

Albany GHG Inventory Update

To: City Council

From: Max Wei, Sustainability Committee

Date: 2/11/18

Summary:

Albany has a greenhouse gas pollution reduction goal of 25% reduction in 2020 from 2004 baseline.

The city is NOT on track for meeting its GHG target in 2020 as the plots below show.

A couple of key points regarding the observed energy and GHG emissions data for 2004-2015 (2015 is last year with data available):

- There was unprecedented global warming in 2014, 2015, and 2016. This led to abnormally low natural gas heating demand (in the residential space heating sector in particular), and this factor is estimated to have saved 4000 tonnes of CO₂ in 2015 alone, from 73,000 to 69,000 tonnes.
- Albany cannot take credit for this large GHG savings due to climate warming (the very problem the Climate Action is trying to address) and thus we project 2015 and 2020 GHG emission assuming no shift in the climate.

With these important points in mind, we estimate a shortfall of about 6000 tonnes of CO₂ in 2020 (Target is 61,100 tonnes and we estimate that current trends will give 67,200 tonnes in 2020). This could be met by a combination of aggressive measures across electricity, transportation, and natural gas sectors including for example the following:

- 1) 100% of households are 85% zero-carbon electricity from East Bay Clean Energy CCA vs nominal 70% zero-carbon from PG&E; AND electric car vehicle miles travelled (VMT) share of total miles increases to 12% of passenger vehicle VMT in 2020
- 2) 100% of households are 85% zero-carbon electricity vs nominal 70% zero-carbon from PG&E AND half of households and commercial customers achieve 20% lower Natural gas consumption in 2020.

These measures are not simple to achieve and need continued support and resources from Council. The Sustainability Committee looks forward to working on these key initiatives: (1) high enrollment in lowest-carbon option available from East Bay Clean Energy CCA; (2) push to have more adoption of zero emission vehicles (ZEV) and public transit; and (3) push to improve natural gas energy efficiency (or fuel switching to electricity-based heating) in homes.

Exhibits:

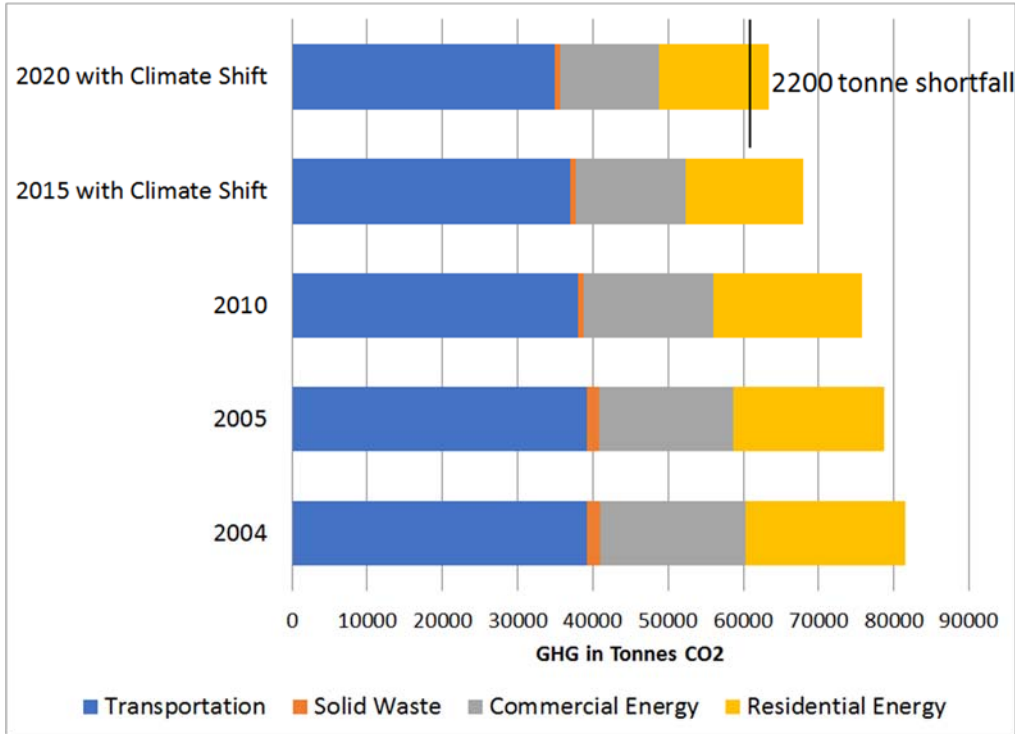


Fig 1 With a “permanent climate shift” of the warming observed in 2014-2015 extended forward, a 2200 tonne CO2 shortfall to the 2020 target is projected. (Baseline 2004 is about 81,500 tonnes CO2; Target in 2020 is about 61,100 tonnes CO2). The 2020 goal is the black line.

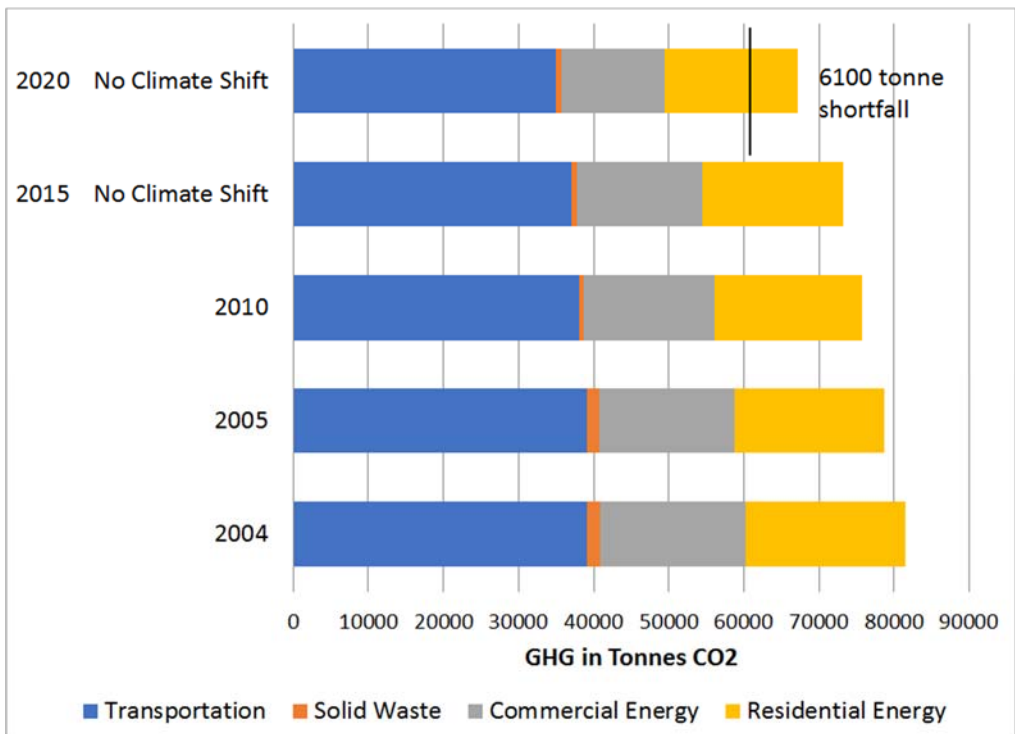


Fig 2 If the 2014/2015 climate warming shift is treated as anomalous, there is a 6100 tonne shortfall in 2020 projected. The 2020 goal is the black line.

THE FOLLOWING PLOTS ARE FOR "NO CLIMATE SHIFT" since Albany should NOT take credit for a shift in the climate:

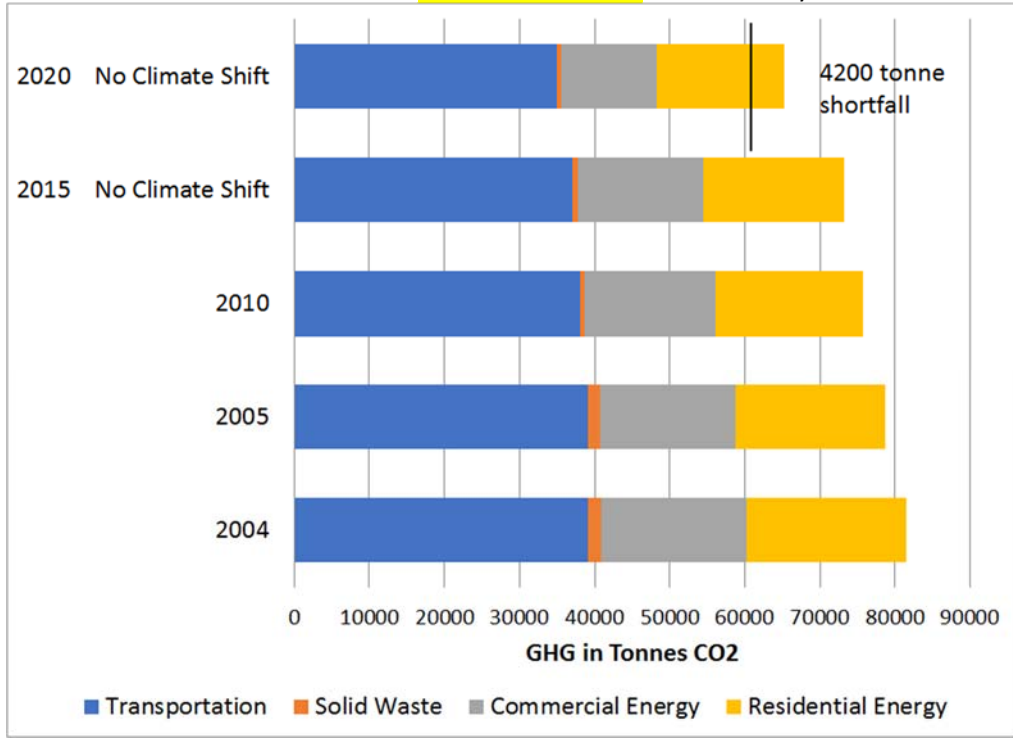


Fig 3 If in 2020, Half of households are at 85% RE vs nominal 70% RE of PG&E, the gap is 4200 tonnes in 2020. (RE=renewable electricity).

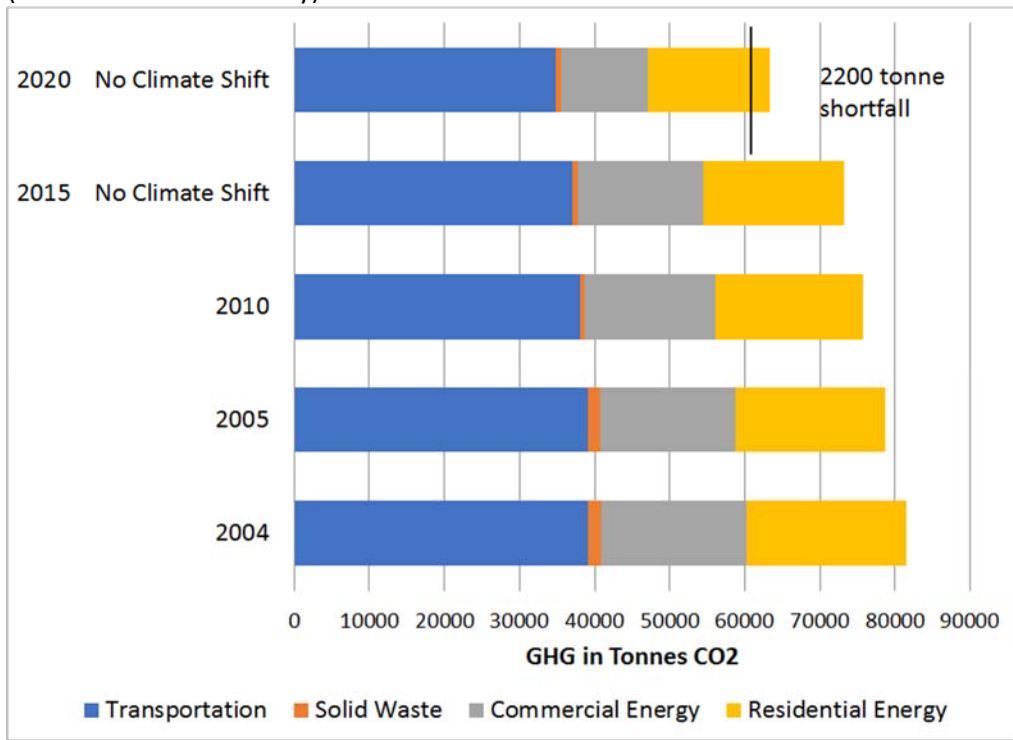


Fig 4 If in 2020, 100% of households are at 85% RE vs nominal 70% RE of PG&E, the gap is 2200 tonnes (RE=renewable electricity)

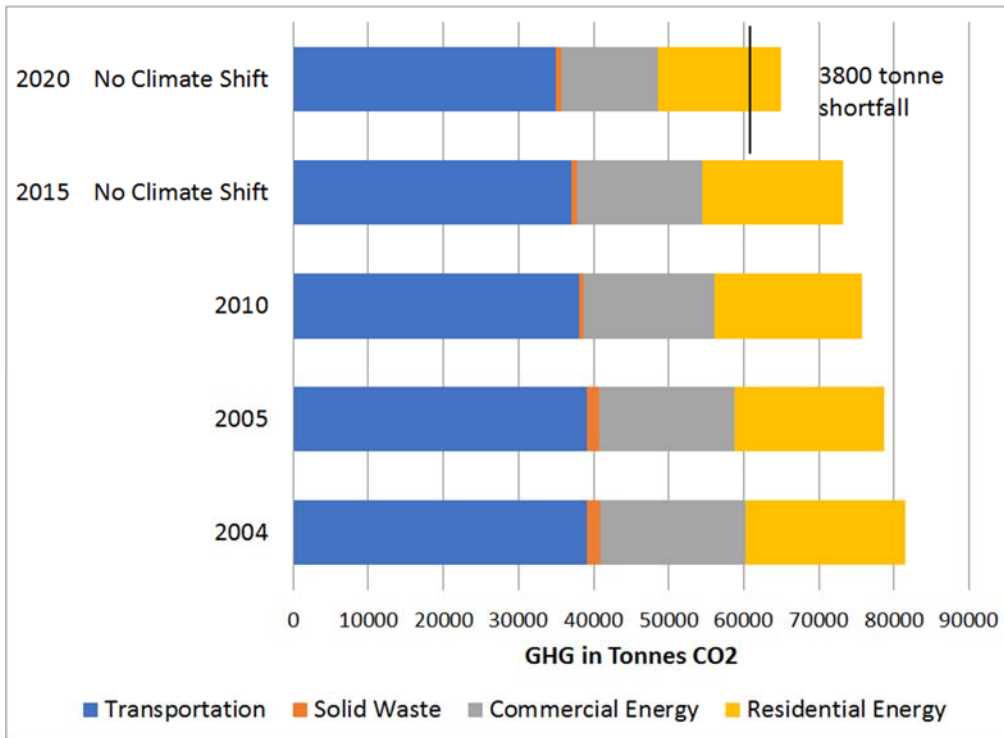


Fig 5 If in 2020, Half of households and commercial customers have 20% lower Natural gas consumption, the gap is 3800 tonnes.

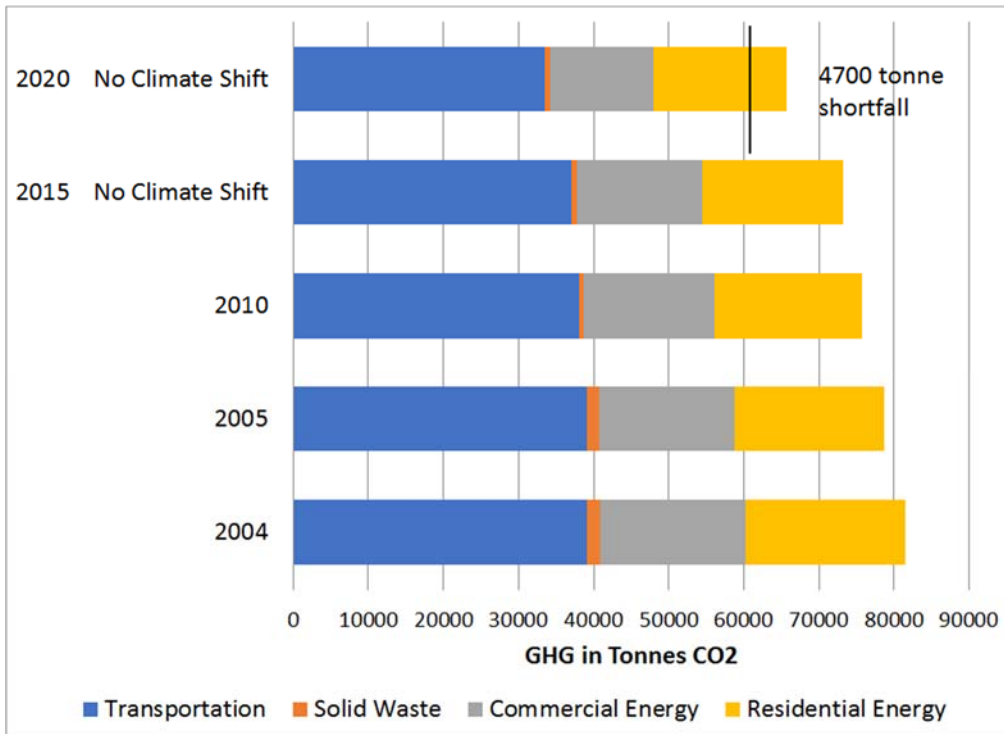


Fig 6 If in 2020, Electric car VMT increases from ~3% in 2020 to 9% of passenger vehicle VMT in 2020, the gap is 4700 tonnes. (12% electric VMT results in gap of 3900 tonnes)

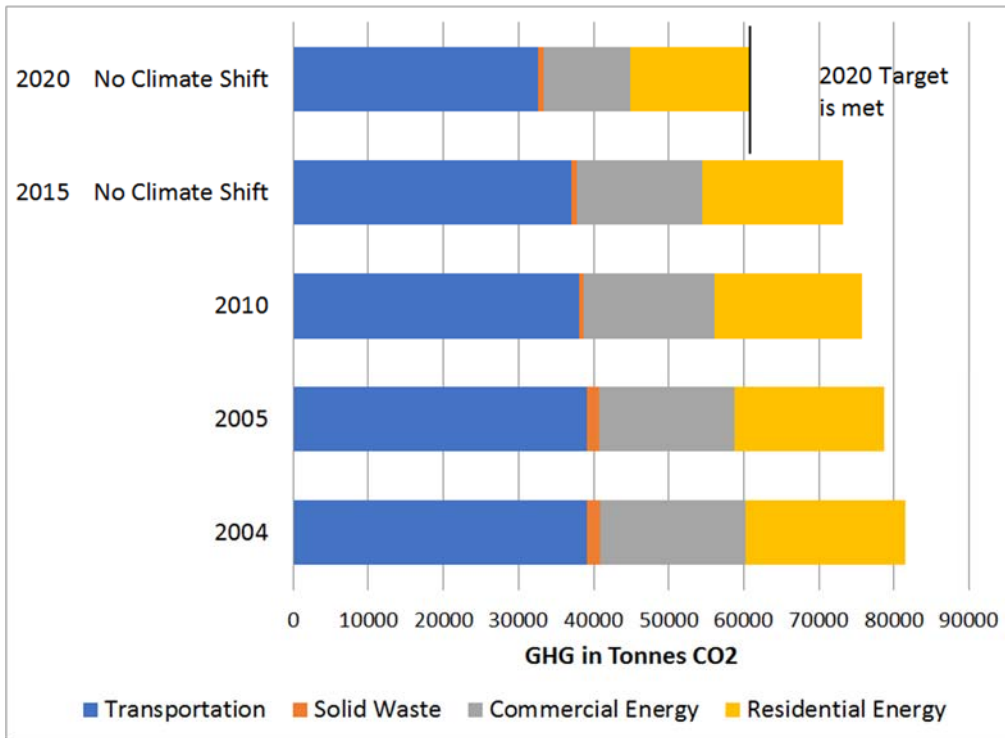


Fig 7 If in 2020, 100% of households are are 85% RE vs nominal 70% RE of PG&E AND electric car VMT increases from 3% in 2015 to 12% of passenger vehicle VMT in 2020, the 2020 target will be met.

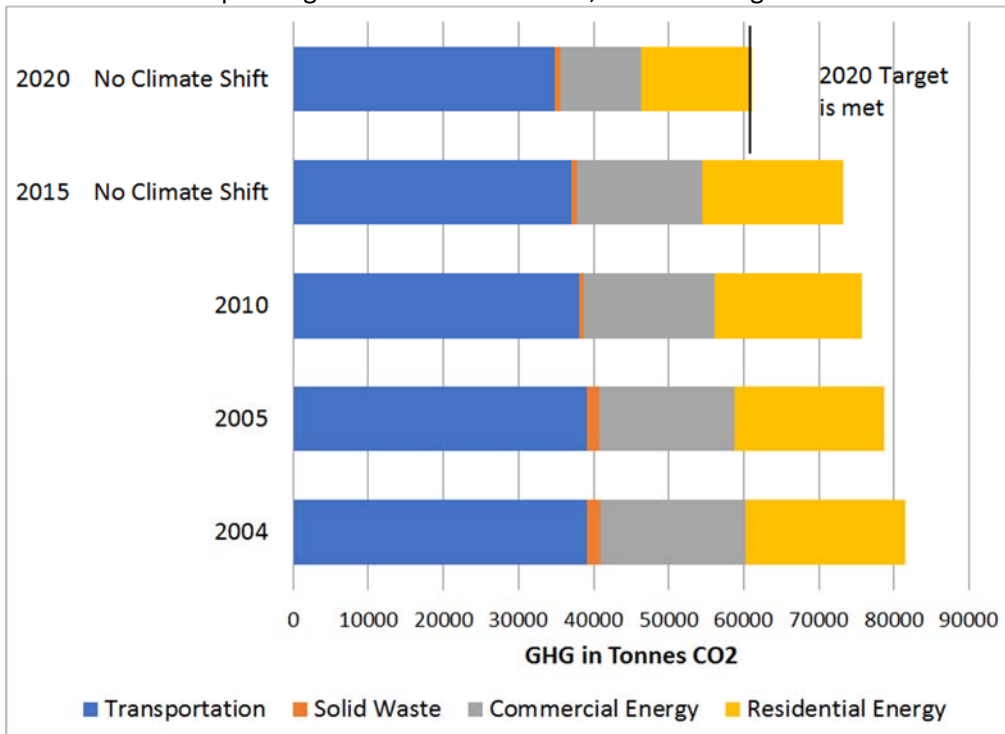


Fig 8 If in 2020, 100% of households are are 85% RE vs nominal 70% RE of PG&E AND Half of households and commercial customers have 20% lower Natural gas consumption, the target can be met.

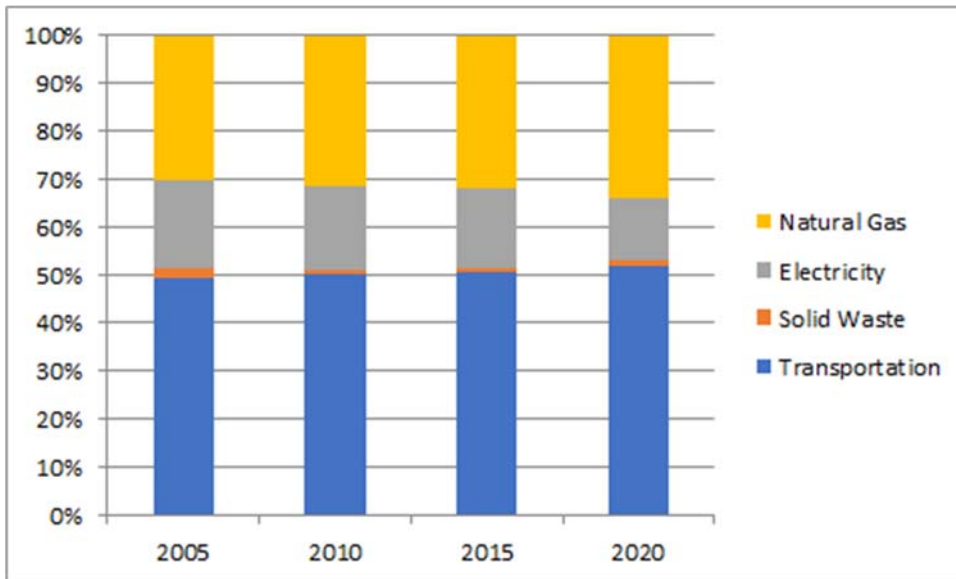
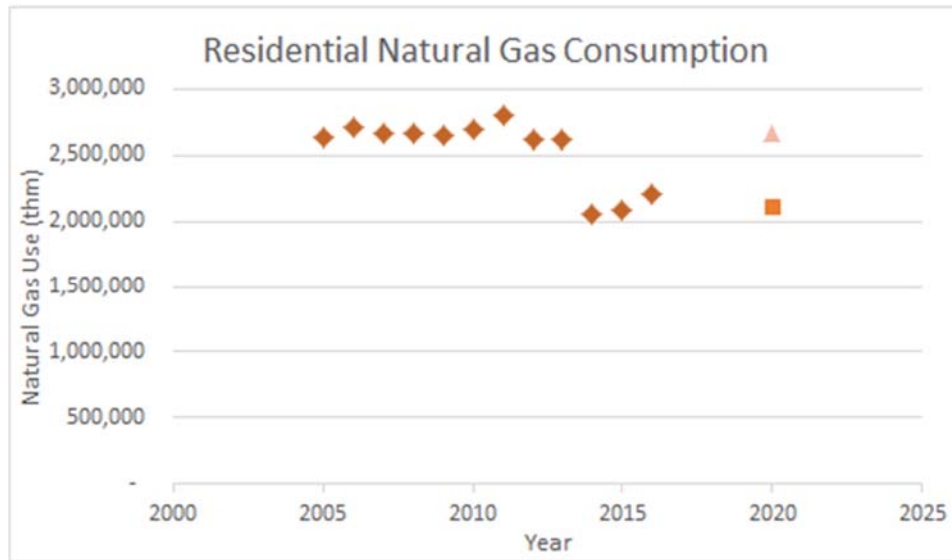


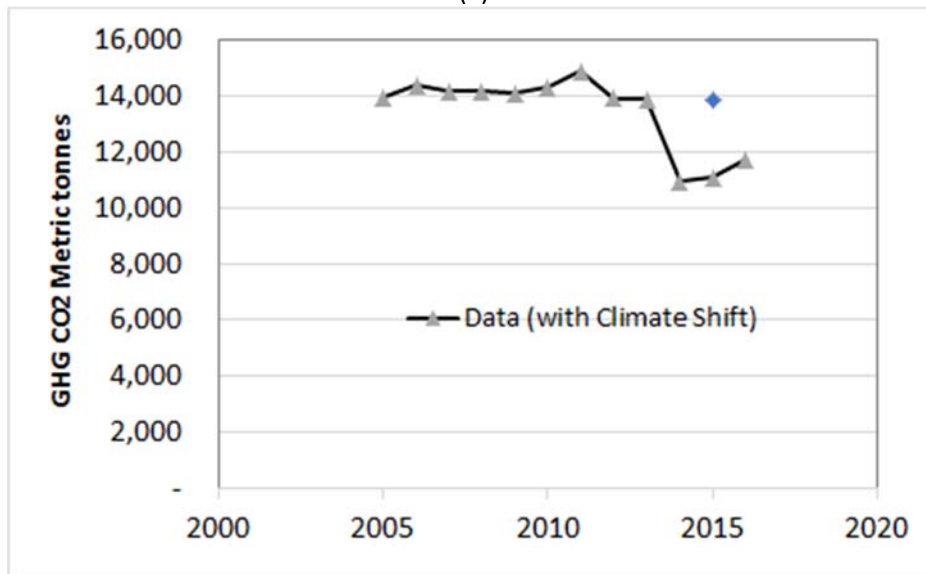
Fig 9 Transportation is about 50% of GHG, electricity fraction is decreasing and NG increasing to about 33% in 2020.

Some Notes

- This update is based on Staff update to the Sustainability Committee in Sept'17
 - The staff update included three years only: 2005, 2010, 2015
 - It did not include 2004, did not mention climate warming, and included Western Forge and Flange.
 - I thank Staff for making the data inputs to their update available to me
- Western Forge and Flange was removed from the Albany GHG Inventory per Albany Sustainability Committee ratification in 2015, and per that decision, it is not included in this update
 - This update also includes 2004 baseline year GHG estimate.
 - The updated baseline for 2004 is 81,489 tonnes CO₂; the old baseline was 66,064 tonnes.
- The transportation mileage method has been changed to include more out of city travel miles. This increases the GHG from the transportation sector significantly (39.2K tonnes CO₂ from 21.8K tonnes in 2004).
- Transportation parameters e.g. fuel emission factors, are taken from Staff update in Sept 2017. These are based on the EMFAC 2014 model for Alameda County.
 - I used these for passenger vehicle, commercial, and bus vehicle types. I applied the same fuel CO₂ emissions factor savings for 2020 relative to 2015 as that for 2015 relative to 2010 (about 5%)
 - The EV ownership for Alameda County as a whole may be on the low side and an effort was made to adjust for this based on data from Fremont from a presentation by Miya. Fremont has about 4800 EVs or 0.064 EV per household. I assumed Albany has about 40% of this ownership rate or about 150 EVs in 2015. This should be refined with real data from DMV. Regardless of this, the VMT % that need to be electric in 2020 to meet the target are not affected.
 - VMT is projected outward to 2020 for each vehicle type based on historical data. VMT is flat for passenger vehicles and slightly up for buses and commercial.
- For the “No Climate Shift cases”, trends in energy use for RES and COMM sectors are taken without the years 2014-2016 since these are anomalously warm years. The key representative plot for this is shown below. 2004-2015 is actual data. The climate warming shift occurred in 2014, 2015, 2016 with much warmer winters leading to a sharp drop in natural gas heating energy. The two points in 2020 (Fig 10a) represent the projections in 2020 with and without this climate shift and the upper point corresponds to the value used for the “No Climate Shift” projections. This difference alone (RES nat. gas) is about 3000 tonnes CO₂. Similar corrections have been applied to RES electricity, COMM natural gas, and COMM electricity.



(a)



(b)

Fig 10. (a) Residential natural gas energy and (b) GHG emissions had a sharp drop in 2014-2016 due to unprecedented climate warming.

- PGE electricity emission factors: Assumed CO₂ emission factors are shown below. These are updated from earlier PGE factors from 2015 and 2016. I estimated the emissions factors for 2017-2020 based on a 2016 correction factor from the Staff update of 1.14. These should also be refined if better estimates are available.

YEAR	PGE 2015/2016	Staff Inv to PGE elec EF correction factor	Assumed Elec EF in kg CO ₂ /kWh
	0.257		
2005	0.222	1.00	0.222
2006	0.207	1.00	0.207
2007	0.288	1.00	0.288
2008	0.291	1.00	0.291
2009	0.261	1.00	0.261

2010	0.202	1.00	0.202
2011	0.178	1.00	0.178
2012	0.202	1.00	0.202
2013	0.194	1.00	0.194
2014	0.197	1.00	0.197
2015	0.177	1.10	0.195
2016	0.168	1.14	0.191
2017	0.158	1.14	0.180
2018	0.149	1.14	0.170
2019	0.139	1.14	0.158
2020	0.131	1.14	0.149

- The East Bay CCA default minimum zero carbon according to Nick Pilch (2/7/18):
 - 35% carbon-free renewable + 35% other carbon-free = 70% carbon-free
 - I estimate that this is about 149g CO2/kWh in 2020
- The East Bay CCA higher zero carbon fraction is:
 - 38% carbon-free renewable + 47% other carbon-free = 85% carbon-free
 - I estimate that this is about 84 g CO2/kWh in 2020
 - I take these as two options available to customers in 2020.
- Other cases to consider: electricity energy efficiency, fuel switching of building heating.