

**Governor's Council on Climate Change (GC3)
Analysis, Data, and Metrics Working Group
MEETING MINUTES**

Meeting Date: March 10, 2016

Meeting Time: 2:00 p.m. —4:00 p.m.

Meeting Location:

Department of Energy and Environmental Protection
79 Elm Street, Hartford, CT

ATTENDANCE

GC3 Members	Title	Organization	Present
Robert Klee	Commissioner	Department of Energy & Environmental Protection	Y
Catherine Smith	Commissioner	Department of Economic & Community Development	N
James O'Donnell	Executive Director	CT Institute for Resilience & Climate Adaptation	Y
John Humphries	Organizer	CT Roundtable on Climate and Jobs	Y
Don Strait	Director	Connecticut Fund for the Environment	Y
Lynn Stoddard	Director	Institute for Sustainable Energy	Y
Arthur House	Chairperson	Public Utilities Regulatory Authority	Y
Tom Maziarz on behalf of James Redeker	Bureau Chief of Policy and Planning	Department of Transportation	Y
T.J. Hanson	Product Manager	Thule	Y
Bryan Garcia	President & CEO	Connecticut Green Bank	Y
George Bradner on behalf of Katharine Wade	Director, The Property and Casualty Division	CT Insurance Department	Y

Associated Staff	Title	Organization	Present
Keri Enright-Kato	Director	DEEP Office of Climate Change, Technology & Research	Y
Jeff Howard	Environmental Analyst	DEEP Office of Climate Change, Technology & Research	Y
Katie Dykes	Deputy Commissioner	DEEP Bureau of Energy & Technology Policy	N
Tracy Babbidge	Bureau Chief	DEEP Bureau of Energy & Technology Policy	Y
Ben McMillan	Staff	DEEP Office of Climate Change, Technology & Research	Y
Arthur Marin	Executive Director	NESCAUM	Y
Paul Miller	Deputy Director & Chief Scientist	NESCAUM	N
Jason Rudokas	Climate Policy Analyst	NESCAUM	Y
Michele Manion	Senior Associate	Abt Associates	N

AGENDA & NOTES

Welcome and Review of Meeting Agenda

Rob Klee, ADM Working Group co-Chair

- Announcements and review of agenda.
- Review of administrative procedures — Signing in for this meeting, accessing ADM materials on www.ct.gov/deep/gc3, making public comments today, submitting written comments, signing up for GC3 e-mail distribution list.

- Comments and edits have been received for the draft of the Exploratory Report. The draft has been sent to the Governor's office and will be submitted to OPM tomorrow and will be finalized and made publically available after that.
- The Exploratory Report highlights our efforts to date and sets the "game plan" for the coming weeks, months, and year.
- No new items need to be added to the agenda.

Review list of GHG Mitigation Technologies and Measures for Future Modeling in LEAP

Rob Klee, Jason Rudokas (NESCAUM), and Arthur Marin (NESCAUM)

Overview

- A list of technologies and measures with descriptions was sent to members last week. The list was also provided at the meeting.
- The initial list represents technologies and measures that NESCAUM plans to evaluate within the LEAP model
- The goal today is to review the list and definitions, answer questions, and for members of the ADM working group to provide feedback on what may be missing from this draft list.
- The costs associated with each technology/measure are not from the LEAP model. They are qualitative descriptions derived from the literature and based on expert opinion. They are relative and directional (for comparison between technologies and measures) rather than absolute.

Factors for prioritization of the technologies and measures:

1. The potential for significant GHG reduction in Connecticut
2. Cost-effectiveness
3. Co-benefits
4. Technical limitations and cost considerations
5. Ability to track progress toward GHG reduction goals
6. Ease of implementation and administration

Working group comments on the draft technologies and measures:

- The basis of the estimated emission reductions and estimated cost should be indicated.
- Including an assessment of co-benefits would be useful. Especially when evaluating costs, there could be significant savings (from a co-benefit) that could make the net costs much lower. Noting what the co-benefit may be – resiliency, air quality/public health, etc.
- Quantification of co-benefits is difficult, but the difficulty should not prevent movement forward or action. Directional valuation would be helpful.
- The LEAP modeling tool looks at technologies or measures that can be mixed and matched. A subsequent step will be to look at policies that incentivize and encourage the use of technologies and measures identified.
- The intent of the list is to populate the LEAP model. It does not take political environments or behaviors into account.
- The next iteration of the list should bundle technologies and measures together where there are opportunities to pair combinations to maximize emission reductions.

- It should be noted that stronger, more resilient buildings could have GHG reduction benefits (because rebuilding has GHG implications).
- Carbon capture and storage should possibly be removed from the list, because it's not feasible in Connecticut due to the geology of the region.
- Nuclear is our cleanest base load energy source and is something that we need to really pay attention to.
- Where is transportation demand management? It is embedded in the VMT reductions. Smart Growth and transportation demand management are two examples of VMT reductions. How we promote VMT reductions is more about policy. Transportation demand management can be achieved through various policies —congestion prices, mileage based user fees, increased transit ridership, etc.
- The LEAP model doesn't really get into the detailed transportation management scenarios. DOT may be able to help in this regard.
- Should we be looking at future technologies like high voltage DC transmission that may allow us to access wind energy from the central part of the country? This may be difficult to model.

Based on this discussion NESCAUM and DEEP staff will add a column to the technologies and measures table to include co-benefits and take a first cut at grouping items together and then send the list back out to the working group.

Criteria for Selecting Scenario Bundles

Jason Rudokas and Arthur Marin

1. Not picking winners and losers.
 - NESCAUM wants to use as many viable technologies and measures as possible to see which ones the model indicates will provide sizeable GHG reductions and which ones it indicates are cost effective.
 - The process will be iterative.
 - Using existing technologies — rather than assuming improvements in technology — will give ADM the worst-case scenario. If a technology improves subsequently, the associated reduction would increase. More optimistic scenarios could be modeled, assuming improvements in technology.
2. Rate of technology turnover.
 - Consideration needs to be given to the typical rate of technology turnover. It is a variable that needs to be considered to make the assessment realistic. Light-duty vehicle fleets turn over every 12 years, heating systems every 25 years, and power plants every 50 years.
3. The impact of existing policies and practices.
 - Consideration needs to be given to how existing policies are driving technology, how alternative policies would drive technology, and how existing and alternative policies would work together.
4. Setting mid-term targets for tracking progress and informing policy.
 - To be able to perform the analysis, NESCAUM needs tentative target or targets to aim for. The targets will determine how aggressive the technologies, measures, and scenarios need to be.

Review NEG/ECP Interim GHG Targets for Initial CT Assessment*Jason Rudokas and Rob Klee**Overview*

- At the New England Governors and Eastern Canadian Premiers annual conference in August, Resolution 39-1, a Resolution Concerning Climate Change, was passed: adoption of a regional 2030 “reduction marker” range of 35-45% below 1990 levels.
- The range serves as a marker for the region as a whole and is not imposed on individual jurisdictions.
- This range can be the starting point for NESCAUM to begin its analysis. Guidelines are needed to create initial modeling scenarios for 2030 and 2040.
- Connecticut could strive for 2030 cuts deeper than 45% or shallower than 35%.

Comments and discussion: Where should Connecticut be?

- 35-45% for 2030 is a good range to adopt, as our governor has already signed onto the NEG/ECP framework.
- A 45% reduction for 2030 would be very near the straight-line trajectory between 2012 and 2050, so it should be regarded as the minimum acceptable reduction for 2030. A lesser reduction (e.g., 35%) in 2030 would mean that we would not be on a path to the 2050 goal.
- The shape of the trajectory we take to reach the 2050 goal also determines the total amount of carbon released into the atmosphere and the overall mitigation impact. More aggressive interim targets will enhance climate protection benefits, as well as co-benefits.
- The question this raises is whether Connecticut would be better served by making deeper reductions in the early years in order to spread the reductions more evenly across the coming years. [The “equity curve” that the Roundtable on Climate and Jobs](#) has put forth suggests that a 55% reduction for 2030 is a more equitable approach in reaching the 2050 target.
- GHG planning needs to be redone every 5 years and reassessed. Developments in technologies will occur that will need to be updated and accounted for.
- It is important to note that changes in infrastructure typically take about 20 years.
- Let’s not lose track of the fact that an important aspect of addressing climate change in CT is not to reduce Global CO2 by ourselves, because it wouldn’t make a difference, but to stimulate technical development for other parts of the world where it would be useful and where the impact would be large and to also demonstrate the commitment for others to follow.
- The mid-term goal should be aspirational not necessarily set on what we know we can achieve.
- The purpose of this range is not to set specific interim targets at this point. The purpose is to give NESCAUM riverbanks for modeling. The results of the modeling will then enable GC3 to recommend interim targets.

Based on this discussion, NESCAUM will begin its analysis using a 35% - 55% range.

Review of Hypothetical Renewable Thermal Scenarios Modeled in LEAP

Jason Rudokas, Arthur Marin, DEEP staff, and Bryan Garcia (CT Green Bank)

Overview

- Emissions from the residential, commercial, and industrial sectors combined make up about 40% of state's GHG emissions, primarily from energy consumption to generate heat.
- Renewable thermal technologies have the potential to play a big role in reducing emissions from these sectors.

Renewable thermal technologies that NESCAUM can model

1. Ground/air source heat pumps
2. Solar water heaters
3. Electrification of space heating (with heat pumps and/or high penetration of renewable electricity)
 - Consider that this will shift emissions to the electric sector
4. Biomass thermal
 - Consider impacts on air quality and forests
5. Advanced biodiesel for use as heating fuel
 - Consider the direct CO₂ benefits vs. lifecycle benefits

Review LEAP modeling output

- When combined with ZEV deployment and zero carbon electricity, a high penetration rate of 60-80% for renewable thermal by 2050 bends the emission trajectory closer to the reduction target of 80%.
 - Electric heat (primarily via air-source heat pumps) may be viable in cities and multifamily dwellings where ground-source heat pumps may not be an option. NESCAUM accounted for increased electricity being drawn from the grid in this "electrification" scenario.
- CT's current penetration rate of renewable thermal technologies is very low (in contrast with European rate).
 - Q: Why are we so slow to adopt these technologies in the United States?
 - A: While they are very cost-effective over the life of the equipment, they have higher upfront costs to the consumer.
 - DEEP, the Green Bank, and the electric utilities are currently sponsoring a Yale study on renewable thermal's technical and market potential in CT. The study's director, Helle Gronli, was introduced.

Overview of current CT finance and incentive programs providing support for renewable thermal technologies

1. Rebates
 - Home Energy Solutions
 - Residential new construction or rehabilitation
2. Financing
 - Smart-E Loan
 - Energize CT Heating Loan
 - Small Business Energy Advantage Loan

- Energy Efficiency Fund
 - Energy Conservation Loan
 - On-bill financing
 - PACE Financing
3. Tax exemptions

Example cash-flow calculator for residential renewable thermal

- Rebates should only be used to catalyze the market, and then private investment needs to be brought in. Market penetration of 60-80% is not going to occur with just rebates.
- Longer loan periods can improve the consumer's cash flow.
- Bundling technologies (e.g., insulation with air-source heat pump) has a more positive effect on the customer's cash flow.
- Markets need to be built sustainably and not become reliant on public funding.

Natural Gas Electric Generation Mix Now and in the Future

Rob Klee, Keri Enright-Kato, and Arthur Marin

- Our next meeting will focus more specifically on natural gas, but we wanted to begin the dialogue today.
- Since 2000, there has been significant fuel switching in ISO NE generation from oil and coal to natural gas. According to ISO NE, CO₂ emissions have decreased 26% since 2001.
- ISO NE projects the 2024 regional generation mix to be 57% natural gas, 16% oil, and 2% coal (with the balance being nuclear and renewables). A transition to a cleaner generation mix beyond 2024 is essential as we look to transition our transportation sector to electric.
- The ISO NE Forward Capacity Market slides do not include behind the meter solar increases. It only includes grid scale renewables so the slide is a little misleading.
- Generation is growing slowly in CT. There is not expected to be a substantial increase in demand as we experience more and more efficiencies and less industrialization.
- We know that the capacity for natural gas is growing from now until 2030 so the question is how do we reconcile that? We can put any range targets in the LEAP model, but how valid are they given these assumptions?
- We can construct narratives around many different assumptions, but the LEAP model illustrates that natural gas is not a part of the long-term mix in the electric sector if CT is to meet the 2050 target, so we will need to wrap our heads around that.
- We will have to maintain nuclear and increase hydro to achieve these aggressive targets. We also need to think about transmission constraints.
- We need to look at natural gas in the building sector too. The GHG emissions resulting from current levels of natural gas use in both the electric and building sectors combined already exceed the emissions goal from all sources for 2050 (9.3 MMT/yr).
- The Comprehensive Energy Strategy(CES) will be looking at this issue and likely focus on renewable thermal for the building sector.
- The next meeting will focus on the interaction between the CES and the work of the GC3.
- What about upstream leakage around natural gas? Will we be incorporating a sliding scale variable in the model to allow us to evaluate different estimates of leakage rates? We could

look at that, but care needs to be taken when looking at lifecycle emissions for some sectors and not for others, because this can skew the numbers.

New Items

- There will be a stakeholder engagement event after the next ADM meeting, on May 5 from 5:30 – 7:30 p.m. There will be 1 central location with 6 satellite locations. More details to follow.

Public Comments

Jerry Silbert, The Watershed Partnership:

- Connecticut is heavily forested. If Connecticut could practice sustainable forestry, it could develop biochar from the wood. Biochar is very stable and could store carbon for hundreds of years.
- Is the carbon dioxide that is generated during production of solar panels being accounted for? If the panels are being produced in another state, will Connecticut count those emissions in its inventory? If not, the numbers may not be accurate.
- Biophysical economics is a fundamental aspect of energy production and consumption. It looks at energy return on energy investment. This is a more realistic way of looking at our energy use, if we look backwards from 2050 to 2001. How much energy from fossil fuels are we allocating per capita in 2001? How much are we allocating per capita in 2050? What impact will this have on our lifestyles here in CT? Thank you to the council. The work you are doing is important.

Lee Grannis, Greater New Haven Clean Cities Coalition:

- Propane has not been included in NESCAUM's list of technologies and measures. It looks at VMT but not the fuel behind the VMT. By the time this research is done, most of the state will be running on propane school buses. We have had 3 more districts sign on, equating to 300 more propane buses.

Ray Albrecht, National Biodiesel Board:

- Use more biodiesel. I suggest that a box be added that incorporates all of the fuels that we use. Natural gas is what we are wrestling with in regards to electric power generation. Oil use in electric generation should be brought down to zero, and we can do this now.
- Consider the use of biodiesel for electricity generation. In combined-cycle generation, which gets fuel efficiencies in the range of 50 to 60%, you can get 20-22 kWh of electricity out of a gallon of biodiesel. If you apply the REC credit for those 20-22 kWh, it gives you about a \$1 per gallon. The bulk price of biodiesel has been driven down to about \$1 per gallon itself. It had been driven down due to the low cost of crude oil. Many electricity plants are now combined-cycle facilities, so why not use renewable fuels?

NOTE: Slides are available on GC3 web page: www.ct.gov/deep/gc3