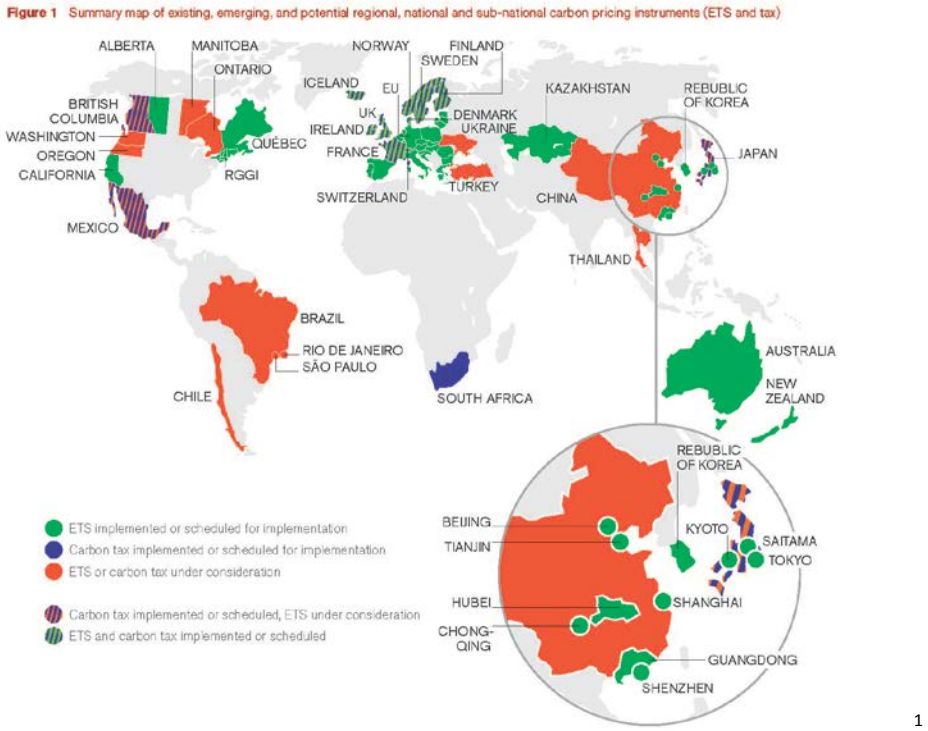
Fall 2015 ENVS 0401 Project Statements

Introduction / Context

According to a June 2015 update to Vermont's statewide greenhouse gas (GHG) inventory, Vermont emissions for 2012 were 8.27 million metric tons CO_2 equivalent ($MMTCO_2e$). This compares to 6,673 $MMTCO_2e$ for the U.S. as a whole in 2013 and approximately 35,000 $MMTCO_2e$ globally. Given the size and urgency of the climate challenge and in light of difficult and ongoing international climate negotiations, there is an increased focus on national, regional and local-scale climate change policy and mitigation actions. According to a 2014 World Bank report on carbon pricing, actions that scale up GHG emission reductions and lower the cost of mitigation are crucial to combating climate change.

Carbon pollution taxes and emissions trading schemes represent a key sector of policy approaches and the below map details the scope of such schemes globally.



[1]

Two of the projects for this seminar will deal with several facets of *Vermont's* proposed Carbon Pollution Tax which was just introduced for the first time during the Spring 2015 legislative session. Student insights into the considerations and implications of this pollution tax related to Vermont's agricultural community and low-income earners will be crucial to the advancement of this legislation during the 2016 session.

Another sector of approaches includes setting emissions reductions targets and/or targets for transitioning to renewable energy. Internationally, the UN Framework Convention on Climate Change details two agreed upon commitment periods for the Kyoto Protocol. For the first commitment period, 38 Parties agreed to reduce their overall emissions by at least 5 per cent below 1990 levels between 2008 and 2012. For the second commitment period, the same number of parties has agreed (via the Doha Amendment to the Kyoto Protocol) to reduce their emissions by at least 18 per cent below 1990 levels between 2013 and 2020. In 2009, President Obama committed to reducing U.S. GHG emissions to 17% below 2005 levels by 2020 and actions to achieve this are detailed in The Presidents Climate Action Plan (2013). Further, in March 2015, President Obama issued an

[1] World Bank Group 2014. "State and Trends of Carbon Pricing" http://www.ecofys.com/files/files/world-bank-ecofys-2014-state-trends-carbon-pricing.pdf

Executive Order that will cut the *Federal Government's* GHG emissions 40 percent over the next decade from 2008 levels.

In 2011, Vermont revised its Comprehensive Energy Plan (CEP) and established the ambitious goal to meet 90% of the state's energy needs from renewable sources and increased efficiency by 2050. This goal includes energy used in all three sectors–transportation, thermal and electric–by residential, commercial and industrial users. Zooming even further in, you are well aware of Middlebury College's goal of carbon neutrality by 2016. And lastly, the Town of Middlebury states in its town plan that it will leverage the College's carbon neutrality pledge to determine if there are opportunities for the Town to achieve its own carbon neutrality status by 2025.

The other two projects for this seminar are directed at facilitating and measuring progress towards the state's, town's and college's goals through working with an innovative community-energy dashboard pilot geared towards incentivizing and tracking energy transitions and developing metrics for both carbon and phosphorus pollution reductions achieved through the college's switch from #9 fuel oil to biomethane, respectively.

For all projects, the opportunity to learn from how these issues are being tackled at the state and local level will be excellent preparation for working on these issues at any scale after graduation.

Generally speaking, those most affected by climate change are not the people leading these planning and adaptation processes. While it is most explicitly addressed in project statement #2, all of our partners are keenly aware of the import of addressing social equity issues during any energy transition. In fact, the coalition championing a carbon pollution tax for Vermont details ensuring equity as 1 of its 3 key tenets of the policy. We expect each project team to consider carefully issues of race and class throughout your project work with an eye to ensuring the your recommendations do not further social inequalities.

Carbon Pollution Tax #1: Considerations and implications for Vermont's agricultural community
Partner: Johanna Miller, Energy Program Director, Vermont Natural Resources Council

In the Spring 2015 legislative session, legislators introduced two bills related to establishing a carbon pollution tax—H.412 and H.395 (H.395 is more aggressive than H.412, with H.412 emerging as the preferred approach after the first legislative session). Energy Independent Vermont (EIV) is a coalition of environmental organizations, Vermont businesses and business associations, academic leaders, low-income advocates, and Town Energy Committees supporting this proposed legislation. EIV has summarized the policy objectives as follows:[2]

1. Reduce Vermont's carbon emissions at a rate that helps us meet our state greenhouse gas (GHG) reduction goal (75% GHG reduction by 2050), and goals for weatherization and renewable energy
2. Do so in a way that is a net economic benefit to Vermont
3. Do so in a way that is equitable for all Vermonters

The carbon pollution tax would be assessed on fossil fuels sold in Vermont (i.e., heating and transportation fuels, such as oil, gas, propane, and coal). Electricity would be exempt as it is covered by the Regional Greenhouse Gas Initiative (RGGI) and is a smaller contribution to VT's emissions given our electricity portfolio. The Vermont Public Interest Research and Education Fund contracted with Regional Economic Models, Inc. (REMI) to model the economic, fiscal, emissions, and demographic implications from a carbon price policy in Vermont. Their eponymous report will be a key starting point for this team. It modeled three different carbon pricing scenarios (a low, medium, and high price per ton of carbon)—inclusive of "revenue recycling" programs—to predict outcomes on metrics such as overall state employment, gross state product, specific categories of industry, and households. The authors note that, "the scenarios included are but only a small set of the theoretically limitless number of possibilities for policy."

A primary task of this group is to determine this policy's impacts on the agricultural community, a key sector of Vermont's economy and an important political force in the state. As the REMI analysis highlights, a price on carbon pollution will have positive impacts on some industries and potential negative impacts on others, depending how the policy is structured. Agriculture in Vermont relies heavily on fossil fuels for farm operations as well as processing and transporting goods; therefore EIV is particularly interested in understanding the potential impacts of the proposed policy on this sector.

This team will 1) consider the impacts of the carbon pollution tax on Vermont's agricultural community and 2) develop proposals for how to structure the policy itself and the Energy Independent Vermont Fund (proposed to be 10% of revenues generated) to help mitigate the impacts that you elucidate. This team will first need to grapple with how you define "Vermont's agricultural community". There is a diverse range within the agricultural sector from large scale conventional dairy farms to small scale organic vegetable farms and you will need to design your research to capture input from a representative set of these sub-sectors. A secondary consideration would be to define a geographic scope—i.e. Addison County or a scale of your choosing.[3]

Key research questions and approaches include:

- Assessing current on-farm energy use (fuel usage costs and other on-farm energy consumption)
    - Several entities may have resources or research on on-farm energy use that you should explore as a starting point. These include, but are not limited to, the Northeast Organic Farmers Association, Rural Vermont, the Vermont Farm Bureau and the Vermont Agency of Agriculture, Food, and Markets (Alex DePillis, energy specialist).
- Assessing potential alternatives to begin to shift Vermont's farming economy and infrastructure away from fossil-fuel heavy usage.

[2] http://www.energyindependentvt.org/wp-content/uploads/2015/03/2015-03-Pollution-Tax-Bill-Overview.pdf
[3] Since you will be exploring issues for a sub-set of Vermont, your final products should include details for replicating you work for the rest of the state.

- Conducting interviews with farmers and farm advocacy groups to explore their concerns and potential impacts (financial or otherwise).
    - Initial outreach script will be developed in consultation with your project partners, drawing on their expertise with setting the stage for productive conversations with a range of stakeholders
    - What policy elements did farmers and farm organizations recommend?

- Once you have identified the scope and scale of potential impacts, identify some policy solutions and/or design elements to address or minimize the impact to Vermont's agricultural economy.
    - Your exploration of policy solutions can span a research spectrum from exempting agriculture from this policy to specific proposals to mitigate agricultural impacts that would work within the frame of the legislation as it currently stands.
    - This work should be informed by an analysis of British Columbia's approach. Initially its carbon tax included agriculture; shortly after they changed the policy to exempt certain agricultural sectors. Why? What does their policy look like now and how might it be a model (or not) for Vermont's approach?
    - What other regional, national, or international policies or taxes might serve as useful models?
    - Would there be a benefit to a regional approach?
    - Should there be some form of rebate mechanism for all or some sectors of the agricultural community? What would be the optimal form and timing of these rebates?

Carbon Pollution Tax #2: Considerations and implications for low-income earners

Partners: Johanna Miller, Energy Program Director, Vermont Natural Resources Council and Amy Shollenberger, Action Circles Consulting

In the Spring 2015 legislative session, legislators introduced two bills related to establishing a carbon pollution tax—H.412 and H.395 (H.395 is more aggressive than H.412, with H.412 emerging as the preferred approach after the first legislative session). The carbon tax would be assessed on fossil fuels sold in Vermont (i.e., heating and transportation fuels, such as oil, gas, propane, and coal). Energy Independent Vermont (EIV) is a coalition of environmental organizations, Vermont businesses and business associations, academic leaders, low-income advocates, and Town Energy Committees supporting this proposed legislation. EIV has summarized the policy objectives as follows:[4]

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Of paramount interest to the Energy Independent Vermont Coalition and other partners working to advance carbon pricing in Vermont is ensuring that any new pricing policy does not adversely impact low-income earners or harm them for not having the resources available to change their behavior. Several meetings and conversations with a range of community action agencies, the Vermont Low Income Advocacy Council, the Community of Vermont Elders, and others have already been held to identify key concerns. While exemptions might be ideal for their constituents, they have not advocated for exempting low income earners from the policy as they recognize that this would be counter to the spirit and intent of the tax.

Furthermore, these statewide conversations have demonstrated that these groups would like to have low-income Vermonters be actively involved in addressing climate change as low-income families are disproportionately affected by climate change. Key concerns that have been highlighted include a range of issues surrounding the structuring of the proposed rebates and how to utilize the funds raised through the tax so that all Vermonters can eventually benefit from their rebate. As they say though, "the devil is in the details," and that is where you come in. The logistics of how to design a policy that will actually address these concerns and realities is the key need at this stage in the process.

The issues and ideas raised to date are detailed below. Through a combination of researching models for redistribution of financial burden elsewhere (need not be limited to the US or to the carbon sector specifically); additional conversations with state leaders from the Office of Economic Opportunity, Office of Economic Services, and the Vermont Low Income Advocacy Council; Vermont legislators; and, most importantly talking with low-income Vermonters directly, develop ideas and suggested solutions to these challenges.

Rebate design:

While you will dive into the details of the proposed carbon pricing and rebate structure, the key points to highlight here are 1) that the rebates will be a flat amount—e.g., $10—and that the bottom quintile of Vermont income brackets will receive double that amount, or $20, and 2) the various rebate mechanisms proposed in the REMI report would function as refundable tax credits.

The issues for low-income earners raised around these points include:

- Should the extra rebate be based on Vermont income quintiles or federal poverty thresholds and guidelines?[5] For example, qualifications for other economic services for low-income Vermonters (e.g. fuel and food assistance programs) are determined based on whether gross household income is equal to or less than 185% of the federal poverty level based on household size and regardless of owned resources.[6]

[4] http://www.energyindependentvt.org/wp-content/uploads/2015/03/2015-03-Pollution-Tax-Bill-Overview.pdf
[5] http://aspe.hhs.gov/poverty/faq.cfm
[6] http://dcf.vermont.gov/esd

- Not all low-income people file taxes, so a refundable tax credit is an imperfect design
- Linking it to tax filings means that any benefit from rebate would be received on a yearly basis. This is less than ideal for people living from paycheck to paycheck.
- Adding $10 to EBT cards[7] is a leading idea for distributing the rebate, but there are issues here as well. For example, many low- or fixed-income Vermonters do not have EBT cards (a combination of being too asset rich as homeowners to qualify and/or stigma). EBT cards have limits/caps for total cash allowances—adding a rebate any given month could put someone over this limit and they therefore would be bumped out of the food-stamp program for a month.
- Lastly, the rebates are proposed to be flat rebates to all *adults*, but low-income benefits are often distributed by *household*, with one household holding one EBT card.

Relevant questions therefore include:

- Is the proposed income-based qualification for rebates optimal?
- When and how should rebates be distributed?
    - What are trade-offs and limitations distributing rebates monthly, bi-annually versus annually?
        - Could the additional $10 coming to the lowest quintile arrive monthly?
    - If not linked to tax credits, how would rebates be distributed?
        - Note that checks are not an ideal option because many low income Vermonters are transient and/or do not have bank accounts.
    - What is the best distribution mechanism?
        - What are the positives and negatives of relying on EBT cards?
        - What are other alternatives?
    - What can be learned through researching what works well and what does not work well regarding the distribution of benefits through current Vermont economic assistance programs (e.g. LIHEAP, 3SquaresVT, and Reach Up), and in other regions, such as under British Columbia's carbon tax (note that BC has a different suite of public assistance programs as compared to Vermont)?

The key goals for addressing all of these challenges is that the solutions 1) do not result in a logistical nightmare for either the state or the recipients, 2) do not cost an excessive amount to administer, and 3) allow low-income earners to spend the rebate however they want/need as cash.

Energy burden analysis:

The concept of energy burden is invoked to describe the percentage of one's income that is spent on energy costs. A 2014 report prepared by the Vermont Law School details that the ideal target is that 10% of one's income be spent on energy costs and estimates that mid-income Vermonters are paying 15-17% and low-income Vermonters are paying 30%.[8] How / can funds raised from the carbon pollution tax go back into programs like "cash for clunkers" and those supporting low-income weatherization and fuel-efficient heating systems?

Scenario analysis:

Consider this policy's likely costs and impacts (as well as the impact of your recommendations regarding rebate structure and energy burden analyses) for several low-income or fixed-income earner scenarios, e.g. a low-income family of 5 versus 2, a retired couple, a family who already has qualified and implemented home weatherization vs. one that has not, and a family or individual who must commute significant distances.[9] The commuting scenario is VERY important to elucidate as the above-mentioned energy burden report only focuses on home energy use and not fuel use for transportation. You may choose to model some of your scenarios off of those utilized in the development of Vermont's Basic Needs Budget.[10]

[7] EBT = Electronic Benefit Transfer Cards (https://www.ebt.acs-inc.com/)
[8] Energy Costs and Burdens in Vermont, Vermont Law School, 2014.
[9] Consider combinations of scenarios as well – i.e. a family of 5 with an un-weatherized house and whose members commute significant distances for work
[10] http://www.leg.state.vt.us/jfo/reports/2015%20Basic%20Needs%20Budget%20report%2001-15-2015.pdf

Community Energy Dashboard Pilot for Town of Middlebury

Partners: Linda McGinnis, Network Program Manager, Energy Action Network and Town of Middlebury Energy Committee

The Energy Action Network (EAN) is "an active network of nonprofit, business and government leaders working to transform Vermont's energy economy by focusing on 4 leverage points: capital mobilization, technology innovation, regulatory reform, and public engagement."[11] The target for this transformation is the 90% renewable energy by 2050 target (inclusive of transportation, thermal, and electricity energy uses) that was laid out in Vermont's 2011 Comprehensive Energy Plan. This project will work most closely with EAN's public engagement efforts. Facets of their work to date on this front include 1) the development of their "Pathways to Clean Energy" report which offers illustrative milestones that detail the changes needed by certain dates to achieve intermediate targets–e.g. 20% by 2020, 40% by 2030, 70% by 2040, 2) work with the Vermont Energy Investment Corporation (VEIC) to develop Long-range Energy Alternatives Planning (LEAP) models that will be piloted with three of the state's regional planning commissions (RPCs), and 3) the development of Community Energy Dashboards to spur town-level action and planning which will be piloted in five towns.

The Town of Middlebury is one of the pilot Dashboard communities and the Middlebury Energy Committee will be the town contact for this process. There are many directions that your work could take to help launch, shape, inform, and evaluate this pilot for Middlebury. These include:

- What other nations-states-communities are making use of this dashboard approach? Review these models for successful elements.
- Help customize the data across the three energy sectors (thermal, electricity, transportation) to chart Middlebury's unique energy pathway.
- Map built surfaces in Middlebury (or the region) to assist in both the Dashboard and RPC mapping analysis as part of the LEAP model.
    - Design a process to assess what built space (on campus, in town or in the country) could be considered viable for solar. This would include large flat roofs, parking lots, and other built surfaces.
    - Identify the key issues to resolve (including meeting with solar developers to understand the hurdles)
    - Identify the additional costs that would be involved
    - Project how much electric generation could be expected, and what share of the total town needs it could meet (based on the pathways analysis contained in the Dashboard)
    - Recommend the necessary policies, incentives (if any), or regulatory changes that might need to be made to encourage development of built sector solar
- Research effective outreach tools and communication strategies to motivate community engagement and behavioral change.[12]
- Measure the carbon impact of reaching the milestones.
    - Is leakage a potential issue here? That is, if we are studying energy use in Middlebury, what happens if Middlebury residents buy their gas in other towns? Or their propane/fuel oil is purchased in other towns?
- Build a toolkit with lessons learned from the Middlebury experience to take the Dashboard to other communities.

[11] http://eanvt.org/

[12] Potential for collaboration with Professor Michelle McCauley's Environmental Problems & Human Behavior Senior Psychology Seminar

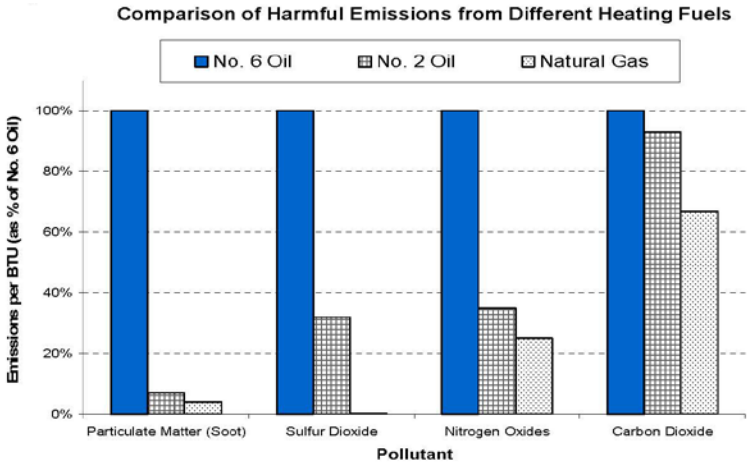
Carbon and Phosphorus Accounting for Renewable Natural Gas

Partners: Jack Byrne, Middlebury College Director of Sustainability Integration and Dan Smith, LincolnRNG & Integrated Energy Solutions, Inc.

The 2009 upgrade to a biomass gasification plant reduced the College's use of fuel oil by 1,350,000 gallons, yet it still burns about 640,000 gallons of #6 fuel oil per year.[13] This remaining fuel oil usage is slated to be replaced by biomethane—or renewable natural gas (RNG)— produced at the Goodrich Farm in Salisbury. The Goodrich Farm is the site of a community manure digester being developed by entrepreneur Dan Smith that will process manure from the Goodrich Farm as well as neighboring farms. While the College estimates that the displacement of the remaining 640,000 gallons of #6 fuel oil with RNG will reduce its carbon emissions by 40% below its 2007 baseline year (combined with the 50% reductions already achieved, this would bring total reduction to 90%), some interesting research questions remain around carbon accounting and phosphorus reduction & removal. These questions are detailed below.

Carbon Accounting:

- A clear, quantifiable, and explainable metric for determining the net carbon or GHG benefits of the College's switch from #6 fuel oil to RNG is needed. While comparing CO_2 emitted from traditional natural gas combustion to that of other fossil fuels is well documented—e.g., switching from # 6 fuel oil to natural gas is estimated to reduce CO_2 emissions by 25-30% and by up to 50-60% as compared to coal[14]—comparing greenhouse gas emissions averted or reduced from natural gas combustion (carbon dioxide/CO_2) vs. manure lagoon emissions (methane/CH_4) is less well developed. The EPA estimates that 1 pound of CH_4 emitted is 25% more potent a greenhouse gas that 1 pound of CO_2.[15]



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- Developing a carbon footprint / lifecycle analysis for both RNG and # 6 fuel oil is also needed. Vermont's Public Service Board is beginning to look at and request a more holistic accounting of the overall footprint of energy production as part of its Certificate of Public Good (CPG) review process. For example, as part of a CPG review of a proposed food waste digester, the impact of trucking in the food waste was measured against the carbon savings. What is the carbon footprint before the manure is produced (e.g., raising cattle feed, cattle digestion, etc.)? While trucking in manure will be a negligible part of this RNG project, the compressor and potential centrifuge (see phosphorus questions) will use significant energy. How does the energy footprint of this RNG project compare to the energy footprint of the College's current #6 fuel oil use?

[13] Biomethane at Middlebury College: Implications for Natural Gas Usage and Infrastructure Development, Environmental Council Report, April 2014
[14] Environmental Impacts of Natural Gas, Union of Concerned Scientists, http://www.ucsusa.org/clean_energy/our-energy-choices/coal-and-other-fossil-fuels/environmental-impacts-of-natural-gas.html#references
[15] EPA, Overview of Greenhouse Gases, http://epa.gov/climatechange/ghgemissions/gases/ch4.html
[16] Bottom of the Barrel, 2008, Environmental Defense Fund, http://www.edf.org/sites/default/files/10086_EDF_BottomBarrel_Exec_Summ.pdf

Phosphorus Accounting:

- Given the state's ongoing focus on reducing phosphorus levels in Lake Champlain—only heightened with the passage of the H.35 Clean Water Bill this legislative session[17]—the phosphorus reduction benefits of this RNG project are also of great interest. The two key needs around phosphorus are:
    - Developing a comprehensive review of available technology for capturing phosphorus during the digestion process for reuse elsewhere. This could include a survey of viable systems already in place as well as emergent technology. As just one example, Native Energy is doing some work in this arena as it seeks to add nutrient offset programs to its already successful carbon offset programs.
    - Mapping optimal locations for possible additional community manure digesters. Green Mountain Power is currently working in the St. Albans Bay watershed to site individual farm digesters. The siting process is grounded in watershed mapping that highlights locations susceptible to particularly high rates of phosphorus runoff. What would this look like for the Otter Creek/Little Otter/Lewis Creek watershed in terms of both farm clusters and runoff potential?

[17] http://legislature.vermont.gov/bill/status/2016/H.35