Outline for the Hartford Comprehensive Energy Plan

Outline drafted by VEIC for the Town of Hartford - March 2017.

Unformatted text is part of the outline of the Plan
Green text is meant more as a note to the authors of the Plan

I. Purpose of this CEP

1-2 paragraphs on our route from today to 2050

I. Vision

a. Describe Hartford after a successful transition: how homes are powered, how people get around, where they work and what that is like (e.g. better indoor air quality and day lighting make work less fatiguing and more enjoyable. Maybe automation is helping lighten the load and save energy?) How are food and other resources provided locally? Describe how this future reduced the amount of energy imported and the amount of dollars exported, reduced spending for energy, and reduced emissions, improving local air quality and contributing to climate change mitigation. List some measures of whether or not this is sustainable, with sustainability being the primary focus, or whether we have farther to go still e.g.:
   i. tonnes $CO2_e$/person is down to 1: sustainable
   ii. economic health of households has improved, maybe poverty is gone and everyone can meet their needs: sustainable;
   iii. Town infrastructure is in good repair and there is adequate budget for services and capital planning: sustainable.

II. Current status in Hartford

Much of the status, goals, and strategies will be similar across VT, with major differences due to availability of natural gas, portion of tourist/seasonal/agricultural activities, etc. This outline includes some ideas for Hartford, but the authors of the plan will need to add most of the Hartford specificity as the authors will know the town best.

A. Overall big picture conditions

(too many GHGs; energy-insecure/use of fossil fuels; money leaving the area; energy proportionally too expensive; need more jobs; transportation patterns not energy-efficient, etc., climate change/severe storms, **(**need to change, because "business as usual makes problems we're already seeing worse"**)** – cf. TRORC list & Damon's section 1[c])
The authors of the plan could consider touching on the concept of industrial society: We are consumers, constantly in pursuit of new "stuff", marching the drumbeat of economic growth which is the default mantra of our "leadership", everything else (GHG emissions, peak-resources, etc.) is a result. How do we seriously address the demand side of the equation without acknowledging and addressing the underlying drivers? If addressing this topic, authors may want to cite as

a reference Naomi Klein's book "This Changes Everything" as a well-known and respected source that backs up this idea with a lot of research.

B. specific issues by sector

i. Thermal

1. Residential

HOUSE HEATING FUEL[1]	Hartford town	
Occupied housing units	4,461	
Fuel oil, kerosene, etc.	2,123	48%
Bottled, tank, or LP gas	1,233	28%
Electricity	457	10%
Wood	350	7.8%
Utility gas	175	3.9%
Other fuel	70	1.6%
Solar energy	47	1.1%
No fuel used	6	0.1%
Coal or coke	0	0.0%

Residential Energy Consumption Survey, RECS, is a good source of residential data.[2] It was last updated in 2009.

a. Imported oil, propane, kerosene are 75% of Hartford resident's primary heating fuel is subject to international and national market forces. This is a big component of the money leaving the state. Transportation is the other.
b. Volatile price can make these the most expensive fuels. Even when prices are low, heating is a large seasonal household expense.
c. Oil and older wood burning systems cause local air pollution in addition to their GHG effect
d. Fossil fuels ARE NOT SUSTAINABLE

2. Commercial

The commercial equivalent of RECS, CBECs[3], was last fully released in 2003. The 2012 results are only partially available because of concerns about sample size and statistical validity. There is no Census or ASC data to supplement. There may not be better options for data than using committee and staff knowledge of commercial heating, or surveying businesses.

3. Institutional, esp. schools

ii. Transportation

1. Dependence on fossil fuels, which are largely imported: x$ leaves Hartford and most of it leaves the country. This is

[1] 2011-2015 American Community Survey, Table DP04: Housing Characteristics, https://factfinder.census.gov/bkmk/table/1.0/en/ACS/15_5YR/DP04/0600000US5002732275

[2] https://www.eia.gov/consumption/residential/

[3] https://www.eia.gov/consumption/commercial/

another major component of money leaving for fossil fuels (heating is the other.)

2. Local air pollution and VT's largest source of GHG emissions.
3. Maintaining transportation infrastructure. This is a huge expense for states and municipalities, and with the exception of a bit of biodiesel and a few PV powered road signs, building, maintaining, servicing this infrastructure depends entirely on fossil fuels.
4. Auto dependence has multiple negative impacts on human health, safety, and wellbeing. Overdependence on driving has led to less active lifestyles contributing to obesity, increased air pollution, high costs for households, and car crashes continue to be one of the nation's top killers. Authors could look up the statistics and highlight that human powered transportation results in fewer accidents and reduce the cost of ownership, if desired. Replacing most of today's travel with human power, transit, and autonomous vehicles would result in fewer and less serious crashes. If the authors want to make this a point in the CEP, comparing to a similar city in the Netherlands or Denmark might illustrate where Hartford could be part of the way to the goal. (There are probably non-western places that would be good examples too)

iii. Electricity

1. Cleanest of the three both for local air quality and GHG emissions.
2. Largely imported. Subject to whims of regional markets. New transmission lines are taking Canadian hydropower to NYC and southern New England, which could affect our price.
3. Grid design - not designed for small scale, distributed production, but it can handle distributed generation at the home/business scale easier than larger systems.

C. current conditions (data –thermal, electric, transportation; GHG emissions; renewable energy generation) (Percent renewable/percent local, amount of energy, GHG. Start with RPC data and State Guidance for municipalizing it. An update to the Dashboard data will be out in April based on the same data the RPC has plus actual town electricity use.) Authors may want to combine with the section above. Or some of this section would stay here and under bullet point B. would be mostly a list of issues. But quantifying the issues requires the current data, so I think they flow together.

i. Total
ii. Thermal
iii. Transportation

iv. Electricity

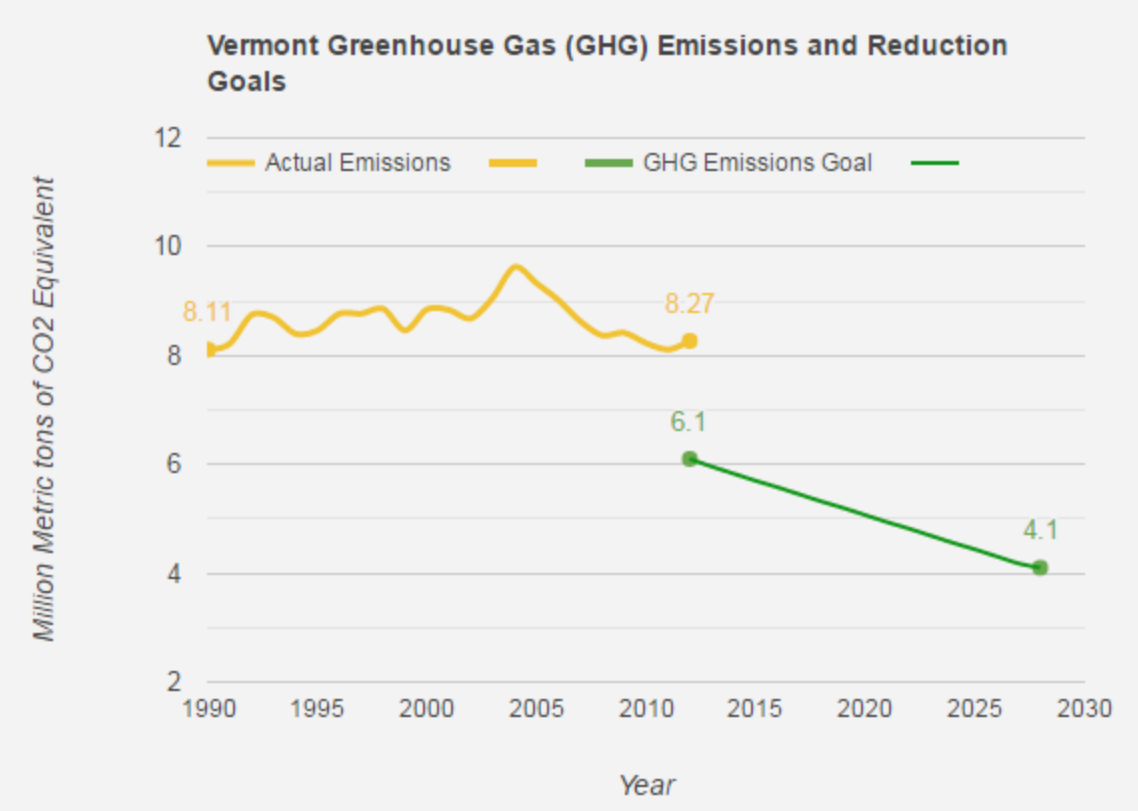
D. opportunities/ resources available (Eff VT; technology developing [EVs and autonomous vehicles, heat pumps, modern wood heating]; etc.)
Authors may want to keep this here or move this down to IV because it relates the strategies to move from the place we just described, to the future we opened with

III. Regulatory environment includes Act 174 compliance plans

A. State (statutory requirements; Act 174)
   a. Town plans now must have energy component
   b. Approved town energy plans get substantial deference at the PSB for renewable energy siting applications.

B. Regional role (regional plan/TRORC)
   a. Towns may defer to Regional plan
   b. TRORC provides mapping of renewable energy potential sites, and town level data, extrapolated from regional data, which was largely extrapolated from statewide data. Use that data as a guide, but maybe not as certain facts.

C. Supports state efficiency, GHG, and renewable energy goals
   a. List goals (start here: http://climatechange.vermont.gov/climate-pollution-goals)



   b. May calculate Hartford's portion of the state, or highlight Hartford's role as an entry point for visitors, showcasing the state's efforts, etc.

IV. Methods for reducing consumption ("conservation") includes Act 174 and state energy plan compliance strategy. Refer to goals listed in Section III. C: 15% reduction per capita by 2025, more than 1/3 reduction by 2050. Lowering consumption is often the easiest and most cost effect way to increase sustainability and progress toward 90% renewable total energy by 2040.

A. Thermal
   i. No Cost options – you can save energy and money without investing anything more than a little time and discipline/effort
      a. Turn down your heating and cooling system
         i. Old national rule of thumb: save 3% of heating energy for each degree F setpoint is reduced. (VEIC has active research that may provide Vermont-specific and more robust estimates than this. They should be ready by the time this Plan is drafted.)
         ii. Setbacks save energy for furnaces and boilers, but heat pumps are most efficient without setbacks
      b. Heat/cool only the areas you need.
         i. Be careful you don't allow pipes to freeze doing this
      c. Use your wood stove. Cordwood is usually the lowest cost heating and pellet stoves aren't far behind. (Cite recent or average numbers from VT fuel price report[4])
   ii. Modern wood heating
      a. Low particulate emissions, higher efficiency, automatic fuel feed. Works well to replace oil boilers
      b. Schools, businesses, and other larger facilities could use wood chips. Would the VA hospital offer tours and Q&A with managers of other facilities that are interested in installing similar systems?
      c. Masonry heaters, rocket mass heaters opportunities for new construction
   iii. Heat pumps
      a. New technology: previously could not work below freezing, a few years ago air-to-air units that could arrived. In 2015, products with multiple indoor units (i.e. multi-zone) and the capability to tie into duct systems arrived, soon we will probably see ones that tie into hot water radiators. For now, they work especially well to replace Rinnai wall furnaces and in spaces without ducts or water pipes.
      b. They work to -20°F and have an average heating season efficiency in Vermont around 240% (this is higher than 100% because electric energy is used to bring in heat from outdoor air, which is not counted as an input in the efficiency calculation)

[4] http://publicservice.vermont.gov/publications-resources/publications/fuel_report

c. Municipal building as an example

iv. District heating
    a. Economics of scale could allow a cleaner heat source for WRJ buildings, included the possibility of using the river as a heat source

v. Specific actions/recommendations (Depending on Hartford's history and the public feeling, the most acceptable and effective method may be follow the State stretch code,[5] offer an incentive through zoning or other, or use education or competition.)
    a. Require new construction to be net zero energy
        i. Encourage a range of ways to meet this through tours, demos, and other outreach:
            1. Most people may think of a high tech, expensive home with solar. That is an option
            2. VerMod[6] as a similar home that is lower cost and fits on a mobile home lot
            3. Passive solar
            4. Tiny homes
    b. Create town weatherization goal e.g. every building weatherized up to some standard by 2050
        i. Create interim goal
    c. Investigate pellet manufacturing, see biomass section
    d. Anything specific to the schools?

B. Electricity
    i. The cleaner source of energy, we want to move end uses/services toward electricity, but use it efficiently
    ii. Shut off lights and devices you aren't using. Older devices can use significant power even when off, though many newer electronics has addressed this problem.
    iii. Refer to Section V.
    iv. Existing Efficiency Vermont services/ENERGY STAR and CEE certification for:
        a. Lighting
        b. Appliances
        c. Electronics and plug in devices
        d. The opportunity varies by home and business but in general LED lighting and new refrigerators offer large savings to most households and businesses
    v. Encourage residents to follow the Town with LED lighting, and when using them outdoors, protecting the dark sky
    vi. Electrification

[5] http://publicservice.vermont.gov/energy_efficiency/code_update
[6] http://vermodhomes.com/

a. Some end uses are drastically more efficient and cleaner when electricity is the fuel than when fossil fuels are burned
    i. Electric cars
    ii. Heat pumps
        1. Heating and cooling
        2. Water heating
b. Grid concerns this topic is located in this section and not above because these are not issues today, but challenges to overcome in a highly electrified and renewable scenario, but his could also find a place in II-B (specific issues)
    i. Electricity is typically generated exactly equal to demand and there is little storage. With growing renewables, this balance can be more difficult because of their variability.
    ii. An oil boiler, or propane water heater contribute little, if anything, to demands on the grid. Their on and off timing has almost no impact, and simultaneous demand of all resident's heating systems is not a problem because everyone has their own on-site fuel storage. Connecting all of these end uses to the grid makes their operational timing matter to grid balancing. However, it offers the opportunity to use the storage capacity inside water heaters or space conditioning systems to support high levels of renewable energy on the grid.
c. Support electrification of heating and transportation along with sensors and controls to help with grid balancing.

vii. Specific recommendations:
a. Work with GMP on citing more EV charging, maybe innovative ones that support the grid of the future, offering lower cost or free charging when renewables are high, and more expensive charging when they are low.
b. Encourage other businesses and homes to showcase their heat pump's comfort, capability, and low operating cost like the Municipal Building does.
c. Promote existing incentives for EVs (Federal tax credit, Drive Electric VT) and heat pumps (Efficiency Vermont)

C. Transportation
i. Land use planning and urban design to reduce transportation demand
    a. Zoning to further support mixed use centers in each of the five villages
    b. Design mixed use centers to support trip-chaining, park once opportunities
ii. Invest in infrastructure to prioritize human powered transportation

a. Develop mixed use, walkable neighborhoods
b. Invest in sidewalks/crosswalks/bike paths and lanes
c. Short term and long term bike parking
d. Complete streets and road design to improve safety for non-auto modes

iii. Transportation demand management strategies
a. Promoting employer based strategies, such as telecommuting, parking management, and incentives for alternative transportation
b. Ride share: traditional carpooling and vanpooling, and emerging opportunities to share rides (e.g. Uber coming to Killington)
c. Promote traditional and new car sharing models

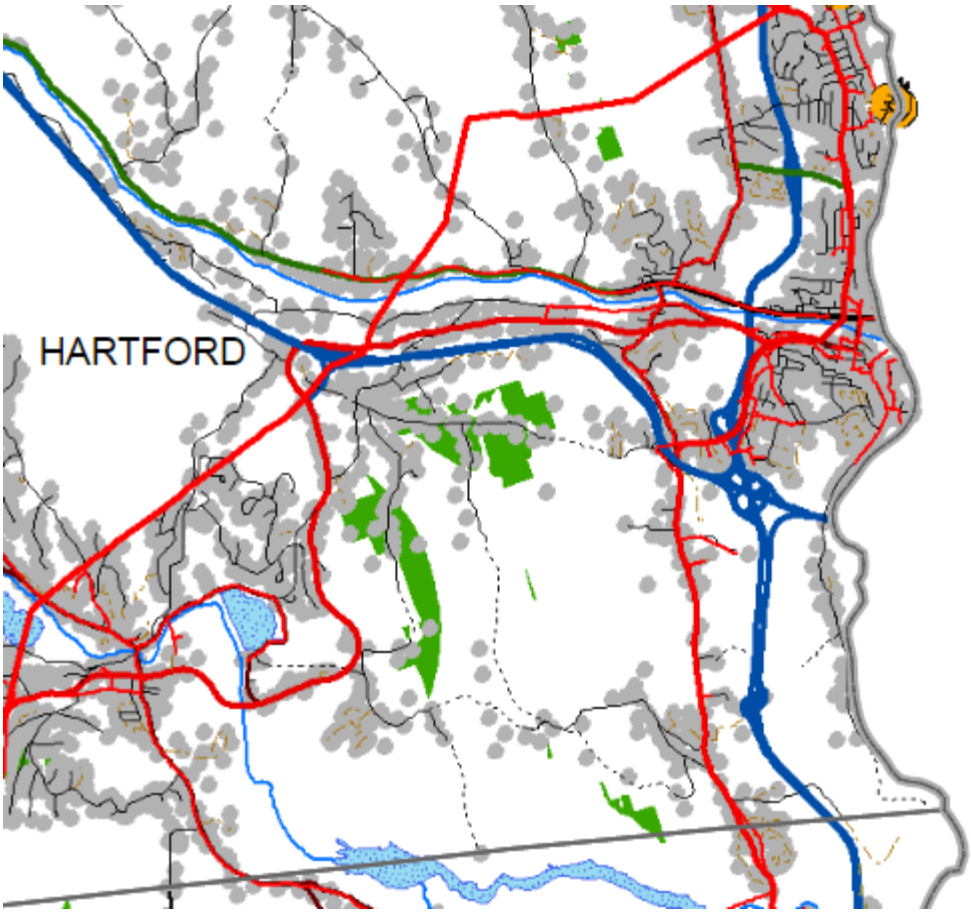
iv. Public transit
a. Pursue opportunities for integration of school and public transportation service (i.e. for high school students)
b. Reduced auto dependence
c. Pursue more tailored public transit opportunities (e.g. taxis, volunteer drivers, small van service) to increase mobility for most vulnerable member of society

v. EVs and autonomous vehicles
a. Develop supporting infrastructure, such as charging stations
b. Promotion and education through demo days
c. Evaluation potential electrification for heavy duty, high mileage, low efficiency vehicles (e.g. school buses)
d. Start considering impacts of autonomous vehicles on existing transportation network and infrastructure
e. See Electric section

V. Generating renewable energy includes Act 174 and state energy plan compliance strategy

A. Wind
a. Site specific. Only a few areas of town have potential.[7] Which of these areas would the town prefer for development and which are not appropriate?

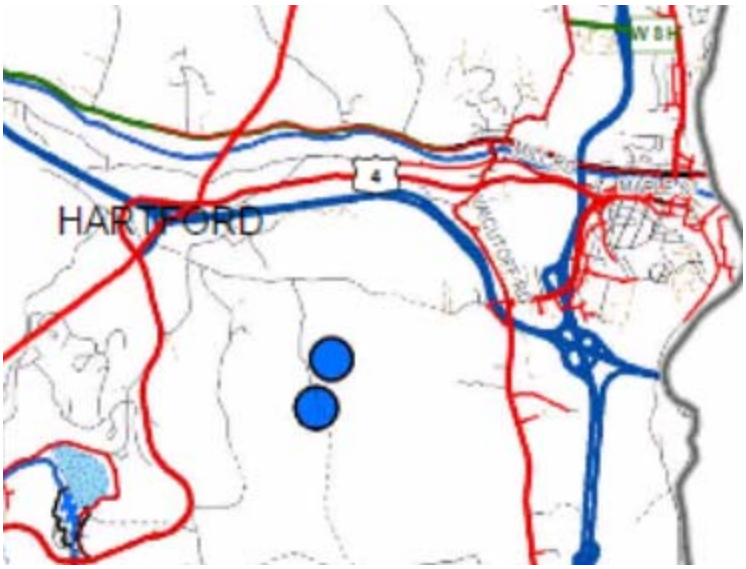
[7] TRORC, http://www.trorc.org/wp/wp-content/uploads/2017/01/Appendix-B_Energy_Mapping_01_13_17.pdf



b. More energy dense than solar, e.g. need fewer wind MW and smaller area to provide the same amount of energy
c. Strong in winter and at night when solar is weak
d. Visual impacts
e. Impacts to neighbors

B. Hydro

a. Site specific. Only two sites in town appear to have potential. Would the town prefer these for development or are they not appropriate?



b. Hydro is very energy dense, i.e. a physically small project provides a lot of energy. Sites are low in valleys and may have very low visual impact.
c. Relatively consistent throughout the year
d. Limited in late summer and during droughts
e. Impact to river

C. Solar
   a. Widespread potential, solar is unique in its democratizing capability:
      i. "The sun shines on everyone for free"
      ii. “The sun shines on the rich and the poor alike. But when it comes to rain, the rich have better umbrellas” If the authors wish, they could conduct an analysis of insolation by median income or house price, but the premise is the solar is much more widespread than other resources.
      iii. But depending on how it is owned and financed, it can also reinforce existing inequality.
      iv. Community solar offers the benefits of solar to renters and people without good sites. The Town can support community solar through identifying sites and promoting
   b. How far do the current solar projects and proposals get Hartford toward these goals?
      i. There is currently 9 MW of solar permitted in Hartford, included 5 MW of utility owned, and 2.2 MW under the Standard Offer. The remaining 1.7 MW is net metered.

1. Hartford's 9,952 people is 1.6% % of Vermont (625,960) as of 2010
2. This compares to 305 MW permitted statewide, so Hartford's permitted solar is ahead of average of the state: 9 MW is 2.9% of the statewide total.
3. By 2050 Vermont could have 1,800 – 2,000 MW of solar. If Hartford hosted a portion according to its 2010 portion of population, Hartford would host 28.8 MW – 32 MW solar generation. So if all 9 MW permitted in Hartford were built, it would be a head start on 2050, already nearly 30% of the way there.

c. Constraints
   i. GIS layers
   ii. Local cultural resources
d. Preferred Sites
   i. Near load
   ii. Strong parts of the grid
      1. Use GMP's Solar Map for a view of the grid's ability to host more solar today. It will change in the future
   iii. Underused disturbed land
      1. Case study on the landfill project
      2. Examples of similar opportunities
   iv. Solar roadways – will this be mature enough in 5-10 years to implement on small scale? Economic and operational feasibility may not be clear at this point. Initially regular solar systems could be installed in highway right or ways and interchanges. Solar roads may be a good option in the future, but may work better further south where they are not plowed and do not suffer from being pointed straight up.
e. Town policies
   i. Consider screening and setback requirements enabled through Renewable Energy and Siting of Facilities (H.40 in 2015)
   ii. Incentivize locations, screening, or pollinator planting?

D. Bio

a. Hartford has potential biomass land on the RPC map though proportionally less than other towns in the region
b. Given access to rail and highways, does Hartford want to be the site for biomass processing, e.g. making and distributing pellets?