in the analyses and are reflective of very near term program activity and modeling approaches and assumptions that are more robust over the longer term.

## **1 Introduction**

The voluntary clean energy purchase program, known as the Connecticut Clean Energy Options program (CCEO), was established by the CCEF as an outgrowth of the Connecticut Department of Public Utility Control Decision in Docket No. 03-07-16<sup>1</sup>. Two “Alternative Transitional Standard Offer” (ATSO) providers, Sterling Planet and Community Energy, were selected through a bidding process and entered into contracts with CL&P and UI to offer a clean energy option (through the providers’ own purchase of RECs) to ratepayers of those two electric distribution companies in the state, beginning in April 2005.

In its first overall strategic plan, covering the period 2005-2007, the CCEF established three organizational goals, one of which (Goal 3) focused on increasing both consumer knowledge of clean energy and consumer participation in the acquisition of clean energy resources. Two objectives were established to support this goal, one for each of the above two elements of the overall goal.

Since 2003 CCEF has implemented a variety of programs and launched initiatives designed to educate, inform, and increase consumer awareness about the benefits and availability of clean energy. Beginning in 2005 some of those activities were directly intended to influence sign-ups for clean energy electricity, while others were designed to increase awareness, understanding and availability of clean energy, ultimately leading to more participation in the CCEO program.

In 2006 a team of consultants led by Nexus Market Research (NMR) conducted an analysis of the costs associated with acquiring those voluntary market sign-ups – one of the two Objectives of Goal 3 in the Strategic Plan. The analysis was prospective – estimates of future program participation and program costs were used to develop program effectiveness ratios past April 2006, the point at which actual participation data were not available. The current analysis examines the same program period, April 2005 through December 2007. Now, however, more expenditure and participant data are available, enabling the investment analysis of the initiatives in support of the CCEO program to reflect the actual program activities during that timeframe.

This report revisits the 2006 Investment Analysis material, keeping much of the review and presentation of the programs and overall program logic that defines the interrelationship among the various CCEF voluntary initiative programs. Data have been updated to reflect actual program performance and actual expenditures, providing the basis for the current investment analyses. The study again focuses on an examination of the costs associated with the acquisition of sign-ups to the Clean Energy Options program and the resulting clean electricity associated with those CCEF induced sign-ups. While there clearly are other outcomes associated with the programs under Goal 3, in the end they are all intended, over time, to lead to an increase in the purchase of clean electricity. It is worth noting that this report was not designed to examine all of the effects through 2007 either of CCEF’s activities related to influencing purchases of clean energy or on purchases of clean electricity that has been occurring outside of CCEF’s

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<sup>1</sup> The Docket was established in response to Public Act 03-135 enabling the DPUC to establish an alternative transitional standard offer option for consumers that incorporated clean energy as the resource providing the electricity.

involvement. Among these are purchases of clean energy by municipalities that have committed to the “20% by 2010” campaign; the reduced energy use by municipalities that have earned PV system installations through their participation in the Clean Energy Communities program; and clean energy RECs purchased by various institutions, in both the private and public sectors. Much of the effects of these activities only began to be noticeable in the latter half of 2007. One would anticipate further examination of these activities in any subsequent evaluations of the Goal 3 programs.

## 2 Voluntary Initiatives Program Logic

Although the CCEF recently prepared a Comprehensive Energy Plan and update goals and objectives structures to guide its operations and activities for several years beyond 2008<sup>2</sup>, the guiding document for the period of this analysis is CCEF’s Strategic Focus (2004-2007). This document presented three strategic goals and objectives for the organization:

1. **Program Goal 1:** Connecticut ratepayers will have access to a diverse supply of installed clean energy resources.
2. **Program Goal 2:** CCEF will support the early stage development of the clean energy industry in Connecticut.
3. **Program Goal 3:** The CCEF will play a significant role in increasing consumer knowledge of clean energy and in consumers actively seeking and adopting clean energy technology for their homes, businesses, and institutions.

The Voluntary Market Demand Programs and the Public Awareness and Education activities are implemented under Program Goal 3, supporting two strategic objectives:

1. **Objective 3A** – 0.5% of electricity demand<sup>3</sup> will come from voluntary purchases of clean energy resources.
2. **Objective 3B** – Drawing from a baseline survey, there will be significant increase in the knowledge and awareness of the benefits and availability of clean energy resources by Connecticut residents.

Figure 1 below shows the relationship organization of the CCEF programs that support Program Goal 3.

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<sup>2</sup> The new Comprehensive Energy Plan was approved by the DPUC on November 12, 2008 in Docket No. 08-04-07

<sup>3</sup> Objective 3A goal is to be achieved by the end of 2007.

**Figure 1: Program Goal 3 Objectives, Programs, Targets**

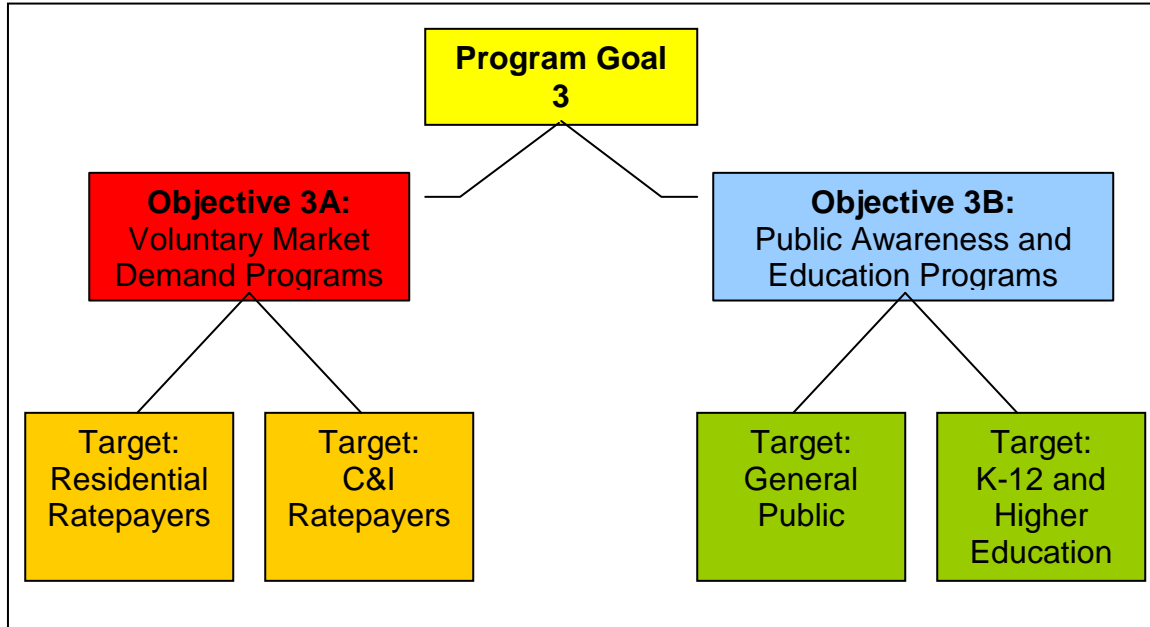


Figure 1 shows a clear delineation of the targeted groups for the two program objectives, based in large measure on the nature of the Program Objectives themselves. As the purpose of the first Objective (3A) is to increase the purchase of clean energy to 0.5% of the state's electricity mix by the end of 2007, the targeted audiences for program activity inherently must be residential, commercial, and industrial ratepayers. Those ratepayers will need to make the purchases of clean energy for this Objective to be met. To increase the knowledge and awareness of the benefits and availability of clean energy resources by Connecticut residents (Objective 3B), CCEF has implemented programs that will meet the Objective in both the short term, by targeting the general public, and the long term, by targeting students at all levels of education.

While this construct in Figure 1 helps CCEF communicate its programs in a meaningful way, the objectives themselves are not completely distinct from each other. For example, efforts to increase awareness about the merits of clean energy will affect consumers as they consider whether to sign up for the clean energy options program, and as consumers do sign up and share that activity with neighbors, it will increase awareness of clean energy. Therefore, because of the interactive effects of the Goal 3 programs' outcomes, observations about the results of specific program outcomes cannot be completely associated with only the direct expenditures made to those specific programs. It is necessary to have a further understanding of the relationships among the programs and the interrelated nature of the steps undertaken in implementing them.

The complex interrelationships between the programs, the program's outputs, and the expected outcomes or effects are illustrated in the program logic model for CCEF's Goal 3 developed by

NMR, shown in Figure 2.<sup>4</sup> This model presents the relationship between the programs, the outputs and targets of those programs, and the short-, intermediate-, and long-term outcomes that the overall voluntary market initiatives are intended to achieve. As the arrows in the model show, program activities generate a large array of outputs through the associated program targets, and these in turn logically result in the program's outcomes.<sup>5</sup> Consequently, for a dollar spent to reach a specific program target, the impact of that dollar becomes mixed with other program dollars spent the further down it is traced in the program logic. For example, Public Awareness program funding, in support of Objective 3B, leads to earned media outreach, which lead to signups for clean energy through Connecticut Clean Energy Options, which is also an outcome under Objective 3A.

The indicators and analytical framework developed in the Program Analysis anchor the development of program effectiveness ratios in this report, as they provide the links between programs, and thus program expenditures, and the outcomes associated with Objective 3A.<sup>6</sup> The analysis of CCEF's voluntary initiative program investments involves an examination of the costs associated with the voluntary programs and the outcomes that can be attributed to those programs. In simplest terms this involves identifying the outcomes, short- and long-term, that result from the programs, and comparing them to the costs that are associated with those programs.

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<sup>4</sup> This is discussed further in "Program Analysis and Monitoring and Evaluation Plan for the Connecticut Clean Energy Fund: Public Awareness, Education, and Voluntary Market Demand Initiatives" Nexus Market Research, January 2006

<sup>5</sup> Within the model, all program elements (activities, outputs, and outcomes) are catalogued and identified by specific indicator identifiers.

<sup>6</sup> For details about the results of the CCEF's awareness campaign, see "Connecticut Clean Energy Fund Program Goal 3 Annual Report (April 1, 2007 to March 31, 2008)" Nexus Market Research, June 2008 and "Monitoring and Evaluation of the Connecticut Clean Energy Fund: Quarterly Balanced Scorecard Report on Program Goal 3 (Fourth Quarter 2007)" Nexus Market Research, June 2008.

**Figure 2: CCEF Program Goal 3 Logic Model**  
 (Base Year for Outcomes is July 2004; Implementation Current as of December 2005)

Objectives

**Objective 3A:  
 Voluntary Market Demand Initiative**

**Objective 3B:  
 Public Awareness and Education Initiative**

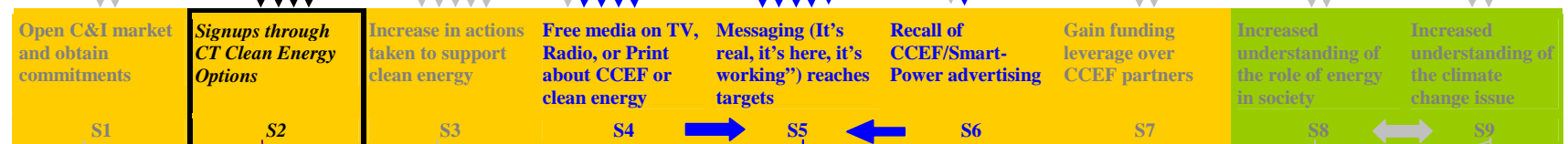
Programs and Inputs



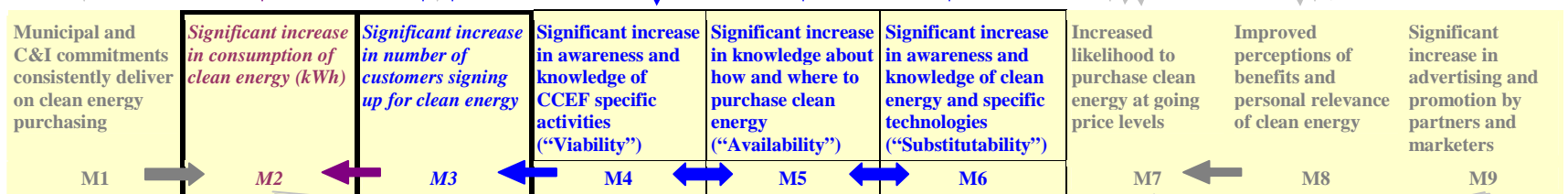
Outputs to Customers/ Targets Reached



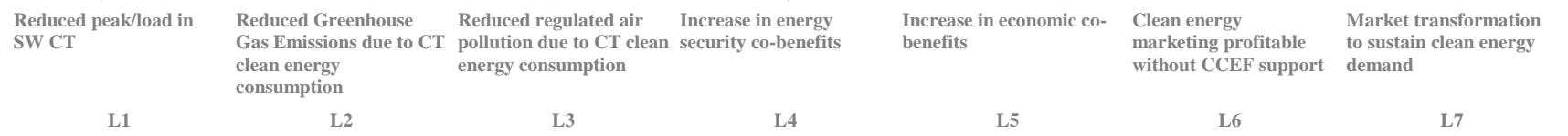
Short-term Outcomes (0 to 3 Years)



Intermediate-term Outcomes (0 to 6 Years)



Long-term Outcomes (6+ Years)



### 3 Methodology

The process used in this investment analysis is essentially the same as the one used for the 2006 analysis, though several additional analyses have been added for this report. The methodology is based on developing program effectiveness ratios, which are ratios of the expenditures (numerator) associated with indicators of the outcomes themselves (denominator). First, a set of appropriate outcome metrics is identified based on assumptions of direct impacts traced to the most relevant programs. To determine an appropriate outcome estimate (denominator), however, requires a subsequent estimate of the “net” impact of the CCEF programs on the voluntary clean energy market, apart from the natural market effect. Finally, the program cost-effectiveness ratios are estimated by isolating expenditure data associated with the specific programs and assumptions identified in the first step.

#### 3.1 Outcome Indicators

For the Voluntary Market Demand Programs objective, several indicators are used, to reflect differing aspects of the overall program’s efforts.

##### 3.1.1 Signups through CT Clean Energy Options (S2)

This indicator reflects a short-term outcome of the program resulting from resources assigned to the Connecticut Clean Energy Communities Program and SmartPower. In Figure 2 the targets reached through these program investments, notably outputs T1 through T4, are identified by black arrows and text. Sign-ups to the Clean Energy Option Program were expected to occur within the first three years as a result of CCEF’s program investments that work most directly with influential stakeholders to reach their networks of potential program participants — innovators and early adopters. This is the leading indicator of program participation and can provide program managers with information about how programs are performing.

S2, the initial measure of program activity, as a representation of the two targeted populations of Objective 3A in Figure 1, is the number of residential and C&I customers who sign up for the clean energy options program. Because to date relatively few C&I customers have chosen to participate in the program and program initiatives were targeted toward residential customers, this analysis focuses only on the residential customers. The analysis examines the number of signups at the end of three calendar years: 2005, 2006, and 2007, which is the end of CCEF’s first Strategic Plan period. The investment analysis includes a calculation of the CCEF “acquisition” cost per residential participant in the clean energy options program for each of these three periods.

##### 3.1.2 Amount of Clean Energy Purchases (S2+)

Eligible ratepayers who participate in the ATSO program have the option of purchasing 100% or 50% of their electricity use from clean energy sources (by paying the selected ATSO provider a premium above the price of conventional electricity for the value of the associated renewable energy credits). From an analytic perspective one clean energy ratepayer may thus not be equivalent to another – one may have purchased twice the percentage of clean energy as another. In addition, consumers use different amounts of electricity from one another, so while one’s participation in the clean energy options program is reflected in the participant count metric, it

does not provide any indication of the amount of clean energy that has been purchased through the program. Indicators that focus on the amount of clean energy electricity consumption provide a more direct measure of the program's success in meeting the objective of the voluntary market demand programs than do participant counts. One such indicator reflects the cumulative amount of clean energy electricity ratepayers have purchased since the beginning of the program. As with the sign-up analyses, the total amount of clean energy purchased by residential ratepayers through the end of 2005, 2006, and 2007 will be examined, on both a cumulative and an annual basis.

### **3.1.3 Amount of Avoided CO<sub>2</sub> Emissions**

One of the purposes underlying the CCEF's existence is the mitigation of greenhouse gases through the development of clean energy markets and projects. Because the electricity generated by clean energy resources supported by CCEF's investments is connected to the regional electric grid, the introduction of clean energy into the system leads to the reduction of electrical generation elsewhere on the grid. Further, as the existing stock of electric generation is predominantly fossil and nuclear-based, the introduction of clean energy generation resources will almost invariably reduce the emissions of CO<sub>2</sub>. The potential amount of avoided CO<sub>2</sub> is thus another outcome indicator of this CCEF initiative, and can be estimated as a direct corollary to the amount of clean energy purchases in section 3.1.2 above. The investment analysis includes the cost of the potential cumulative avoided emissions of CO<sub>2</sub>.

### **3.1.4 Other Indicators**

There are other indicators that can inform the program manager of the results of program activity and offer opportunities for near term program modifications without constructing cost-outcome relationships. Examples include the number of municipalities that have enrolled in the 20% by 2010 campaign, the amount of clean electricity (through RECs) purchased to meet the campaign obligation, the number of municipalities that have qualified for the Clean Energy Communities Program, the number of PV installations on municipal facilities, and the number of signups for 50% clean energy. With the limited disaggregation of the cost data, conducting an investment analysis with these outcomes would not provide any meaningful information. In addition, as mentioned in the Introduction above, many of these activities only began to be noticeable in mid-2007, and limited data are available. Direct examination of the trend-lines of these indicators, along with anecdotal information on how these activities are developing, may be more appropriate for gaining a short term appreciation for how well the programs are deploying.<sup>7</sup>

The influence of the public awareness and education programs is more difficult to establish, and in the near term they may be less meaningful than those associated with the market demand initiatives. A review of the Program Logic Model shows how the outcomes of expenditures, or investments in these public awareness and education programs are intended to influence consumer behavior, leading to increased purchases of clean energy. The investment analysis focuses on the associated outcome indicators, and examines the effectiveness of the awareness

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<sup>7</sup> For example, as of December 31, 2007 Clean Energy Communities (CECs) program had consistently outperformed non-participating communities in terms of total signups (CECs represent 17% of municipalities but account for 51% of all signups).

investments through the signups to the clean energy options program.<sup>8</sup> In this analysis the focus is on the short-term outcome S2. Over time other outcome indicators can be included, including those ones associated with M3 and M2.

### **3.2 Net Analysis**

Connecticut's clean energy options suppliers also function in the state without CCEF's involvement and program investments in seeking to encourage the volunteer market, as do other clean energy suppliers. Any analysis of CCEF's investments in Goal 3 activities must therefore only include program outcomes that are a result of the organization's efforts, and exclude comparable outcomes that would have occurred without the programs' existence. The analysis thus becomes a net analysis, comparing the actual market outcomes with estimates of what the outcomes would have been had the programs not been in place.

There are several ways to estimate this "baseline" activity, and the choice of which to use is generally based on a considered balance among the availability of data to support the alternate approaches, the relative costs to undertake the alternatives, the time available to conduct the studies, and the anticipated range of certainty that these different approaches might provide in relation to the project being examined. For example, one approach is to compare the CCEF results with locations elsewhere which have similar key characteristics (e.g., income, demographic distribution, education levels, etc.) with a clean energy program but no external program to increase awareness or encourage purchases of clean power. Another potential approach is to conduct an econometric analysis that quantifies the factors that affect the ratepayers' decision to purchase clean power from an ATSO provider and yields the net result.

A third is to conduct what is known as Delphi analysis. The process relies on a panel of experts with diverse views on the general subject of clean power to respond to alternate scenarios of the future, one with the CCEF programs and one without those programs, and to estimate future ratepayer participation in the ATSO providers' clean energy options offers based on each of the scenarios. Once each panel member has responded individually, the results are summarized and circulated to the members, who have an opportunity to modify their estimates based on the summarized responses of the other Delphi panelists. Depending on the complexity of the scenarios and the number of panel members, one or more rounds are conducted.

The Delphi approach was selected as the most effective means to obtain a baseline estimate for this study.<sup>9</sup> Seven individuals knowledgeable of the energy field in Connecticut or the region participated on the panel. Two Delphi rounds were conducted, allowing the panelists to review the results provided by their fellow panelists. Panelists were asked to estimate the annual (year-end) levels of awareness among Connecticut residents of grid-delivered clean energy, of the Clean Energy Options program, and the number of Clean Energy Options residential sign-ups, for two scenarios: (1) That CCEF's programs are in place and continue to be for the next 10

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<sup>8</sup> The investment analysis does not take into consideration other CCEF investments, such as On-Site Renewable Distributed Generation and Residential solar PV systems, as they are associated with Goal 1 and would likely have only a minor impact in influencing public awareness that would lead to signups rather than new PV installations.

<sup>9</sup> "Voluntary Clean Energy Market Baseline in Connecticut: A Delphi Panel Assessment" Nexus Market Research, June 2006

years, and (2) that there are no such programs for the same period. The Delphi analysis asked the panelists to make year-end projections through 2015, beginning at the end of 2006, from a similar year end 2005 starting point. For analyses that rely on actual program results, the difference between the actual outcome indicators and the Delphi derived baseline (i.e., no CCEF programs) data is the amount of outcome activity attributable to the CCEF programs. The Delphi estimates of future program results with CCEF program investments can also be compared with the baseline projections to develop estimates of future program results associated with CCEF's involvement.

As indicated above, the annual projections of ratepayer awareness and program signups were developed by a panel of seven experts. To develop annual figures for each indicator, the Delphi study summed the results of the panelist's projections in two ways – by determining the median result among the estimates and by calculating the mean (average) result for each indicator. Because of the small number of panelists involved in developing the estimates, the mean values can be largely affected by panelist data that are noticeably higher or lower than the other data. The median results, on the other hand, provide a more stable set of data from which to conduct the investment analysis. The results discussed in the text and presented in the analysis tables are consequently based on the data resulting from the derivation of the medians. Table 1 shows the sign-ups attributable to CCEF activities, and the data used to calculate the net growth in sign-ups for the Clean Energy Options program. These include the Delphi projection of residential sign-ups without the involvement of CCEF's programs and actual sign-up data through 2007<sup>10</sup>.

**Table 1. Residential Sign-Ups for the Clean Energy Options Program Attributed to the CCEF Activity, 2005-2007**

	2005	2006	2007
<b>Delphi Panel Sign-ups - Baseline (no program)</b>	5,200	7,400	6,758
<b>Actual Clean Energy Sign-ups</b>	5,628	10,191	16,376
<b>Sign-Ups Due to CCEF Activities</b>	428	2,791	9,618

### **3.3 Program Outcome Related Expenditures**

The investment analysis of the voluntary market demand initiative (Program Objective 3A) includes all the costs associated with those programs that directly or indirectly influence the near-term program outcome under Program Objective 3A – the participation of sufficient ratepayer participation in the Clean Energy Options Program to reach 0.5% of total electricity consumption by year-end 2007 from clean energy purchases. As the Program Logic Model in

<sup>10</sup> For this analysis, residential Clean Energy sign-ups were derived from utility customer data rather than marketer data. Utility customer data were chosen because they provided both sign-up information and monthly electricity consumption. The sign-up data were typically on the conservative side, on a month to month basis, because there is a lag between program enrollment through the marketers and utility billing for the clean energy. In addition, because utility reported data do not differentiate between residential and C&I customers, residential sign-ups were estimated as 98% of reported utility customers. Residential sign-ups have represented at least 98% of all marketer reported sign-ups since the beginning of the program.

Figure 2 shows, in addition to those programs and activities directly involved in attaining Objective 3A (sign-ups), some of the general awareness program activity under Objective 3B also results in customer sign-ups for the Clean Energy Options program. One step in preparing the cost data for use in the analysis is thus to determine which Program Objective 3B programs do influence ratepayer signups, and to assign a percent of those funds toward achieving the market demand outcomes in Program Objective 3A.

Program expenditure data through 2007 were obtained from the program manager. Table 2 below shows, by calendar year, the costs associated with those programs under CCEF Goal 3 which to a greater or lesser degree influence customer participation by year, by program, and by Objective, as assigned by CCEF staff.

**Table 2: Total CCEF Program Expenditures for Goal 3 – 2003-2007<sup>11</sup>**

Objective 3A		Objective 3B	
2003	Expenditures	2003	Expenditures
No program funding		SmartPower	\$250,000
2004	Expenditures	2004	Expenditures
No program funding		No program funding	
2005	Expenditures	2005	Expenditures
Clean Energy Communities 1&2	\$17,818	SmartPower	\$900,000
SmartPower	\$150,000	Clean Energy Trail	\$24,954
RECs	\$6,446		
M&E	\$37,430		
2006	Expenditures	2006	Expenditures
SmartPower	\$200,000	SmartPower	\$100,000
Clean Energy Communities 1&2	\$159,883	Community Innovation Grants	\$99,125
RECs	\$5,116		
M&E	\$115,506		
2007	Expenditures	2007	Expenditures
SmartPower	\$150,000	SmartPower	\$450,000
Clean Energy Communities 1&2	\$247,937	Community Innovation Grants	\$88,163
RECs	\$19,741	Clean Energy Trail	\$6,270
M&E	\$57,802		

**3.3.1 Estimation of Objective 3A Program Expenditures to Objective 3A Program Outcomes**

The Clean Energy Communities Program (CECP) is the single program designed to support directly the attainment of Objective 3A. This program supports those municipalities who, after

<sup>11</sup> While the table includes all program expenditures under Program Objective 3B, only a portion of the funds are included in the final analysis. Because some of the general awareness program activity under Objective 3B results in customer sign-ups for the Clean Energy Options program, a portion of the associated funds are assigned toward achieving the market demand outcomes in Program Objective 3A.

having signed on to SmartPower's "20% by 2010" campaign (municipalities commit to purchasing 20% of their electricity from clean energy sources by 2010) promote clean energy purchases within their boundaries; for every 100 customers who do sign up for clean energy CCEF provides a 1 kW photovoltaic system to the municipality. As the Logic Model in Figure 2 shows (through several paths, most directly cells T1 or T2 to S2), the intended short term outcome of the use of these funds is signups for clean energy. Data show that several municipalities joined the Clean Energy Communities Program during the second and third quarters of 2005, as did ratepayers in several of those communities. The analysis here will thus include the expenditures associated with this program.

Expenditures for the SmartPower campaigns support the organization's earned media and other efforts, as it has promoted general awareness of the benefits of clean energy and the "Clean energy. It's real. It's here. It's working" campaign. A portion of the funds, however, were designated directly for Program 3A initiatives in support of the Clean Energy Communities Program, in direct support of Objective 3A. These funds, noted in Table 3 above, are included in the analysis.

The other two cost categories shown in Table 3 under Objective 3A are ancillary to the implementation of activities to attain this objective, but are costs associated with these efforts. One relates to expenditures associated with the administrative costs for the sale of renewable energy credits (RECs) associated with the photovoltaic systems installed on several Clean Energy Communities. The other cost is associated with on-going monitoring and evaluation of the voluntary initiative programs.

### **3.3.2 Estimation of Objective 3B Program Expenditures to Objective 3A Program Outcomes**

During 2003 and 2004 CCEF, along with several private foundations, invested in the establishment and startup of SmartPower, an organization designed to create awareness about the benefits of clean energy among Connecticut's electric consumers. These funds were used in a variety of media outlets, to initiate awareness campaigns that would begin the process of informing consumers about the benefits of clean energy sources and encouraging them to use clean energy. These early investments, even before the establishment of the Clean Energy Options Program, both reinforced and built upon the existing general awareness among the state's population about clean energy.

CCEF has continued to support SmartPower, through on-going funding, as the primary way to maintain and enhance public awareness of the merits of clean energy. While the primary focus of SmartPower's efforts under Objective 3B is to increase general public awareness, those awareness efforts have also been expected to influence cities, municipalities, and individual ratepayers to participate in the voluntary market demand initiatives. This is shown in the Program Logic Model, as the SmartPower efforts are shown to support several activities under Objective 3A. Accordingly the analysis here assigns 40% of these SmartPower funds to support Objective 3A programs and outcomes and 60% to Objective 3B programs and outcomes.

Communities that have committed to SmartPower's 20% by 2010 Campaign are eligible to receive a \$5,000 Community Innovations Grant. Because the grants are to be used to support

local clean energy awareness and education projects, CCEF has assigned this program to Objective 3B. When applying for the Community Innovations Grant Program (CIGP) grant, applicants must identify the primary goals of the project, which include raising community awareness, educating school students, or increasing sign-ups to the Clean Energy Options program. An examination of program reports for all projects completed between October 2006 and August 2007<sup>12</sup> indicated that approximately 38% of the funds were for projects that yielded sign-ups for clean electricity.<sup>13</sup> In deciding what portion of the CIGP expenditures should be assigned to Objective 3A for all of 2006, it was assumed that this percentage of the program's expenditures also led to sign-ups during the earlier part of 2006<sup>14</sup>. Analysis of subsequent reports, for all CIGP projects completed between September and December 2007, indicated that during this period approximately 70% of the funds were for projects that resulted in Clean Energy Options sign-ups. CIGP expenditures were allocated to Objective 3A for the first half of 2007 using the 38% result of the data review. For the second half of 2007 the percentages from the two sets of reports were averaged based on the applicable number of months (two months for 38%, four months for 70%). The result, 59%, is the value used to allocate CIGP expenditures from Objective 3B to Objective 3A for the latter half of 2007.<sup>15</sup>

The Clean Energy Trail program, intended to increase awareness by demonstrating previous projects installations, has received funding support in 2005 and 2007 under Objective 3B. The Program Logic Model shows that it may have an indirect and distant influence on customer signups (largely through message reinforcement), but to a lesser degree than do the SmartPower and Community Innovation Grants programs. Accordingly, only 20% of these expenditures are included in the investment analysis.

Table 3 below presents the program costs that will be used in the investment analysis. The entirety of the costs associated with programs within Objective 3A are included in the Table, similar to the costs in Table 2. Those portions of programs assigned by CCEF to Objective 3B which also support Objective 3A, as described above, are also included in the following table. The relevant percentage allocations to Object 3A are also presented in the table, reflecting the portions assigned to influencing the Objective 3A outcomes, as shown in the Program Logic Model and discussed above.

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<sup>12</sup> CIGP applications and grantee reports were provided by Bob Wall of CCEF.

<sup>13</sup> Grant dollars were allocated according to a composite weighting factor based on grant goals identified by grantees in their reports to CCEF. Grant dollars were allocated evenly among each goal identified by grantees. For example, if a grant report identified raising community awareness and increasing sign-ups as grant goals, 50% of the grant funds were allocated to increasing sign-ups for the purposes of this analysis.

<sup>14</sup> The 2006 Investment Analysis Report had assumed that 40% of CIGP expenditures should be assigned to Objective 3A

<sup>15</sup> CIGP recipients have engaged in a wide variety of activities that include substantial amounts of volunteer time from recipients. Some activities have been very focused on raising signups, while others have had more of an educational and public awareness focus. CIGP recipients consistently account for disproportionate amounts of new signups each quarter. For more details, see "Monitoring and Evaluation of the Connecticut Clean Energy Fund: Quarterly Balanced Scorecard Report on Program Goal 3 (Fourth Quarter 2007)" Nexus Market Research, June 2008.

**Table 3 – CCEF Funds Included in the Investment Analysis – 2003-2007**

Objective 3A		Objective 3B	
2003	Expenditures	2003	Expenditures
No program funding	\$0	SmartPower (40%)	\$100,000
2004	Expenditures		Expenditures
No program funding		No program funding	
2005	Expenditures	2005	Expenditures
SmartPower	\$150,000	SmartPower (40%)	\$360,000
Clean Energy Communities 1 & 2	\$17,818	Clean Energy Trail (20%)	\$4,991
RECs	\$6,446		
M&E	\$37,430		
2006	Expenditures	2006	Expenditures
SmartPower	\$200,000	SmartPower (40%)	\$40,000
Clean Energy Communities 1 & 2	\$105,878	Community Innovation Grants (38%)	\$37,668
M&E	\$115,506		
CCEC	\$54,004		
RECs	\$5,115		
2007	Expenditures	2007	Expenditures
SmartPower	\$150,000	SmartPower (40%)	\$180,000
Clean Energy Communities 1 & 2	\$247,937	Community Innovation Grants (38%, 59%) <sup>16</sup>	\$38,360
M&E	\$57,802	Clean Energy Trail (20%)	\$1,254
RECs	\$19,741		
Total Expenditures Assigned to Support Objective 3A through December 2005:			\$676,685
Total Expenditures Assigned to Support Objective 3A through December 2006:			\$1,234,857
Total Expenditures Assigned to Support Objective 3A through December 2007:			\$1,929,950

### 3.4 Program Outcome Related Residential Clean Energy Purchases

#### 3.4.1 Amount of Clean Energy Consumed

In addition to reporting the number of their ratepayers who sign up for clean energy, both CL&P and UI also report the monthly amount of electric energy associated with the ratepayer signups to the Clean Energy Options program.<sup>17</sup> Total monthly program participant kWh purchases are thus available for the April 2005 – December 2007 period. In combination with the known monthly sign-up data, average program participant energy consumption can be calculated. Once

<sup>16</sup> See discussion of the development of these percentages in Section 3.3.2 above.

<sup>17</sup> Residential kWh were estimated from total kWh data. CL&P provided residential and C&I kWh data from June 2005 to December 2006. For the purposes of these analyses, it was assumed that UI had identical proportions of residential and C&I kWh as CL&P from June 2005 to December 2006. From December 2006 through December 2007 identical proportions of residential and C&I kWh to those reported by CL&P from June 2005 to December 2006 were assumed.

ratepayers sign up for the clean energy options program by selecting either Community Energy or Sterling Planet as their clean energy provider, they tend to remain participants in the program over time. Since the inception of the program in April 2005, clean energy purchases have grown, both as the amount of clean energy purchases from past signups have accumulated but also as the number of program participants has grown.

### **3.4.2 Application of the Delphi Analysis to Clean Energy Purchases**

A net analysis of clean energy purchases must also incorporate the results from the Delphi analysis, to account for the electricity savings associated with residential participation in the Clean Energy Options Program that would have occurred had CCEF not supported programs designed to influence consumer purchases of clean energy. The Delphi panel analysis, however, focused on annual numbers of ratepayer signups, not on levels of kilowatthours consumed. While monthly clean energy purchases are known through December 2007, the clean energy purchases associated with the baseline numbers of ratepayer signups are not known, and thus must be estimated.

The development of the net electricity purchases are based on monthly, not annual, data, in order to incorporate changes in average electricity usage due to seasonality factors. The Delphi panelists projected program sign-ups on an annual basis. These results were interpolated to develop monthly baseline sign-up values between December 2005, December 2006, and December 2007. It was also necessary to develop estimates of monthly sign-ups between the start of the Clean Energy Options Program in April 2005 and the reference Delphi data point, for December 2005. Monthly values were back-cast from the 5,200 Delphi baseline value to April 2005, in proportion to the actual sign-ups and pro-rated for nine months. Calculations and results are shown in this report's Appendix.

Once the monthly baseline sign-up values were developed, calculating the difference between those data and the actual monthly numbers of sign-ups yields monthly net program participant values. Monthly average clean energy purchases per residential sign-up are calculated from the actual participation data (total kWh divided by the number of residential sign-ups). Multiplying these results by the monthly net program participation values produces the net monthly levels of clean energy purchases. These monthly results are summed cumulatively to yield the total clean energy kilowatthours resulting from CCEF's implementation of programs to support Program Objective 3A.

## **4 Analysis and Results**

The outcome indicators and CCEF investments targeting those program outcomes have been discussed in the methodology section above. In summary, the outcome indicators include:

- 1 - Residential signups (S2)
- 2 - Cumulative MWh clean energy consumed<sup>18</sup> (S2+)

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<sup>18</sup> The terms "purchased" and "consumed" are used interchangeably in this report as they relate to clean energy use. A ratepayer signup for clean energy does not produce a record of energy until that ratepayer has operated electrical equipment and consumed or used the energy. The electric utility reports clean energy use through its billing process, and records the consumption through the ratepayer's payment (purchase) for the consumption of the clean energy.

#### 4.1 Outcome Indicator 1: Sign-ups of Residential Ratepayers

The time periods for the investment analyses are April 2005 through December 2005, and to year-end 2006 and year-end 2007. The analyses first focus on the cumulative numbers of sign-ups and associated costs for each time period, from the beginning of the Clean Energy Options program sign-ups in early 2005 and including CCEF program expenditures focused on influencing the sign-ups. A secondary analysis examines the cost per sign-up on a year to year basis. CCEF program expenditures associated with those annual sign-ups are calculated in two ways to provide a range of costs per sign-up. A discussion of the two alternative assumptions about the CCEF expenditures is provided below.

The methodologies for developing the data to conduct this analysis have been described in Sections 3.2 and 3.3 above. The results of the comparison of cumulative costs to net sign-ups are shown in Table 4 below.

**Table 4 - Cost Per Net Residential Sign-Up, Cumulative through 2005, 2006, 2007**

	Cumulative Through 2005	Cumulative Through 2006	Cumulative Through 2007
Program Costs	\$676,685	\$1,234,857	\$1,929,950
# Residential Sign-ups	5,628	10,191	16,376
Baseline # Sign-ups from Delphi	5,200	7,400	6,758
Net Sign-ups	428	2,791	9,618
Cost per Net Sign-up	\$1,581	\$442	\$201

The results of this analysis show a high acquisition cost per residential participant for signups through December 2005. This cost declines as the cumulative number of sign-ups influenced by the CCEF programs increases over the following two years. A calculation of the cost per net sign-up on a year-to-year sign-up basis provides some insight into the above results. As seen in the Table 5 below, from a reorganization of data from Section 3, the annual cost per net sign-up has been declining over the past three years, influencing in a downward direction the cumulative costs per net sign-up shown in Table 4.

**Table 5 - Cost Per Net Residential Sign-Up, Annual for 2005, 2006, 2007, Using Calendar Year Costs**

	2005	2006	2007
Program Costs - Calendar Year	\$676,685	\$558,172	\$695,094
Net Sign-Ups	428	2,363	6,827
Cost per Net Sign-up	\$1,581	\$236	\$102

As these results show, the annual cost per net sign-up has been dropping rather dramatically since the first year of the Clean Energy Options Program’s operation. Net sign-up acquisition costs during the past year approached \$100. Future costs per sign-up, of course, will depend on the continued increase in net sign-ups (above and beyond those projected by the Delphi panelists - see the “no program” values in Table 1 for those projections) in relation to the expenditures on CCEF’s programs which are intended to influence program sign-ups.

The above results were based upon expenditures made during the same timeframe as the sign-ups. One could make a reasonable case that late-in-the-year costs will have no influence on current year sign-ups, while expenditures made in the latter half of the previous year may well influence ratepayer sign-ups the following year. Establishing the duration between program promotions, general awareness campaigns, and other efforts designed to influence consumer choice and the time when a consumer ultimately takes the desired action is difficult at best. One logical way to approach this is, instead of using calendar year expenditures, use the fiscal year expenditures (July to June). Hence, for the following analysis a six month time lead is used, under the assumption that the on-going funding since 2005 by CCEF of the several programs which are intended to influence customer sign-ups reflects an appreciation for the need to maintain a programmatic involvement with customers, rather than short term programs. It also serves as a balance between the cumulative cost and sign-up analyses and the same year analyses, above. Results are shown below.

**Table 6 - Cost Per Net Residential Sign-Up, Annual for 2005, 2006, 2007, Using 12 Month Costs With a 6 Month Investment Lead<sup>19</sup>**

	2005	2006	2007
Program Costs - Fiscal Year	\$576,684	\$317,712	\$567,826
Net Sign-Ups	428	2,363	6,827
Cost per Net Sign-up	\$1,347	\$134	\$83

These results show even lower cost per net sign-up than the previous analysis. The values in this table and in Table 5 provide reasonable boundaries for the cost per sign-up during these years.

Further discussion of the assumptions underlying the analyses is presented in the Conclusions and Observations section (Sections 5 and 6) below.

## **4.2 Outcome Indicator 2: Residential Clean Energy Purchases**

The results of the indicator analyses focused on net costs per residential purchased clean kWh are derived in a similar way as were the cost per net sign-ups. The time periods for the investment analyses are April 2005 through December 2005, and to year-end 2006 and year-end 2007. The analyses first focus on the cumulative levels of residential clean energy purchases and associated costs for each time period, from the beginning of the Clean Energy Options program

<sup>19</sup> The costs are based on fiscal year and the sign-ups on calendar year data (i.e., FY2005 monies and calendar year 2005 sign-ups, etc.)

sign-ups in early 2005 and including CCEF program expenditures focused on influencing the sign-ups (and resulting kWh purchases). A secondary analysis examines the cost to acquire clean energy kWh on a year to year basis. The CCEF program expenditures associated with those annual sign-ups are calculated in the same two ways as was done for the sign-ups, to provide a range of costs per sign-up.

The methodologies for developing the data to conduct this analysis have been described in Sections 3.3 and 3.4 above. The results of the comparison of cumulative costs to net clean energy kWh purchases are shown in Table 7 below.

**Table 7 - Cost Per Net Residential Clean Energy kWh Purchase, Cumulative through 2005, 2006, 2007**

	Cumulative Through 2005	Cumulative Through 2006	Cumulative Through 2007
Program Costs	\$676,685	\$1,234,857	\$1,929,950
Cumulative Net Program Related kWh	956,453	11,397,633	62,795,322
Cost per kWh for all Program Associated Purchases	\$0.7075	\$0.1083	\$0.0307

The results of this analysis show a high acquisition cost per residential kWh through December 2005. This cost declines as the cumulative number of sign-ups influenced by the CCEF programs increases over the following two years. A calculation of the cost per net sign-up on a year-to-year sign-up basis provides some insight into the above results. As seen in the Table 8 below, from a reorganization of data from Section 3, the annual cost per net sign-up has been declining over the past three years, influencing in a downward direction the cumulative costs per net sign-up shown in Table 7.

**Table 8 - Cost Per Residential Net kWh Purchase, Annual for 2005, 2006, 2007, Using Calendar Year Costs**

	2005	2006	2007
Program Costs - Calendar Year	\$676,685	\$558,172	\$695,094
Net kWh	956,453	10,441,179	51,397,690
Cost per Net kWh	\$0.7075	\$0.0535	\$0.0135

As these results show, the annual cost per net acquired kWh has been dropping rather dramatically since the first year of the Clean Energy Options Program’s operation. Net kWh acquisition costs during the past year was around 1.3¢. Future costs per sign-up, of course, will depend on the continued increase in net sign-ups and associated kWh purchases (above and beyond those calculated using the Delphi panel data) in relation to the expenditures on CCEF’s programs which are intended to influence program sign-ups and consequent clean energy purchases.

Similar to the analysis of signups, we present an alternative approach based on the CCEF fiscal year rather than the calendar year. This approach presents the results with a six month time lead, under the assumption that the on-going funding since 2005 by CCEF of the several programs which are intended to influence customer sign-ups reflects an appreciation for the need to maintain a programmatic involvement with customers, rather than short term programs. It also serves as a balance between the cumulative cost and clean energy purchase analyses and the same year analyses, above. Results are shown below.

**Table 9 - Cost Per Net Residential kWh Purchase, Annual for 2005, 2006, 2007, Using 12 Month Costs With a 6 Month Investment Lead**

	2005	2006	2007
Program Costs - Calendar Year	\$576,684	\$317,712	\$567,826
Net Sign-Ups	956,453	10,441,179	51,397,690
Cost per Net Sign-up	\$0.6029	\$0.0304	\$0.0110

These results show lower cost per net sign-up than the previous analysis. The values in this table and in Table 8 provide reasonable boundaries for the cost per clean electricity kWh purchase during these years.

### 4.3 Outcome Indicator 3: Cumulative Avoided Tons of CO<sub>2</sub>

The amount of avoided CO<sub>2</sub> emissions is directly related to the amount of clean energy that is purchased through the clean energy options program. Because of the nature of central dispatch of the generation stations throughout New England, it is not possible to attribute the avoided emissions to Connecticut-based generation. Data reflecting actual regional emissions were used to develop a CO<sub>2</sub> emissions factor (lbs/CO<sub>2</sub> per MWh). These were then applied to the cumulative clean energy purchases data in section 4.2 above to derive the cost per ton of avoided CO<sub>2</sub> for the same time periods as used in the sign-up and clean energy consumption analyses. The results are presented in the following tables.

**Table 10 – Cumulative Acquisition Cost Per Ton of Avoided CO<sub>2</sub> from Program Activity**

	Through 2005	Through 2006	Through 2007
Program Costs	\$676,685	\$1,234,857	\$1,929,950
Metric tons of CO <sub>2</sub>	466	5,247	28,272
Cost per Ton of Avoided CO <sub>2</sub> from Program Activity	\$1,452.33	\$235.36	\$68.26

As expected, based on the results of the sign-up and kWh analyses, the program costs associated with avoiding a ton of CO<sub>2</sub> drops over time. On a cumulative basis, through 2007, the program related costs needed to avoid a ton of CO<sub>2</sub> through this voluntary initiative program, is slightly over \$68. Table 11 shows the unit costs based on inclusion of the calendar year program expenditures associated with the calendar year CO<sub>2</sub> emissions. On a year to year basis, one can

see that the program associated costs to avoid a ton of CO<sub>2</sub> emissions have dropped to a little over \$31 by year end 2007.

**Table 11 – Annual Acquisition Cost Per Ton of Avoided CO<sub>2</sub> from Program Activity, Using Calendar Year Costs**

	2005	2006	2007
Program Costs - Calendar Year	\$676,685	\$558,172	\$695,094
Metric tons of CO <sub>2</sub>	466	4,596	21,928
Cost per Ton of Avoided CO <sub>2</sub> from Program Activity	\$1,452.33	\$121.44	\$31.70

Table 12 shows the unit costs based on a 6-month lead on the program expenditures, under the assumption that it takes some time before program activity begins to influence customer behavior, particularly related to sign-up for the Clean Energy Options Program, which entails expenditure of personal funds (through an increase in one’s electric bill). As can be seen, based on this approach the cost per avoided ton of CO<sub>2</sub> emissions drops to approximately \$26 by year-end 2007.

**Table 12 – Annual Acquisition Cost Per Ton of Avoided CO<sub>2</sub> from Program Activity, Using 12 Month Costs With a 6 Month Investment Lead**

	2005	2006	2007
Program Costs - Fiscal Year	\$576,684	\$317,712	\$567,826
Metric tons of CO <sub>2</sub>	466	4,596	21,928
Cost per Ton of Avoided CO <sub>2</sub> from Program Activity	\$1,237.70	\$69.12	\$25.90

## 5 Observations about the Investment Analysis Methodology

A variety of assumptions were included in the analyses that had significant impacts on the results. Key among them:

- Because the Clean Energy Options program was established outside of CCEF’s domain and can function without CCEF’s program investments, examination of CCEF’s investments in influencing ratepayer participation in the Clean Energy Options program (the voluntary market demand program identified in Program Objective 3A) must remove the effects of naturally occurring (baseline) participation in the program. This study relied on a Delphi analysis to produce the baseline and net results.
- The Delphi analysis, described briefly in this report and at greater length in a separate report to CCEF, is itself based on a model that has its own assumptions.
- All costs associated with the CCEF investments in Program Objective 3A program outcomes were kept in the primary analysis. This effort was intended to examine the sum of CCEF’s costs in relation to program outcomes. Additional analyses, focusing on costs

associated with influencing single calendar year sign-ups and clean electricity purchases, were also conducted, using both lagged (based on the fiscal year) and calendar year expenditure data.

- It will be tempting to compare these results with those of other jurisdictions or of other CCEF programs. We caution doing so without being fully mindful of the underlying differences in the analytic assumptions, in particular the net analysis necessary to this program because of the unique relationship between CCEF and the Clean Energy Options program.
- It will be equally tempting to set aside the effects of the net analysis and recalculate results based on the total number of signups or kilowatthours consumed. We advise against this approach.

## 6 Conclusions

This investment analysis focused on two program outcome indicators for CCEF's Program Objective 3A – number of residential signups to the Clean Energy Options program and the associated clean energy purchases (kWh) that result from those signups. The analysis consisted of developing estimates of the cost to acquire each of these signups and the cost for each clean energy kWh.

- The CCEF related acquisition cost for ratepayer signups as of December 2005, using cumulative costs associated with Objective 3A, is calculated at \$1,581 per ratepayer. Using a similar methodology, acquisition costs drop to \$442 by year end 2006 and \$201 by year end 2007. When the cost of attaining sign-ups during any single year is limited to either the associated calendar year or a 6 month lead for the expenditures, the acquisition costs drop to between \$236 and \$134 by year end 2006 and between \$102 and \$83 by year end 2007 analysis. These latter results are within CCEF's anticipated range<sup>20</sup>.
- The cost for all the clean energy purchased since the inception of the program in April 2005 and attributable to CCEF's program activity has also fallen over time. The cumulative kilowatthour acquisition cost is calculated to be \$0.708 at the end of 2005, dropping to \$0.108 by year end 2006 and \$0.031 by December 2007. On a calendar year basis, with the two approaches for the expenditures discussed above, these costs drop to between \$0.054 and \$0.03 by the end of 2006 and between \$0.014 and \$0.011 by December 2007.
- Because of the direct relationship between cumulative clean energy purchases and avoided emissions of CO<sub>2</sub>, one can also observe a drop in the cost of the net avoided CO<sub>2</sub> emissions in these timeframes. The cumulative acquisition cost of an avoided ton of CO<sub>2</sub> is calculated at \$1,452 at the end of 2005, dropping to \$235 by year end 2006 and \$68 by

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<sup>20</sup> The CCEF document "Clean Energy Communities Program Plan" (draft, Feb 2005) on page 4 indicates an expected acquisition cost of no more than \$200 per customer sign-up for the clean energy options program.

December 2007. On a calendar year basis, with the two approaches for the expenditures discussed above, these costs drop to between \$121 and \$69 by the end of 2006 and between \$32 and \$26 by December 2007.

- The results contained in this report are highly sensitive to the assumptions stated in Section 5 and discussed in the body of the report, and therefore are reflective of very near term program activity and modeling approaches and assumptions that are more robust over the longer term.
- There are a variety of other ways in which the available data can be analyzed, to provide CCEF with insights into its programs. These will be able to be pursued and examined as the programs continue to operate, as more time passes with program activity, and as data supporting these indicators are collected, enabling the analysis to leverage actual historical data signup and cost patterns.
- On balance, this investment analysis—despite the uniqueness of the policies, institutions, and assumptions inherent to the analysis and the relative uncertainty underlying those assumptions—shows reasonably cost-effective performance data indicators for the voluntary market initiatives in support of Program Objective 3A. Not only does the performance data compare favorably with original planning documents—especially for acquisition cost; but also, anecdotally, they compare favorably with known acquisition costs for more traditional approaches to clean energy market development (e.g., bounties at \$150 to \$200 per signup). Another more profound question is whether the CCEF model to promote the voluntary market participation is replicable. That question, however, is beyond the scope of this report.