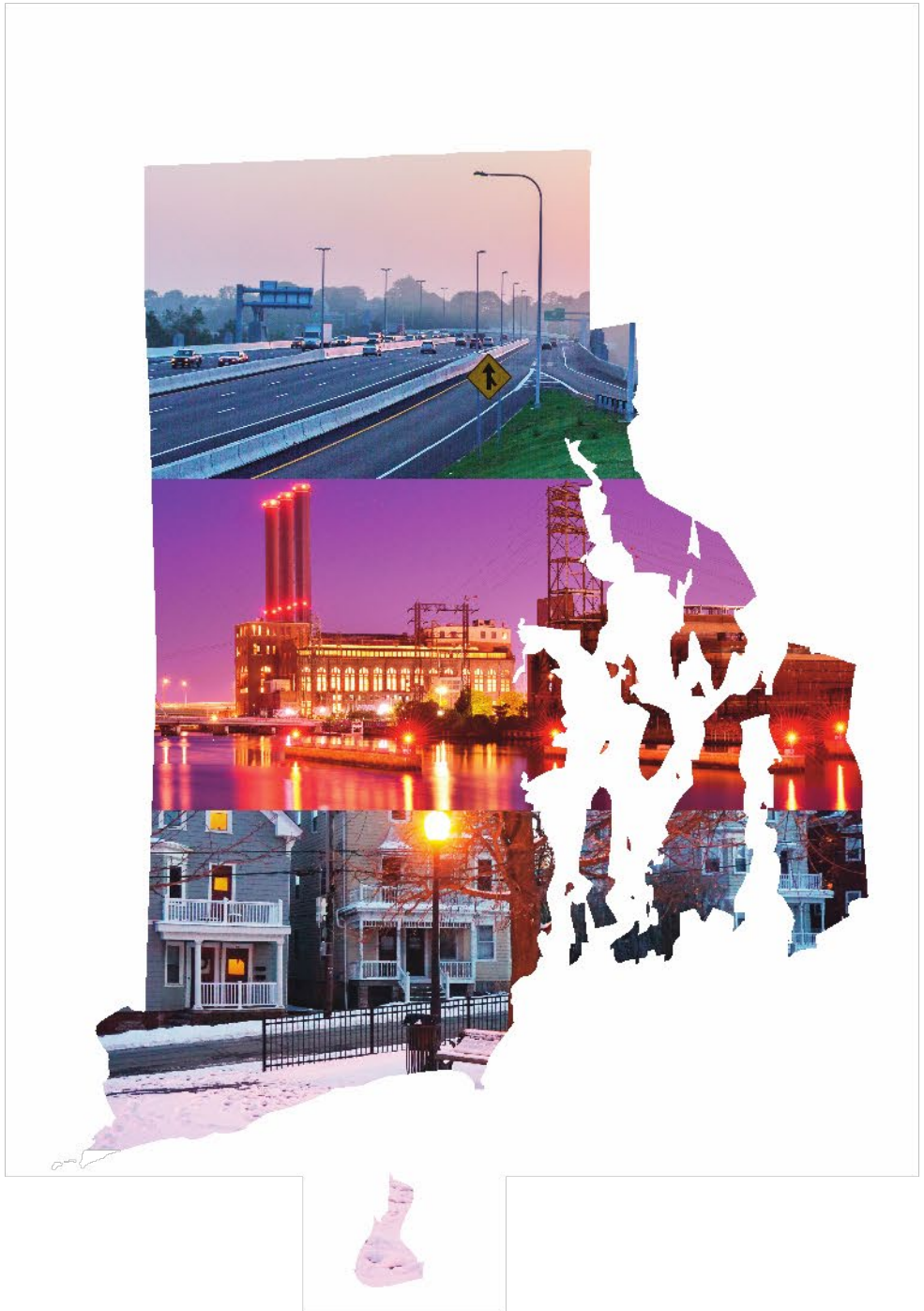


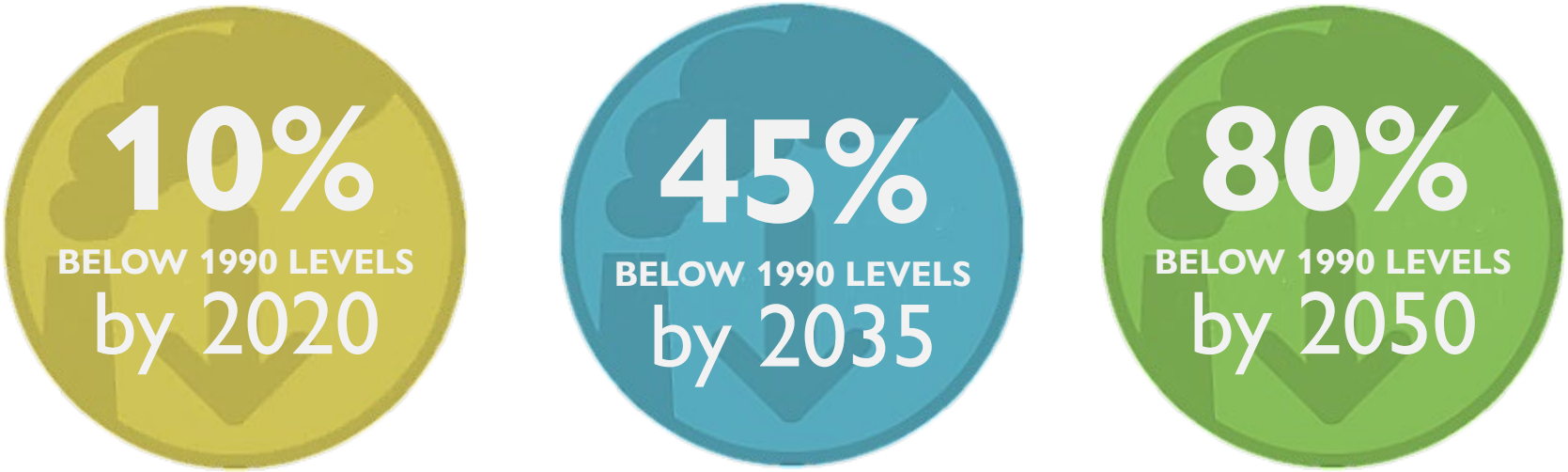
Rhode Island's 2016 Greenhouse Gas (GHG) Emissions Inventory Update

EC4 Meeting
September 12, 2019

Rhode Island Department of Environmental Management
OFFICE OF AIR RESOURCES

Resilient Rhode Island Act (2014)

- The RI Executive Climate Change Coordinating Council (EC4) was charged with developing strategies to meet GHG reduction targets below 1990 levels



Update Today

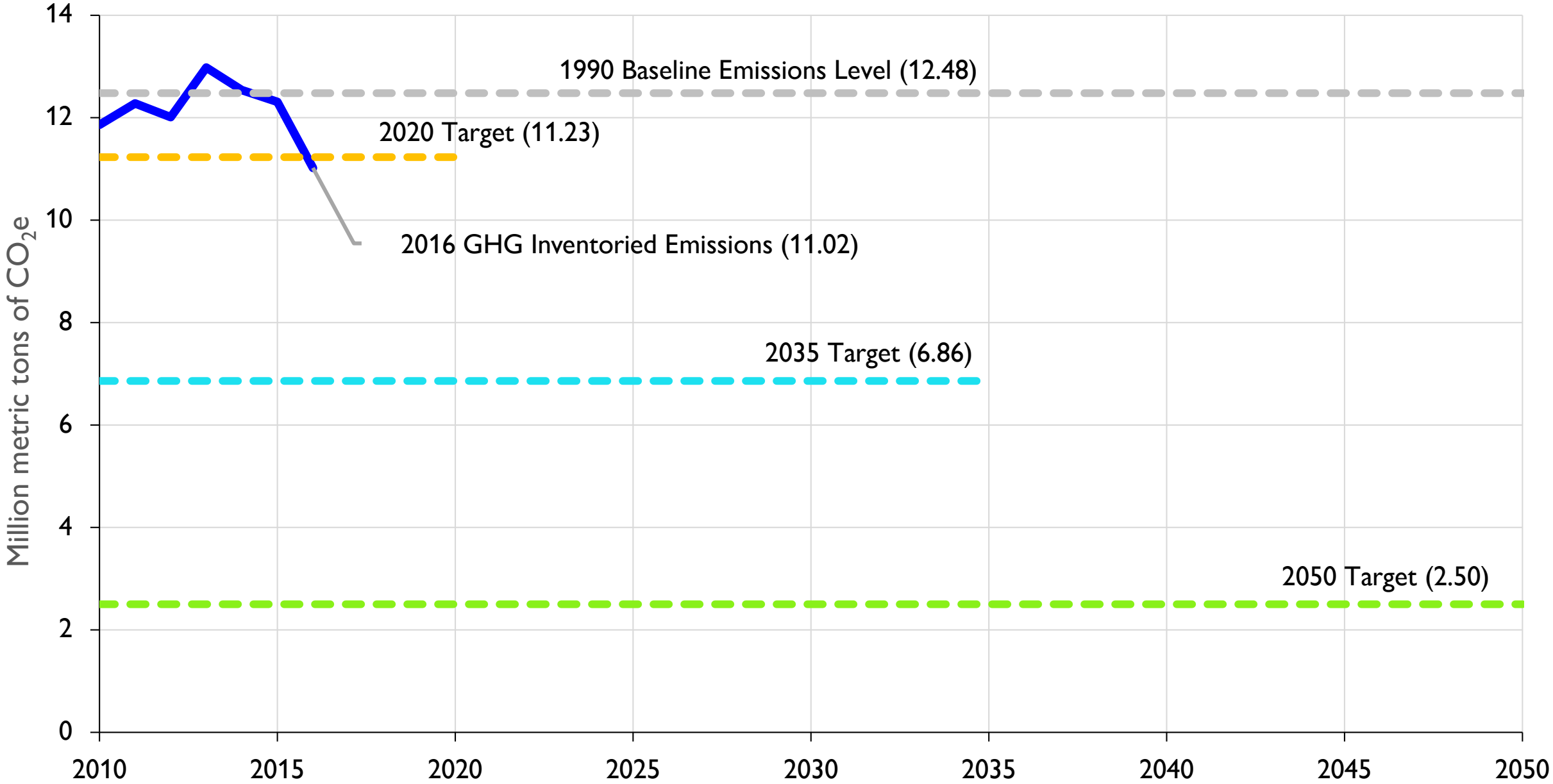
- Completed 2015 & 2016 GHG inventoried emissions

2016 emissions = 11.02 MMTCO2e

2020 Target Reached *(11.7% below 1990 levels)*

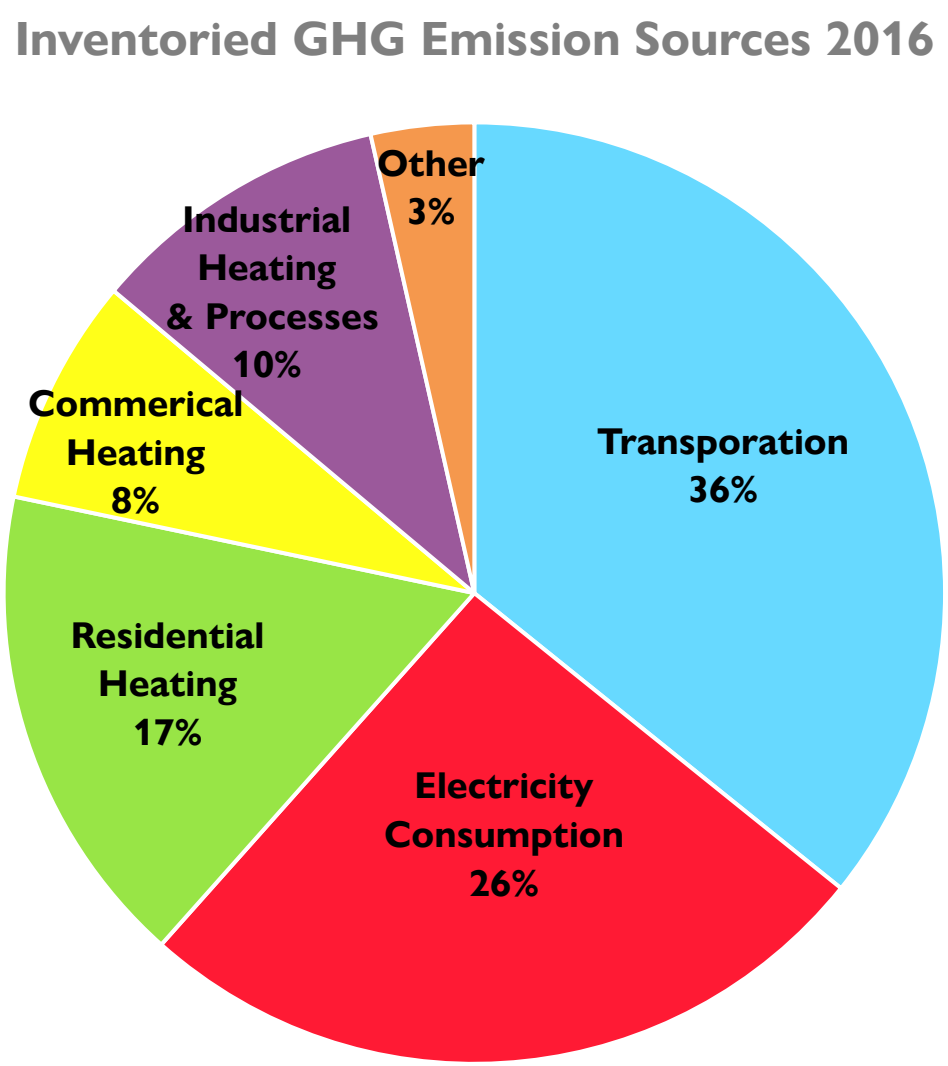
- The EC4 formally adopted the use of a consumption based emission accounting because this method more realistically comports with the regional nature of New England's electric grid and is consistent with the approaches taken by neighboring states.

Rhode Island Greenhouse Gas Emissions Reduction Targets



Major Sources of RI GHG

RI Greenhouse Gas Emissions by Sector ($MMTCO_2e$)	1990	2013	2014	2015	2016
Transportation	4.97	4.59	4.25	4.09	3.94
Electricity Consumption	2.82	3.52	3.25	3.21	2.84
Residential Heating	2.37	2.27	2.34	2.46	1.84
Industrial Heating & Processes	0.81	1.24	1.14	1.12	1.14
Commercial Heating	1.15	0.91	1.13	1.00	0.86
Other	0.65	0.45	0.43	0.43	0.39
Land Use, Land Use Change, and Forestry (LULUCF)	-0.29	N/A	N/A	N/A	N/A
Total Greenhouse Gas Emissions	**12.48**	**12.98**	**12.54**	**12.31**	**11.02**



Other includes emissions from agriculture, waste, and natural gas distribution.

Rhode Island GHG Emissions Trends

Rhode Island Greenhouse Gas Emissions 1990 v. 2016			
Sector	**Change in $MMTCO_2e$**	**Percent Change**	**Trend**
Transportation	-1.03	-20.7%	↓
Electricity Consumption	0.02	0.7%	↑
Residential Heating	-0.53	-22.4%	↓
Industrial Heating & Processes	0.33	40.7%	↑
Commercial Heating	-0.29	-25.2%	↓
Other	-0.26	-40.0%	↓
Total	-1.46	-11.7%	↓

Rhode Island Greenhouse Gas Emissions 2015 v. 2016			
Sector	**Change in $MMTCO_2e$**	**Percent Change**	**Trend**
Transportation	-0.25	-3.7%	↓
Electricity Consumption	-0.37	-11.5%	↓
Residential Heating	-0.62	-25.2%	↓
Industrial Heating & Processes	0.02	1.8%	↑
Commercial Heating	-0.14	-14.0%	↓
Other	-0.04	-9.3%	↓
Total	-1.29	-10.5%	↓

Other includes emissions from agriculture, waste, and natural gas distribution.

Transportation Sector Methodology

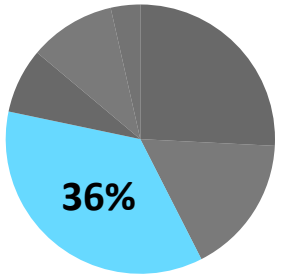
- Transportation Sector
  - Highway vehicles (92%)
  - Aviation (7.5%)
  - Lubricants (0.5%)
    - (i.e. petroleum based grease used in vehicles)
  - Non-Road (~0.0%)
    - Marine & diesel off-road
- For Highway Vehicles EPA MOVES Model Used

- MOVES v SIT

MOVES Inputs (2016)	SIT Inputs (Prior to 2016)
Age Distribution	Fuel Consumption
Fuel Blends	Vehicle Miles Traveled
Inspection Program (I/M)	
Meteorology	
Vehicle Population	
Road Distribution	
Speed Distribution	
Vehicle Miles Traveled	

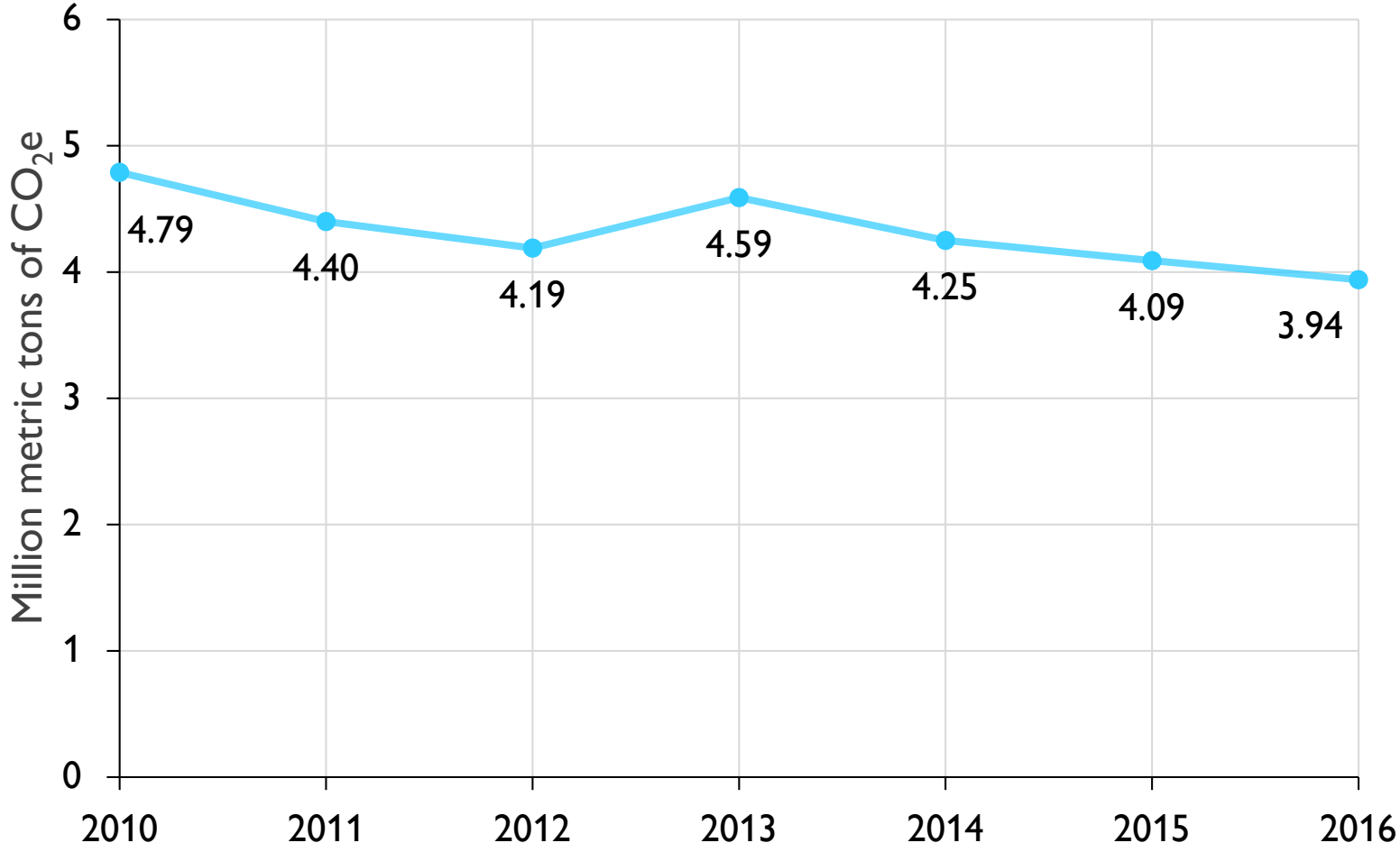
Transportation Sector Trends

- **In 2016,** largest source of GHG emissions (36%)
  - *3.7% ↓ in emissions 2015-2016*



- **In 1990 =** 4.97 $MMTCO_2e$
  - *20.7% ↓ in emissions 1990-2016*

Rhode Island Transportation Greenhouse Gas Emissions 2010-2016

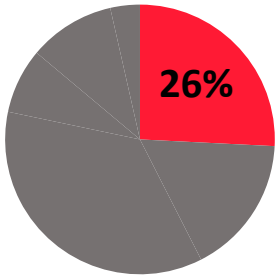


Electricity Consumption Sector Methodology

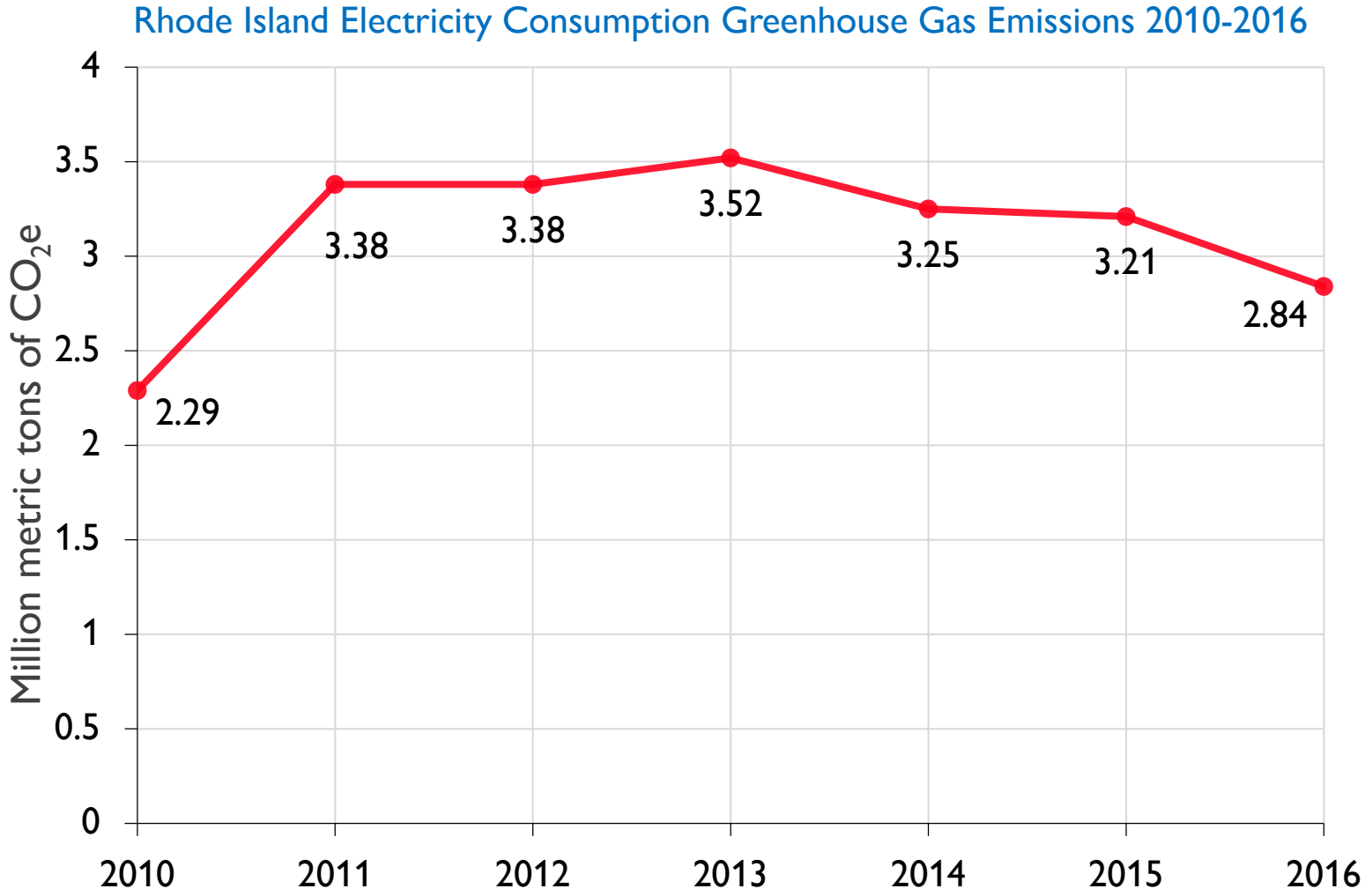
- Up until Year 2016, the GHG emissions associated with Electricity Consumption sector were calculated with the SIT.
- As discussed at EC4 meeting in May, we aligned our methodology with MA & CT.
- The key difference between the SIT and our new refined methodology is the accounting for Renewable Energy Certificates (RECs) purchased/sold by RI retail electricity sellers.

Electricity Consumption Sector Trends

- **In 2016,** second largest source of GHG emissions (26%)
  - *11.5% ↓ in emissions 2015-2016*



- **In 1990 =** 2.82 MMTCO$_2$e
  - *0.7% ↑ in emissions 1990-2016*

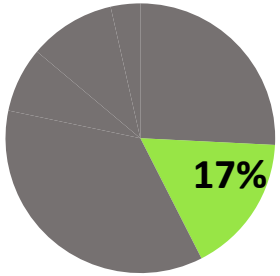


Residential Heating Sector Methodology

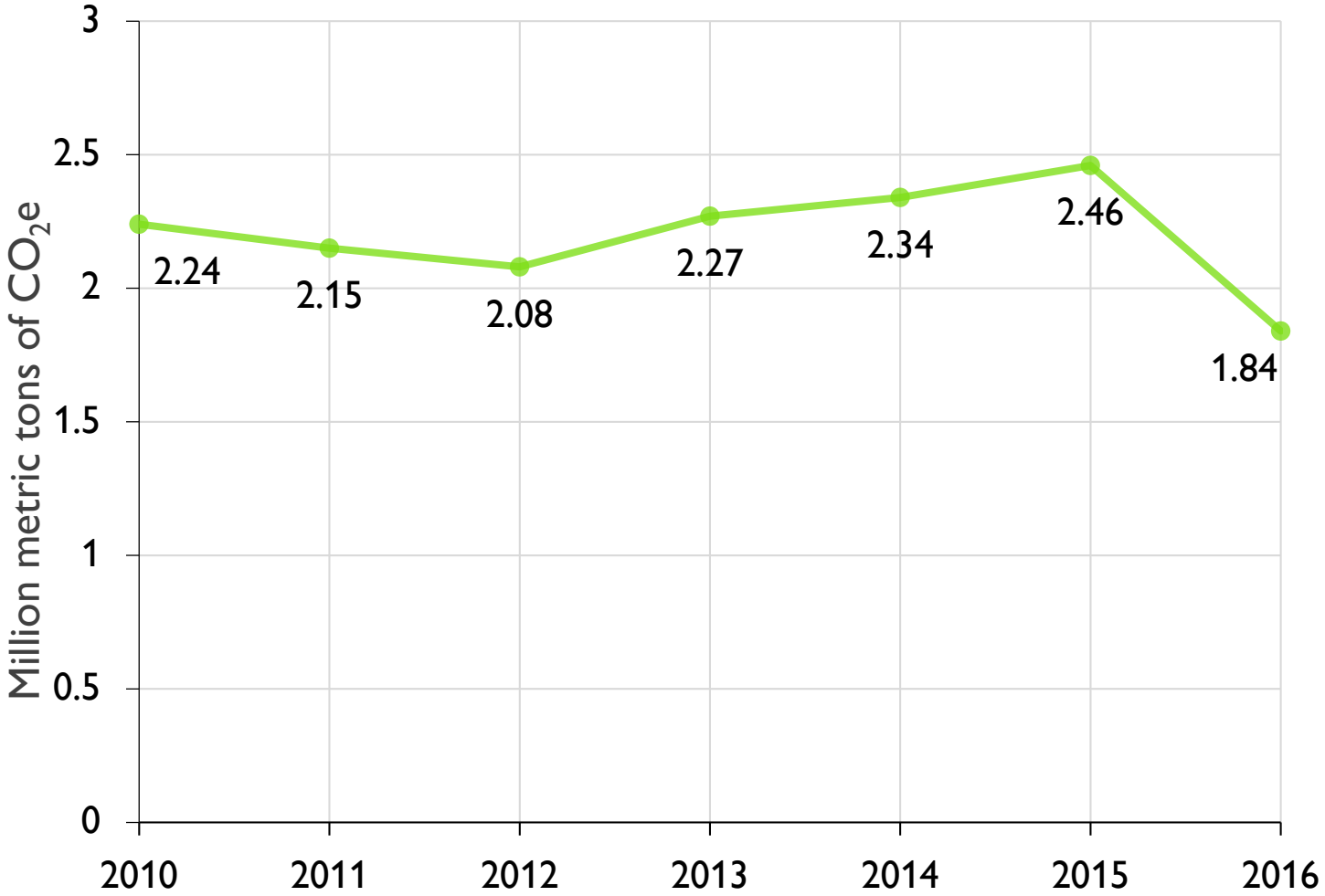
- Rely on SIT Tool to estimate GHG emissions.
- SIT tool data is populated by the U.S Energy Information Administration (EIA).
  - *For example, in RI National Grid provides natural gas consumption data to EIA*
- CO_2 emissions from fossil fuel combustion are calculated by multiplying energy consumption by the emission factors for each fuel (natural gas, distillate fuel, kerosene, LPG).

Residential Heating Sector Trends

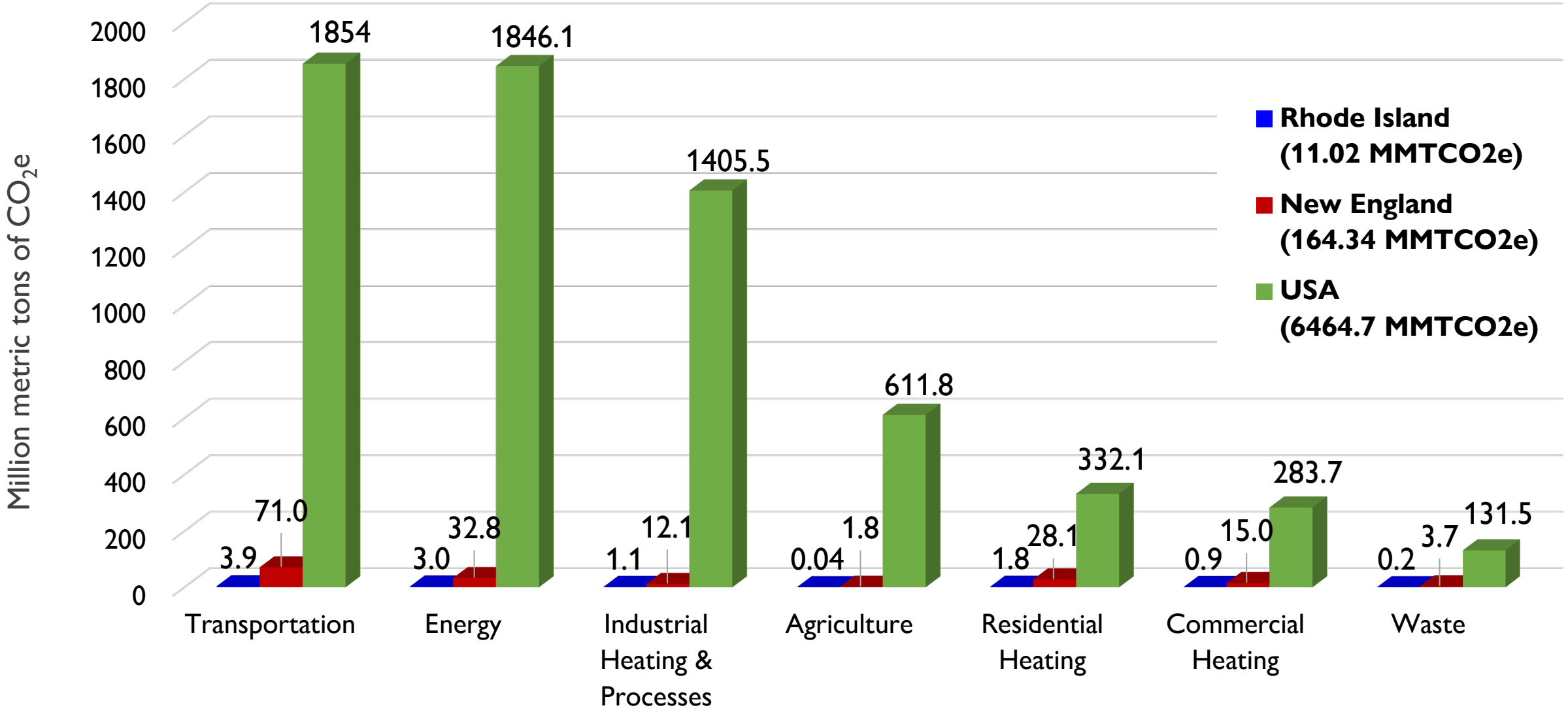
- **In 2016,** third largest source of GHG emissions (17%)
  - *25.2% ↓ in emissions 2015-2016*



- **In 1990 =** 2.37 MMTCO$_2$e
  - 22.4% ↓ in emissions 1990-2016



Rhode Island, New England, & U.S. Greenhouse Gas Emissions 2016



ME & NH Greenhouse Gas Emissions data collected from 2015 inventories. All other New England data compiled from 2016 inventories.
National Greenhouse Gas Emissions data collected from EPA. Methodologies to calculate sector totals may vary in different states.

RI GHG Inventory: Next Steps

- **October 2019**
  EC4 Meeting – Draft 2016
  GHG Emissions Inventory

- **November 2019**
  Public Informational Session

- **December 2019**
  Final 2016 GHG Emissions Inventory

Thank You!

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GHG Emissions Inventory History

- RI's 1st GHG emissions inventory completed by NESCAUM (2013)
  - Estimated 1990 baseline
  - Completed 2010 inventory
  - Projected 2020 emissions
  - Primary tool: EPA's State Inventory Tool (SIT)
    - *SIT is an interactive spreadsheet model that calculates sector by sector GHG emissions.*
    - *Users can pre-load default data or state-specific data*

- RIDEM/Air Resources continues to estimate GHG emissions primarily using the SIT

Pathways to a Successful GHG Emissions Inventory

As identified in the 2016 GHG Reduction Plan, the EC4 provided the following recommendations:

- To monitor progress using a triennial schedule of GHG reductions based on the Resilient Rhode Island GHG targets
- To develop a triennial GHG emissions inventory for Rhode Island and report on progress towards meeting Resilient Rhode Island GHG targets
- To evaluate the possibility of meeting higher targets through cost-effective measures in the triennial report

Taking a Closer Look at the Electricity Consumption Sector

- How renewable energy should be reflected in the GHG emissions inventory?
- RI's Renewable Energy Standard (RES) requires that an increasing amount of renewable power be sold each year.
- Since the RES requires increasing amounts of RE over time, it is possible that the previous methodology would have caused an increasingly less accurate RI GHG Inventory over time.

Refining & Aligning our Methodology – Electricity Consumption Sector

- Up until now, RI used the SIT tool to capture electricity consumption-based GHG emissions.
- Now, given RI's ambitious RES (38.5% by 2035), it's important that we capture the associated emissions reductions in our inventory.
- Going forward, RI intends to align our inventory methodology with MA & CT which includes accounting for Renewable Energy Certificates (RECs).
- This will account for emission reductions from RECs purchased/sold by Rhode Island retail electricity sellers.

Comparing Apples to Apples?

	Deeper Decarbonization in the Ocean State - 2019 RI GHG Reduction Study	DEM – GHG Emissions Inventory
Accounting Methodology	Production Based	Consumption Based
IPCC Report	AR5	AR4
Global Warming Potential (GWP)	20-year	100-year
2016 Emissions	15.7 $MMTCO_2e$ modeled	11.02 $MMTCO_2e$ actual

Methane Emissions Comparison

	Deeper Decarbonization in the Ocean State - 2019 RI GHG Reduction Study	DEM – GHG Emissions Inventory
Methane Emissions	2017 - **4.9 MMTCO$_2$e** AR5 20-Year (84 GWP)	2016 - **0.39 MMTCO$_2$e** AR4 100-Year (25 GWP)
		2016 – 0.39 MMTCO$_2$e converts to approximately **2.77 MMTCO$_2$e** when AR5 20-Year GWP used (84 GWP) *and* same leakage rate as referenced in Deeper Decarbonization Study

Global Warming Potentials – AR4 v AR5

- A measure of how much heat a GHG traps in the atmosphere up to a specific time horizon relative to CO_2. CO_2 has a GWP of 1 because it is the reference gas.

Greenhouse Gases	Global Warming Potential (GWP) (AR4)		Global Warming Potential (GWP) (AR5)	
	20-Year	100-Year	20-Year	100-Year
Carbon Dioxide (CO2)	1	1	1	1
Methane (CH4)	72	25	84	28
Nitrous Oxide (N20)	289	298	264	265

IPCC data sources for more information: AR4 (2007) values: https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html
AR5 (2014) values: https://www.ipcc.ch/pdf/assessmentreport/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf

Rhode Island Comparisons

Comparing total shares of GHG Emissions	Deeper Decarbonization in the Ocean State - 2019 RI GHG Reduction Study	DEM – GHG Emissions Inventory
RI v New England	-	6.71%
RI v USA	0.19%	0.17%
RI v World	**0.029%**	**0.024%**