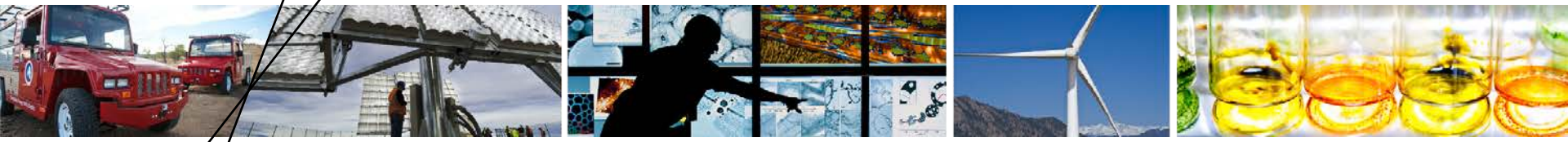
NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Financing Residential Energy Efficiency with Carbon Offsets



Steve Erario

Energy Programs Associate at Alarm.com

March 13, 2013

- Steve Erario served as the Carbon Project Coordinator at MaineHousing, which houses the state of Maine's weatherization program. In that role, he helped develop the certified carbon offsets project from 2010 to 2012. Ultimately Steve managed the sale of carbon offsets to Chevrolet Motors, and the revenue from the sales are currently being used to weatherize low-income homes in Maine.

- Prior to MaineHousing, Steve helped create a sustainability nonprofit, Sustain Mid-Maine, and consulted internationally on greenhouse gas, watershed quality, and natural resource management issues.

- Steve holds a B.A. in Environmental Policy from Colby College and he has certifications from the Greenhouse Gas Management Institute, the Building Performance Institute, and the Environmental Change Management Institute.

- He was awarded the Colby College Philanthropist of the Year award, he is a Morris K. Udall Scholar, and he was a Clean Air-Cool Planet Climate fellow. Steve is currently a Senior Fellow at the Environmental Leadership Program and serves on the board of the Udall Scholar Alumni Association.


MaineHousing
Maine State Housing Authority


ALARM.COM™

Overview

- MaineHousing
- Carbon Financing Model
- 8 Phases of Residential Offset Development
- Questions


MaineHousing
Maine State Housing Authority

MaineHousing

- Maine agency that administers Weatherization Assistance Program (WAP) funding
- Existing need for low-income weatherization funding was greater than funding availability
- Began focusing on carbon offsets as an additional financing stream in 2008
- Secured investment from Chevrolet in 2012, proving the concept

MaineHousing Goals

- Develop Methodology
- Pilot Project – Develop and Sell Carbon Offsets
- Share Lessons Learned

MaineHousing Funders and Partners

Methodology Development

Funders	Partners
Ford Foundation	Climate Focus
New Jersey Housing and Mortgage Finance Agency	Det Norske Veritas
Pennysylvania Housing Finance Agency	First Environment
Unity College	Harvard Law School
U.S. Department of Energy	Lee International
	Oak Ridge National Laboratory
	Verified Carbon Standard

Project Development

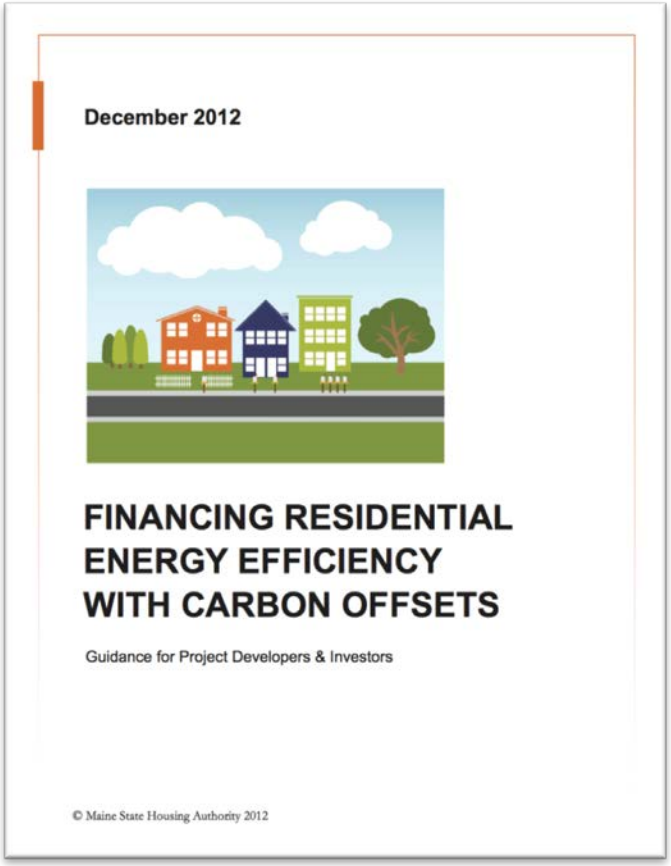
Funders	Partners
Chevrolet	Bonneville Environmental Foundation
U.S. Department of Energy	Climate Focus
	First Environment
	Lee International
	Verified Carbon Standard

Source: MaineHousing

Contributing Organizations

Handbook and Financial Calculator

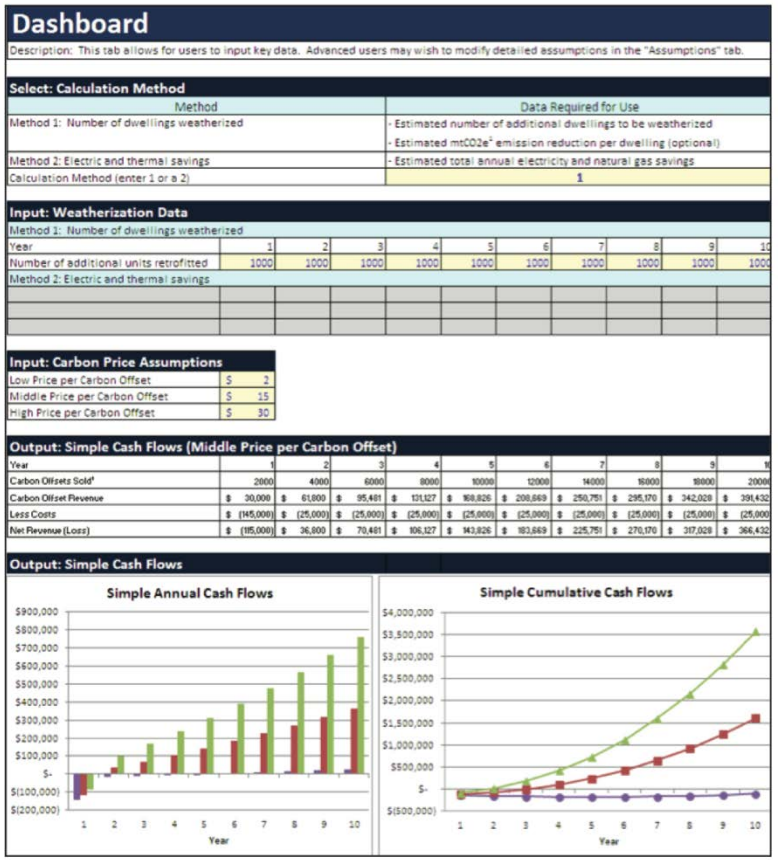
Available for download at: www.mainehousing.org/carbon


December 2012

FINANCING RESIDENTIAL ENERGY EFFICIENCY WITH CARBON OFFSETS

Guidance for Project Developers & Investors

© Maine State Housing Authority 2012


Dashboard

Description: This tab allows for users to input key data. Advanced users may wish to modify detailed assumptions in the "Assumptions" tab.

Select: Calculation Method

Method	Data Required for Use
Method 1: Number of dwellings weatherized	- Estimated number of additional dwellings to be weatherized - Estimated mtCO2e² emission reduction per dwelling (optional)
Method 2: Electric and thermal savings	- Estimated total annual electricity and natural gas savings
Calculation Method (enter 1 or a 2)	1

Input: Weatherization Data

Method 1: Number of dwellings weatherized

Year	1	2	3	4	5	6	7	8	9	10
Number of additional units retrofitted	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Method 2: Electric and thermal savings

Input: Carbon Price Assumptions

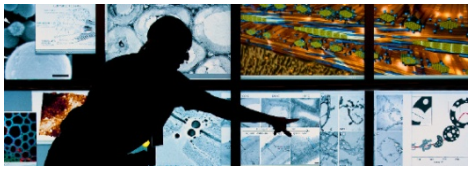
Low Price per Carbon Offset	$ 2
Middle Price per Carbon Offset	$ 15
High Price per Carbon Offset	$ 30

Output: Simple Cash Flows (Middle Price per Carbon Offset)

Year	1	2	3	4	5	6	7	8	9	10
Carbon Offsets Sold²	2000	4000	6000	8000	10000	12000	14000	16000	18000	20000
Carbon Offset Revenue	$ 30,000	$ 61,800	$ 95,481	$ 131,127	$ 168,826	$ 208,669	$ 250,751	$ 295,170	$ 342,028	$ 391,432
Less Costs	$ (145,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)
Net Revenue (Loss)	$ (115,000)	$ 36,800	$ 70,481	$ 106,127	$ 143,826	$ 183,669	$ 225,751	$ 270,170	$ 317,028	$ 366,432

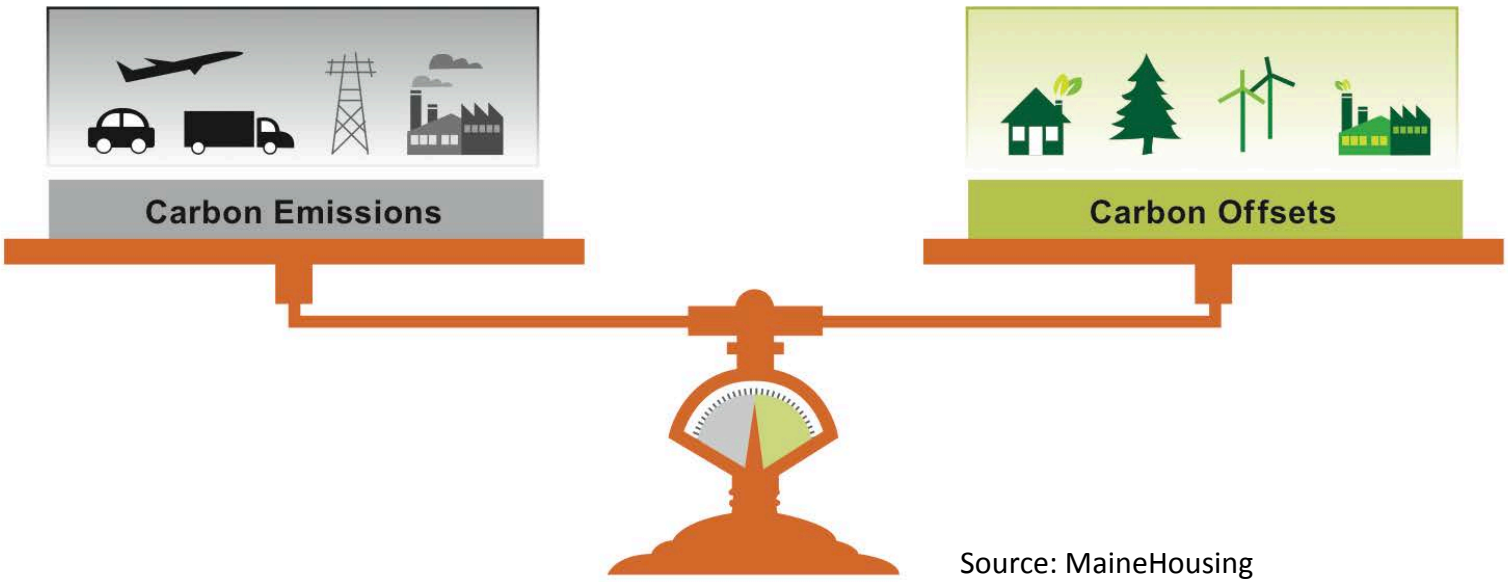
Output: Simple Cash Flows

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Carbon Financing Model

Carbon Offsets Defined

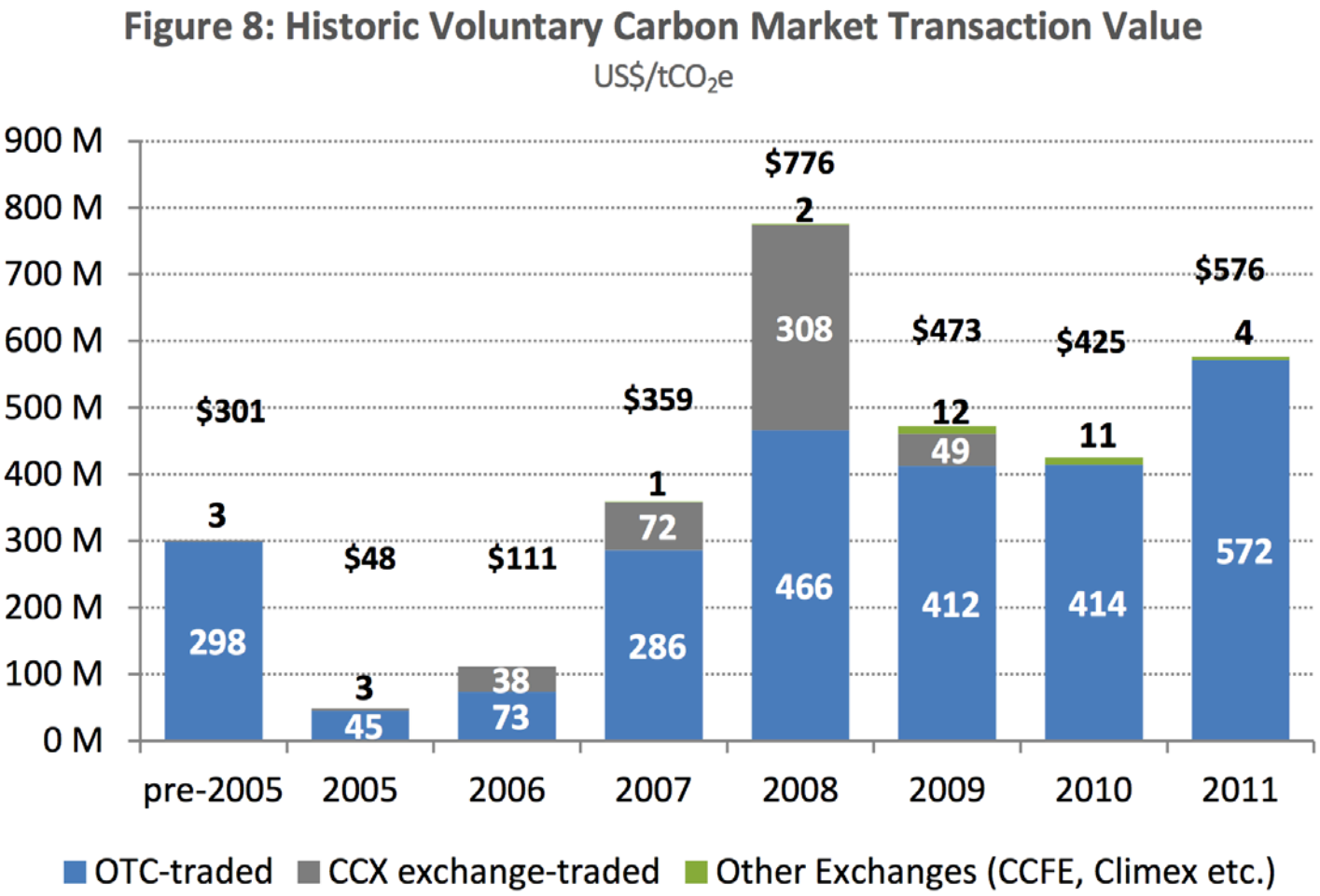


Source: MaineHousing

Definition: A reduction in emissions of carbon dioxide or greenhouse gases made in order to compensate for or to offset an emission made elsewhere.

In this presentation, carbon offsets are also called “residential offsets”.

Voluntary Carbon Market Transaction Value



Source: Ecosystem Marketplace. Note: Based on 862 observations.

Verified Carbon Standard

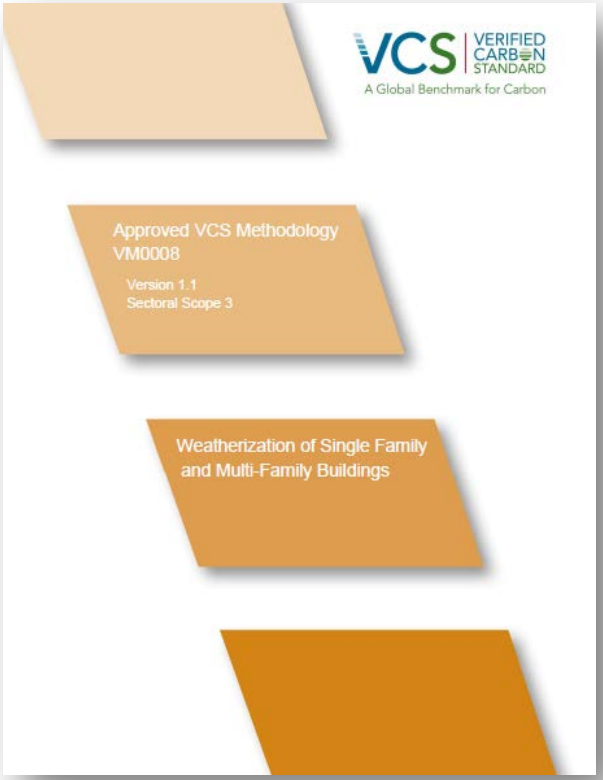
- **VCS is a greenhouse gas (GHG) program that provides a framework for measuring GHG reductions or removals**

- **Sets rules for and approves:**
  - General carbon accounting
  - Methodologies
  - Third-party auditors

VCS | VERIFIED CARBON STANDARD
A Global Benchmark for Carbon

- **Does not typically get involved in:**
  - Detailed technical reviews of specific projects

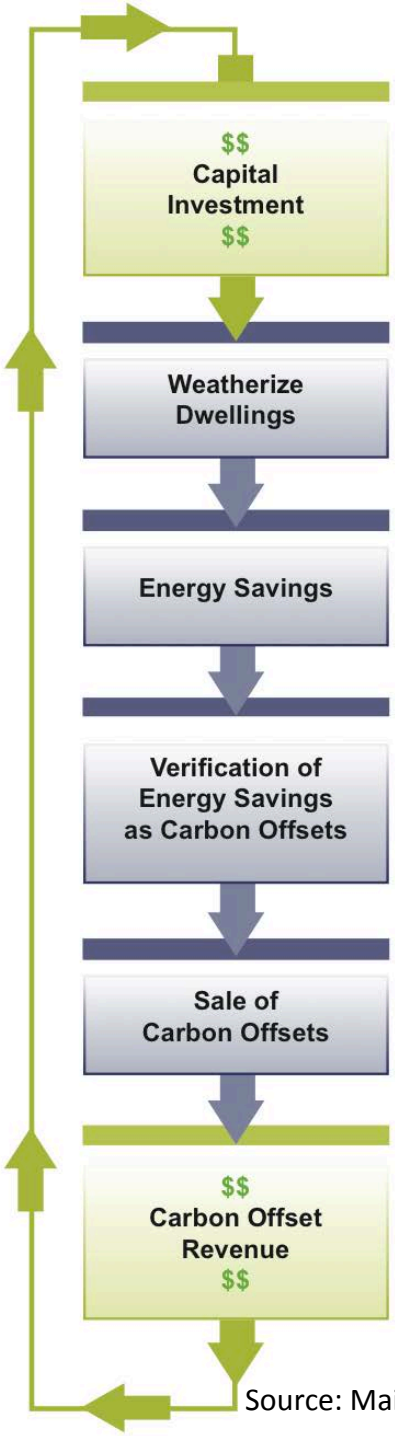
Validated VCS Methodology



VM0008, The Methodology for Weatherization of Single Family and Multi-Family Dwellings, is available for download from www.v-c-s.org

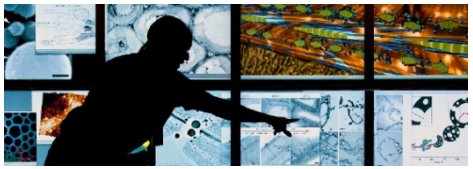
Financing Model

Source: NREL



Source: MaineHousing

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

8 Phases to Residential Offset Project Development

8 Phases of Project Development

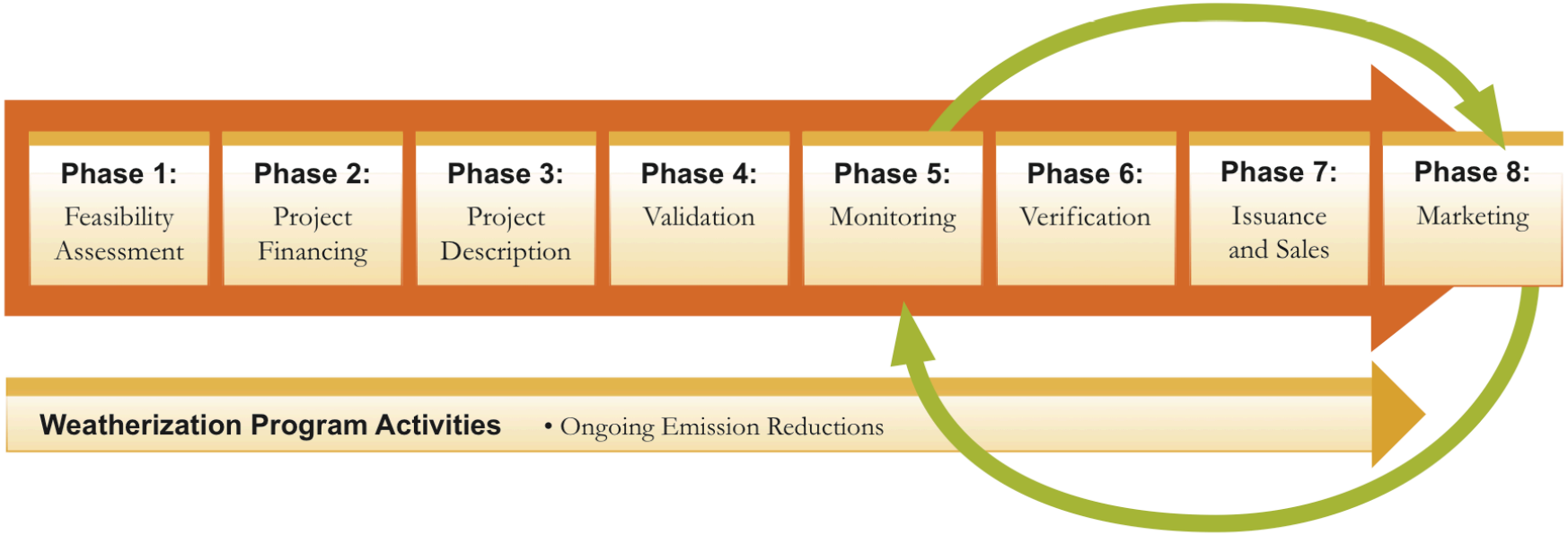


Figure 8: The Eight Phases of Residential Offset Project Development

Source: MaineHousing

Project Timelines: 1 to 3 Years

One Year -

- Rigorous Online Data and Monitoring
- Few Legal Issues
- Clear Ownership
- Willing Buyer
- Previous Experience with M&V

Two Years +

- Manual Data and Monitoring
- Ownership in Question
- Lack Project Management Resources/Personnel

Phase 1 – Feasibility – Allowable WAP Activity

	Generally Eligible	Generally Not Eligible
Types of energy savings	▪ Electricity savings* ▪ Fuel savings	
Types of buildings	▪ Existing single family buildings ▪ Existing multi-family buildings ▪ Existing mobile homes buildings	▪ New construction ▪ Commercial buildings ▪ Industrial buildings ▪ Industrial processes
Income level of owners / occupants	▪ Low-income ▪ Non-low-income	
Geographic location of projects	▪ Communities, regions, and states in the U.S. and internationally	
Types of weatherization measures	▪ Lighting and appliances (e.g. lighting or refrigerator replacement) ▪ Heating and cooling system efficiencies ▪ Building envelope upgrades (e.g. insulation, air sealing)	▪ Fuel switching (e.g. oil to natural gas conversion) ▪ Renewable energy (e.g. solar, geothermal, biomass)

**Electricity savings may be subject to ownership issues, particularly in jurisdictions subject to cap and trade regulations*

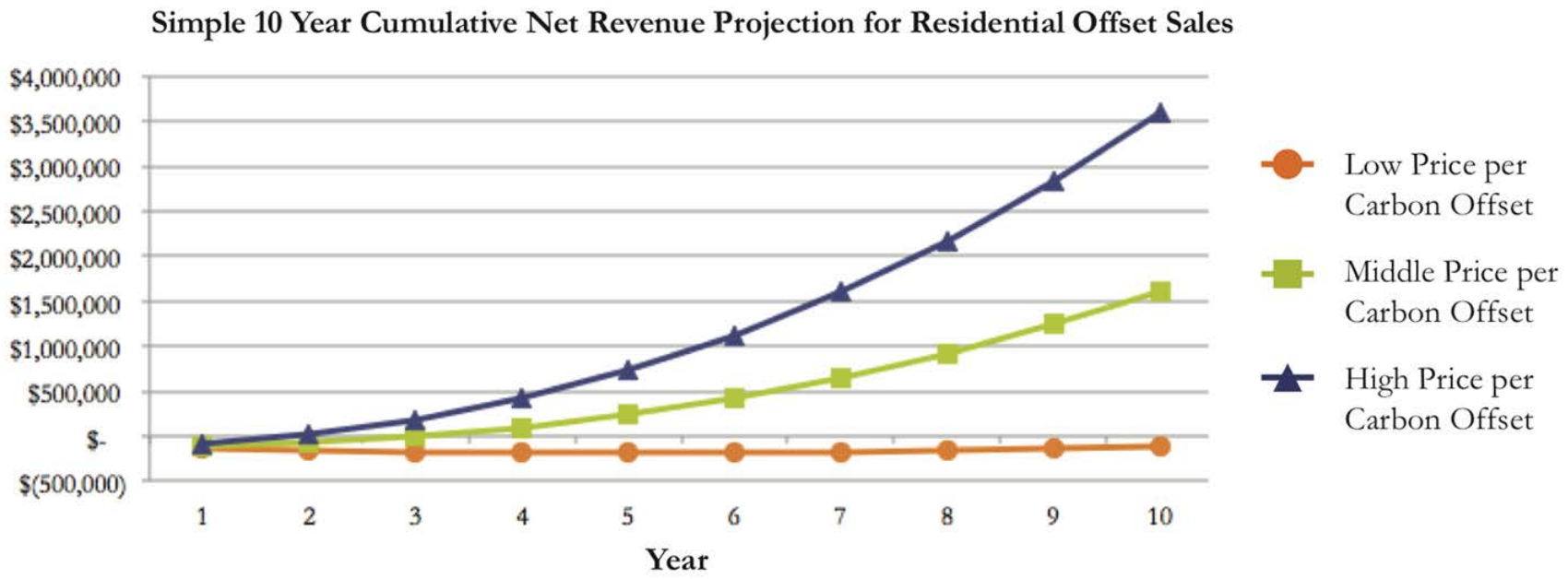


Figure 3: Simple 10 Year Net Revenue Projection for Residential Offset Sales

The net revenue curve was created using the financial calculator which complements this Guide. Projections are based on an example case, although actual costs and will vary. The following assumptions were made in this example:

Cost assumptions: *year one upfront costs of $120,000, annual recurring costs of $25,000, and no project partners (the project is implemented unilaterally and there is no cost-sharing).*

Revenue assumptions: *weatherization of 1,000 dwellings per year, with each dwelling generating two metric tons Carbon Dioxide equivalent (mtCO2e) emission reductions annually, equal to two Residential Offsets. The low, middle, and high carbon prices per Residential Offset are assumed to be $2, $15, and $30, respectively. The reduction of 2 mtCO2e roughly equals savings from the reduction of 300 – 400 therms of natural gas or 2,000-4,000 kWh of non-renewable electricity.*

Discounting assumptions: *because this is a 'simple' 10 year projection, there is no discount rate and no rate of change for carbon offset prices.*

Source: MaineHousing

Phase 1 & 2 - Key Profitability Determinants

- **Whether an organization decides they can generate profits from carbon offset sales depends on a number of factors:**
  - Is there sufficient scale (or can the organization partner to achieve sufficient scale?)
  - What price can be secured for carbon offsets?
  - Are there financial benefits that might arise aside from the actual sale of carbon offsets?

Dashboard

Description: This tab allows for users to input key data. Advanced users may wish to modify detailed assumptions in the "Assumptions" tab.

Select: Calculation Method

Method	Data Required for Use
Method 1: Number of dwellings weatherized	- Estimated number of additional dwellings to be weatherized - Estimated $mtCO2e^2$ emission reduction per dwelling (optional)
Method 2: Electric and thermal savings	- Estimated total annual electricity and natural gas savings
Calculation Method (enter 1 or a 2)	1

Input: Weatherization Data

Method 1: Number of dwellings weatherized										
Year	1	2	3	4	5	6	7	8	9	10
Number of additional units retrofitted	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Method 2: Electric and thermal savings										

Input: Carbon Price Assumptions

Low Price per Carbon Offset	$ 2
Middle Price per Carbon Offset	$ 15
High Price per Carbon Offset	$ 30

Output: Simple Cash Flows (Middle Price per Carbon Offset)

Year	1	2	3	4	5	6	7	8	9	10
Carbon Offsets Sold[1]	2000	4000	6000	8000	10000	12000	14000	16000	18000	20000
Carbon Offset Revenue	$ 30,000	$ 61,000	$ 95,481	$ 131,127	$ 168,826	$ 208,669	$ 250,751	$ 295,170	$ 342,028	$ 391,432
Less Costs	$ (145,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000)	$ (25,000
Net Revenue (Loss)	$ (115,000)	$ 36,000	$ 70,481	$ 106,127	$ 143,826	$ 183,669	$ 225,751	$ 270,170	$ 317,028	$ 366,432

Output: Simple Cash Flows

Phase 1 & 2 – Feasibility and Financing Other Benefits

- **Proof of Positive Program Impacts**
  - Third-party verification of weatherization program energy savings
  - Can be streamlined with other measurement and verification (M&V) requirements to reduce incremental costs
  - Highlight other weatherization benefits such as job creation, cost savings, and occupant comfort

- **Improvement in Program Management**
  - Tracking of weatherization process and its outcomes
  - Framework and financial incentive to enhance program management oversight

- **Organizational Capabilities and Branding**
  - Demonstrate:
    - ability to attract non-traditional long-term funding sources
    - capacity to plan and execute advanced projects
    - organizational support of energy efficiency, climate change mitigation, job creation, and local economic growth
  - Attract non-carbon financing from internal or external sources

Phase 3 & 4 – Project Description & Validation

- Similar to writing and securing third-party approval for a weatherization program energy efficiency savings M&V plan

- Based on weatherization activities that will occur in the future
  - Include projections of various data
  - Expected savings per home
  - Expected number of completed weatherization units per year

VCS | VERIFIED CARBON STANDARD
A Global Benchmark for Carbon

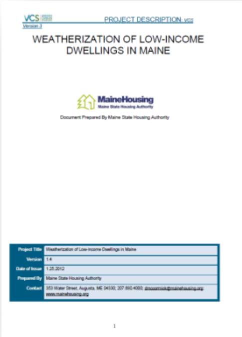
Phase 3 – Project Description

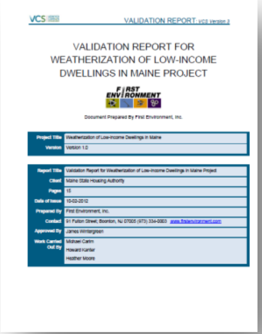
- A description of the weatherization program and project activity boundaries
- A description of the features that will be shared by each of the weatherized units and the features that limit the scenario in which the activity actually happens, e.g. location, level of efficiency, and range of technologies
- A detailed overview including baseline selection and justification, demonstration of additionality, and eligibility criteria to be used to assess new instances being added to a program
- A detailed description of how the information will be documented, maintained, secured, and managed to reduce errors, corruption, and omissions of data

Phase 3 – Project Description, Continued

- An estimate of annual residential offset volume over the crediting period (10 years)
- Disclosure of assumptions
- A detailed monitoring plan, including sampling methodology; and
- A framework describing the duties and responsibilities of the Project Proponent and Project Administrator for each project unit, including contractors (e.g. energy auditors and construction crews).

Phase 4 –Validation Documentation


WEATHERIZATION OF LOW-INCOME DWELLINGS IN MAINE


VALIDATION REPORT FOR WEATHERIZATION OF LOW-INCOME DWELLINGS IN MAINE PROJECT

February 2012

VCS VERIFIED CARBON STANDARD VALIDATION REPORT: *VCS Version 3*

Summary:

The Weatherization of Low-income Dwellings in Maine project (the Project) is a grouped project involving energy efficiency improvements to single family, multi-family, and mobile home dwellings of low-income residents within the state of Maine. The Project reduces the heat load of dwellings, thereby reducing fossil fuel consumption and resulting in a net reduction of CO_2 emissions. The Maine State Housing Authority (MaineHousing) is the Project Proponent and owns all rights to emission reductions generated by the Project.

The validation process consists of the independent third-party assessment of the project design and emission reduction assertion against the criteria stated in the Verified Carbon Standard (VCS) Standard, 1 February 2012, v3.2 and the approved VCS methodology VM0008 (Version 1).

During the validation process, First Environment, Inc. issued several clarification and corrective action requests – all of which were addressed adequately by MaineHousing. In summary, First Environment, Inc. is reasonably assured that the Project meets all relevant VCS Version 3 requirements and correctly applies the approved VCS methodology VM0008.

Phase 5 & 6 – Monitoring & Verification

- Similar to gathering data and gaining third-party approval for energy efficiency savings and M&V calculations
- Based on weatherization activities that have previously occurred
- Based on actual data that has already been collected

VCS | VERIFIED CARBON STANDARD
A Global Benchmark for Carbon

Phase 5– Monitoring Report

- Basic information about the project, including sectoral scope, boundaries, start date, monitoring period, and project location

- A description of the qualitative progress on project implementation, including whether activities have been implemented as planned in the Project Description

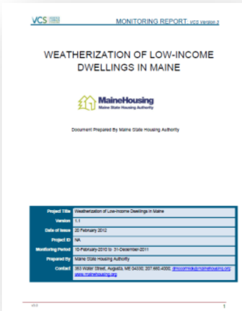
- A detailed description of how the data was managed to reduce errors and omissions

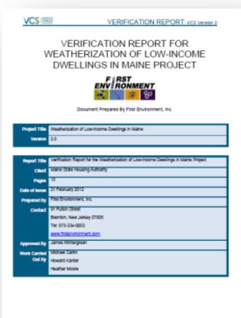
- A description of the parameters monitored and the monitoring plan

- A description of how the eligibility criteria were met for instances included in emission reduction calculations; and

- A summary of emission reduction calculations by project unit by year

Phase 6 - Verification Report





February 2012

VCS VERIFIED CARBON STANDARD — VERIFICATION REPORT: *VCS Version 3*

Summary:

The Project is a grouped project involving energy efficiency improvements to single family, multi-family, and mobile home dwellings of low-income residents within the state of Maine. The Project reduces the heat load of dwellings, thereby reducing fossil fuel consumption and resulting in a net reduction of CO_2 emissions. The Maine State Housing Authority is the Project Proponent and owns all rights to emission reductions generated by the Project.

The verification process consists of the independent third-party assessment of the project design and emission reduction assertion against the criteria stated in the Verified Carbon Standard (VCS) Standard, 1 February 2012, v3.2; the approved VCS methodology VM0008 (Version 1) and the validated Project Description (VCS PD).

The Project claims emission reductions of 7,008 metric tonnes CO_2e for the verification period of February 10, 2010 through December 31, 2011. First Environment is reasonably assured that the Weatherization of Low-income Dwellings in Maine Project meets all relevant requirements in the VCS Standard, 1 February 2012, v3.2, and is consistent with the VCS methodology VM0008 (Version 1) and the validated VCS PD.

Phase 7 & 8 – Sales & Marketing

- Voluntary carbon market, where carbon offsets are sold, is liquid and variable
- Transactions total roughly $500 million per year
- The most typical buyers are businesses looking for some type of **public relations benefit**
- Types of sales approaches for weatherization programs
  - Direct sales – No middleman, requires more time and knowledge of markets
  - Brokered sales – Uses middleman to identify willing buyer(s)
  - Retail sales – Similar to brokered sale, except sold to more smaller volume buyers

Phase 7 – Sales

- Contracts for the purchase of GHG offset projects are typically called Voluntary Emissions Reduction Purchase Agreements (VERPAs)

- MaineHousing consultant Lee International acted as the carbon broker
  - Carbon brokers have contacts with interested buyers in the carbon offset space

- MaineHousing and its consultants negotiated on price and terms with Bonneville Environmental Foundation (BEF), who acted as the broker for Chevrolet

- Like most contracts, the one between MaineHousing and BEF specify that price and terms cannot be disclosed

Phase 8 – Marketing

- Emphasize the co-benefits of the project
- Speak to the overall robustness of the VCS Program
- Provide additional transparency regarding weatherization program outcomes
- Engage supportive environmental non-governmental organizations early on in the process

Questions?

Guidebook and financial calculator available free for download at:
www.mainehousing.org/carbon

Contact:
s.erario@gmail.com