

PA 5790 Sustainable Infrastructure and Cities: Suggestions for a Sustainable Future in Rosemount



Approaches to GHG Measurement

- We started with Scope 1 & 2
 - RII Data (Electricity, Natural Gas, VMT, Share of Airport Emissions, Solid Waste, Water/Wastewater)
- We added Scope 3
 - Utilized the standards of the ICLEI Community Protocol
 - Added Agriculture, Cement, Food
 - Analyzed In-Boundary vs. Trans-Boundary methodologies

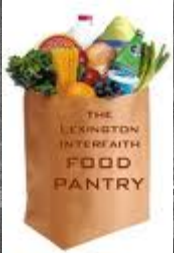
Framework for Assessing Environmental Sustainability, Health & Livability in All City-Types



Electricity



Fuel



Food



Water/Sanitation

COMMON ELEMENTS OF WELL-BEING

- Basic Provisioning addressing Resource Supply Chain Scarcity
- Access to Jobs/Livelihoods
- Regulating the Environment: Heat/cold/floods, pollution
- Well-Being – thriving/happy
- Safety, security
- Recreation, culture

Construction Materials

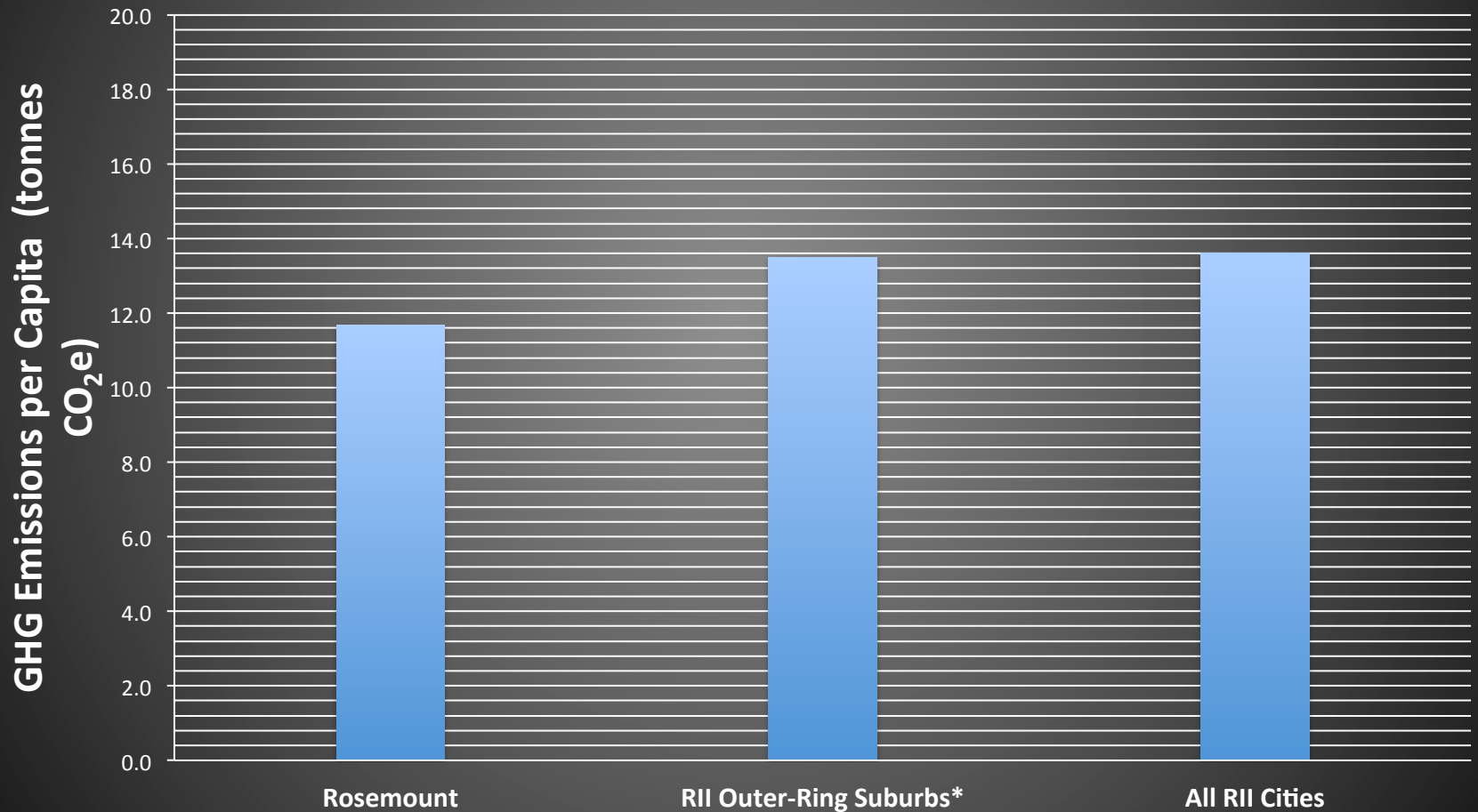
Parks & Recreation



Larger Road, Rail, Freight & Airline Networks

Waste- Pollution

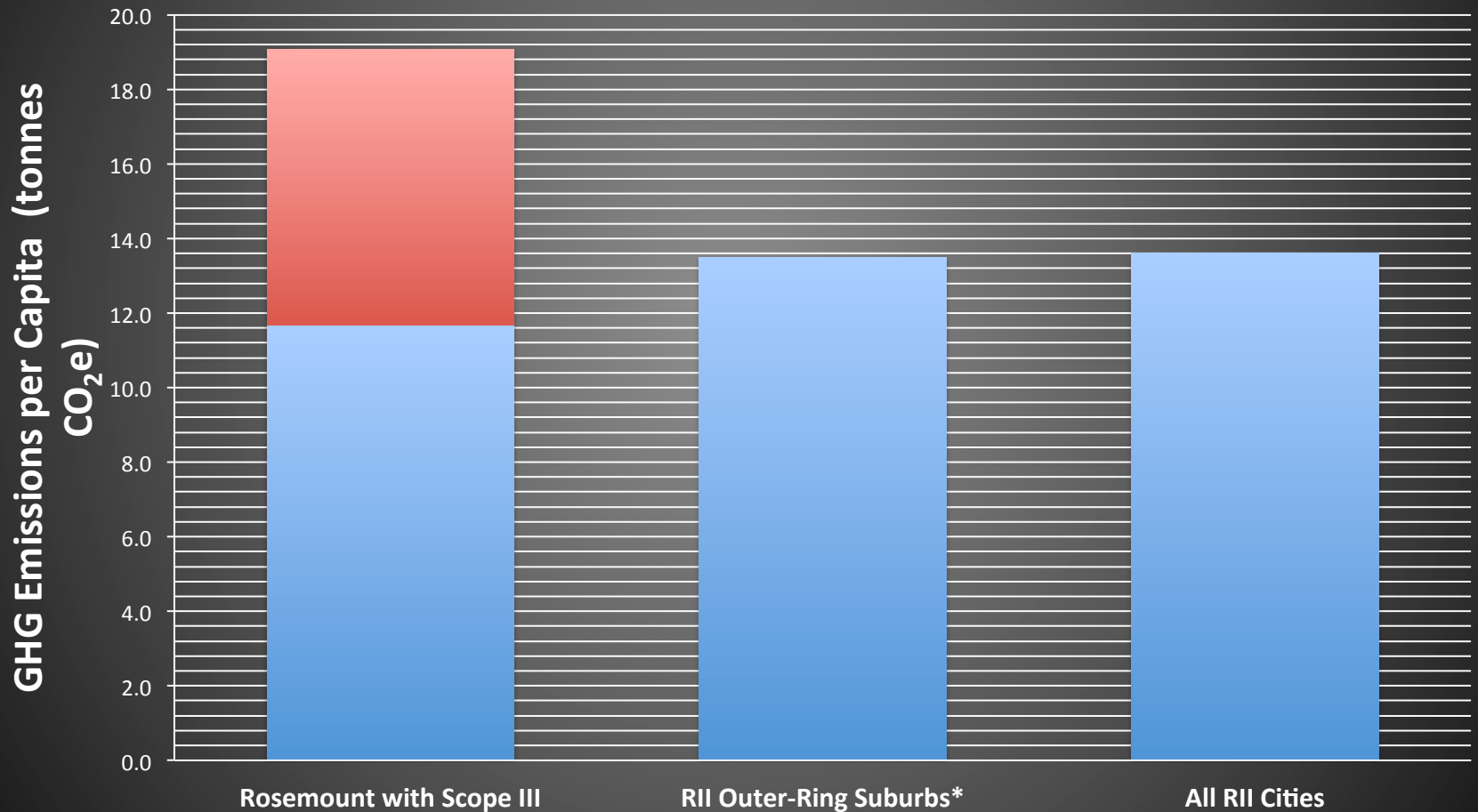
2012 GHG Emissions by Scope 1 & 2:



*Outer-Ring suburbs are White Bear Lake, Coon Rapids, Oakdale, Bloomington, Shoreview, Eagan, Eden Prairie, Minnetonka, Woodbury, Lake Elmo, and Rosemount.

**Food data from 2009. VMT data from 2010. Cement and Agriculture data from 2012.

2012 GHG Emissions by Scope 1, 2 & 3:

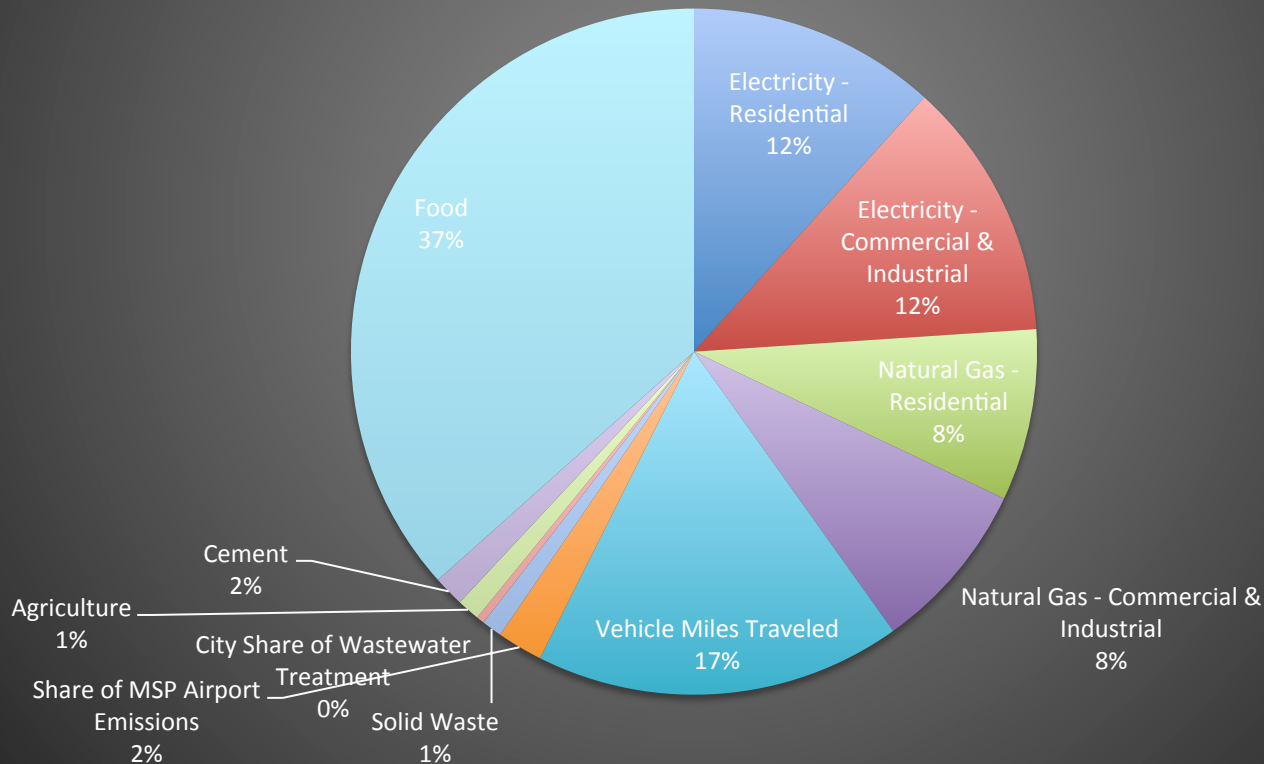


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2013 Breakdown by Infrastructural Sector

Sector Share of GHG Emissions, 2013* (tonnes CO₂e)



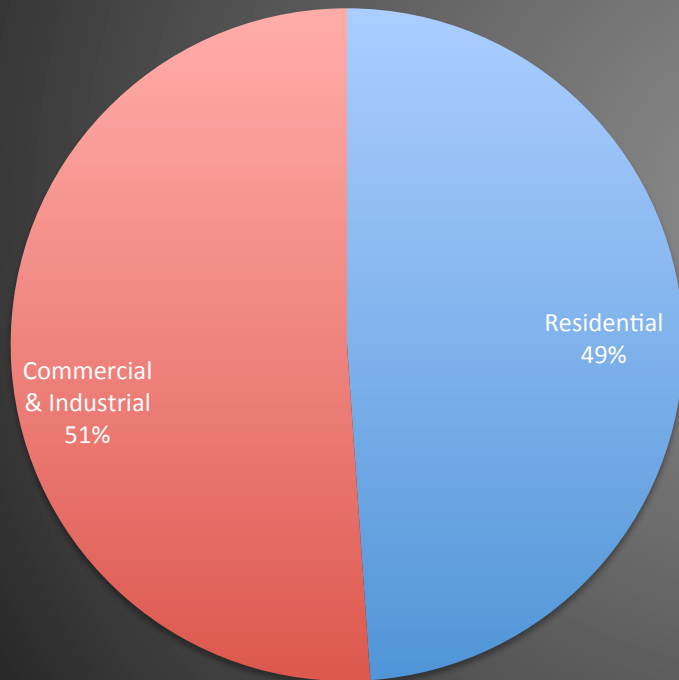
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Key Infrastructure Sectors - Rosemount

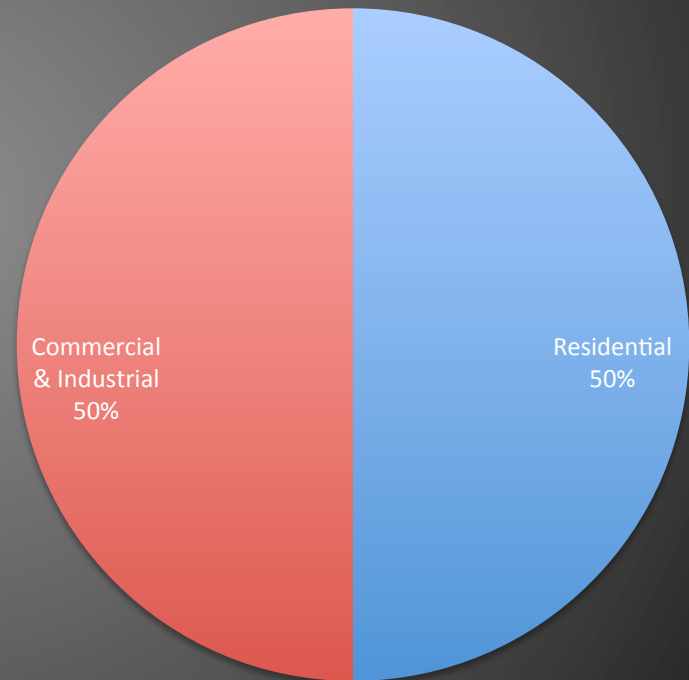
- Energy
- Travel
- Waste
- Water

Energy

Electricity by Use Type, 2013



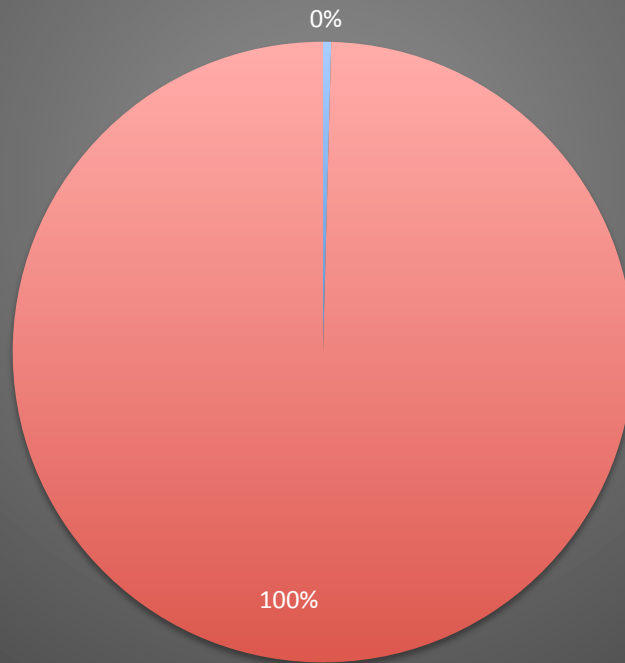
Natural Gas by Use Type, 2013



Travel

GHG Emissions by Vehicle Type, 2010 (tonnes CO₂e)

■ MVTA Transit Vehicles ■ On-Road Vehicles

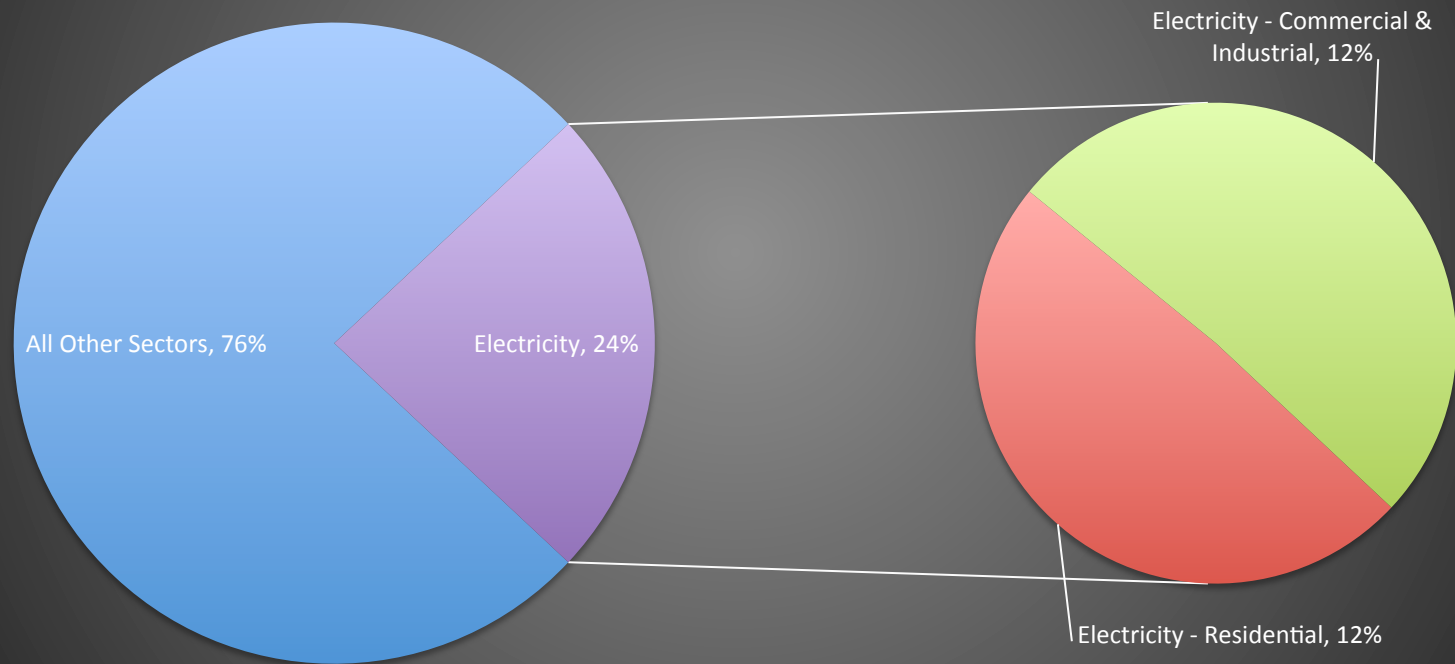


Recommendations for a Greener Future



Energy Recommendations

Total Electricity Share of GHG Emissions, 2013 (tonnes CO₂e)



Residential Electricity: Real-Time Energy Displays

- Behavioral feedback
- Residential energy 12%
 - Energy savings of 6-12% of household home
- Cost approximately \$100
 - Payback within 1 year



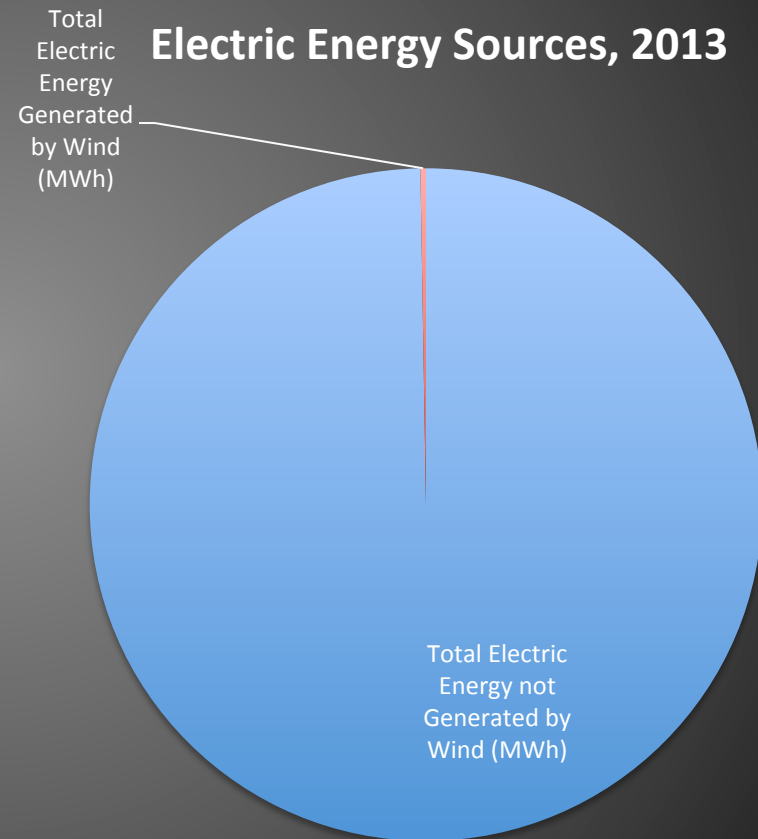
Note: Basic energy displays do not report data to a 3rd party.

Program Design: Real-Time Energy Displays

- Voluntary
 - Estimated 2-4% participation
 - Individual outreach
 - Some technical expertise needed
 - .03% total GHG reduction
- Universal adoption
 - 1.1% total GHG reduction

Residential, Commercial & Industrial Electricity: Voluntary Green Electricity Purchases

- Rosemount currently receives a very small percentage of its electricity from Windsource, Xcel's voluntary wind energy program



Residential, Commercial & Industrial Electricity: Voluntary Green Electricity Purchases

- Denver witnessed an ~64% increase in green-energy purchases from 2005 to 2007 (residential and commercial)
- National studies indicate that energy purchases totaling 1-5% of MWh are achievable
- 0.6% total GHG reduction

Energy Efficient Housing

- Rosemount is expected to grow by 3000 more households by 2030
- These homes will need to be heating, cooled, and provided electricity
- This is a huge opportunity to reduce CO₂e per capita



Small things to improve housing efficiencies

- Heat recovery systems should become standard as homes become better and better insulated
- Granny additions
- Simple rainwater collection methods like gutter-barrels
- Improved insulation requirements like those recommended by the International Energy Conservation Code (IECC), last updated 2012

Zero Energy Ready House



- Initiative by the Department of Energy
- These homes provide a number of benefits over standard houses
 - Completely self-sufficient!
 - Often provide energy back to the grid!
 - Lower utility bills!
 - Great indoor air quality ratings!
 - Lowers GHG emissions by 3.06% over five years



U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

DOE ZERO ENERGY READY HOME™



TC Legend Homes

Cedarwood
Bellingham, WA



- June 2014
- 1,055 ft² of conditioned space
- 1 bedroom, 1 bath, 2 floors
- \$10,000 higher upfront builder cost than IECC 2009
- \$604 total annual utility cost w/o solar addition

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

DOE ZERO ENERGY READY HOME™



New Town Builders

The ArtiZEN Plan
Denver, CO



- September 2013
- 2,115 ft² of conditioned space
- 3 bedrooms, 2.5 baths, 2 floors
- \$2,000 higher upfront builder cost than IECC 2009
- \$493 annual savings w/o solar addition compared to IECC 2009 house

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DOE ZERO ENERGY READY HOME™



One Sky Homes

Cottle Zero Net Energy Home
San Jose, CA



- April 2012
- 3,198 ft² of conditioned space
- 5 bedrooms, 3.5 baths, 2 floors
- \$65,000 higher upfront builder cost than California Title 24 Code household (solar addition included)
- \$2,900 monthly savings when compared to California Title 24 house

The One Sky Homes development's monthly savings are so low because it sells energy back to the power company

Zero Energy Ready Housing

	<u>Current Trend</u>		<u>Zero Energy Ready Home</u>		
	tCO2e per house	tCO2e	tCO2e per house	tCO2e	dtCO2e
2020	20.192	202744	17.24	173067	29,677
2030	17.593	221367	13.75	173067	48,300

Zero Energy Ready Home – Local MN Partners



University of Minnesota Resources

- Dr. Pat Huelman – head of the Cold Climate Housing Program. Advised the UMN design team, OptiMN, who won first place at the Race to Zero design competition hosted by NREL.
- Dr. Robert Seavey – teaches the class on efficient housing design at the U of M.



The OptiMN team with Dr. Pat Huelman in the middle/back.



Dr. Robert Seavey sporting a nice hat

Housing Trends

Living Small In The City: With More Singles, Micro-Housing Gets Big

Millennials and Micro-Units Are the Hottest New Trend Pairing



2012 Build Small
LIVE LARGE

A Market Revival for Single-Family Housing

The Shifting Nature of U.S. Housing Demand

The U.S. housing market is growing again—but not as we knew it

Graduate student joining nat'l trend of tiny homes

House

and high efficiency faucets, showers and water heaters.

One of the most impor-

AVERAGE HOUSE VS. TINY HOUSE

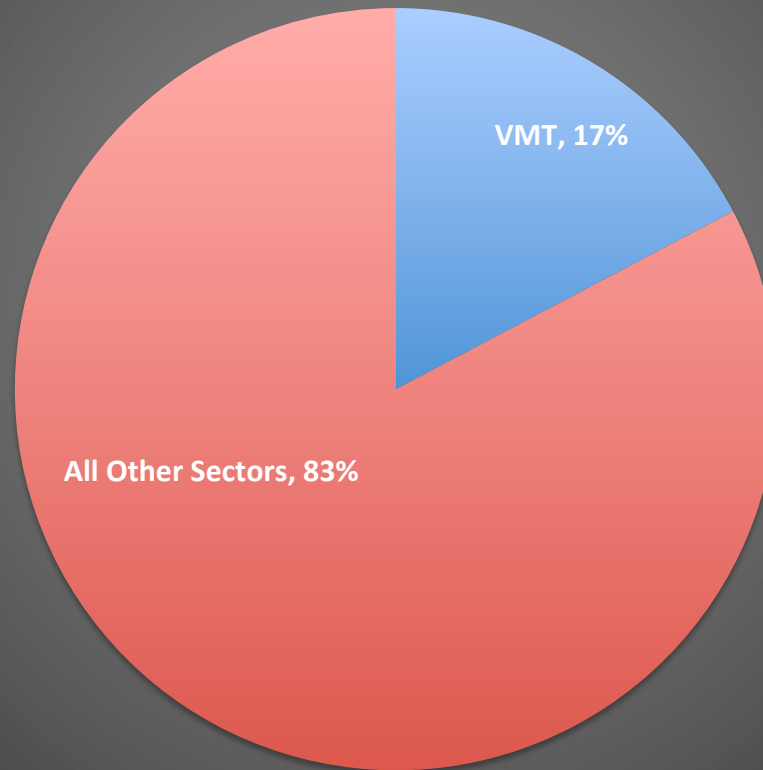
House has 10 light bulbs, which consume 100 kWh of electricity per year

An average tiny house has 6 light bulbs, which consume 85.2 kWh of electricity per year

Housing Trend Embraces the Mantra: Smaller is Better

Transportation Recommendations

Transportation (VMT) Share of GHG Emissions, 2010 (tonnes CO₂e)



*MNDOT data used for analysis.

MET Council method for VMT breakdown daily

- In-Boundary VMT 1,220,886
(469,000 from RII/MnDOT)
- Starting In - End Out 2,148,171
- Starting Out - Ending In 1,175,070
- Total Attributable VMT 2,882,507
- Rosemount's Daily per capita VMT 127
(May include freight)

There are various trips that have more than 200 VMT for outbound trips within the boundary

MnDOT/RII method for VMT breakdown

- **National** – 27 VMT per capita
- **Regionally** (Minnesota) – 24.5 VMT per capita
- **Rosemount** is currently **127 VMT** per capita
- This is approximately 4 times the national average!

Approaches Used for VMT breakdown

MnDOT method (RII Protocol)

- Accounts for all VMT travelled in the boundary of Rosemount
 - **Limitations with this method are they do not account for trips ending and/or starting outside the boundary that start or end in Rosemount.**

Met Council (Origin and Destination)

- Analyzes the start and end destinations for all trips within the boundary of Rosemount and also trips outside the city

Method of Data Collection and Calculation

MnDOT

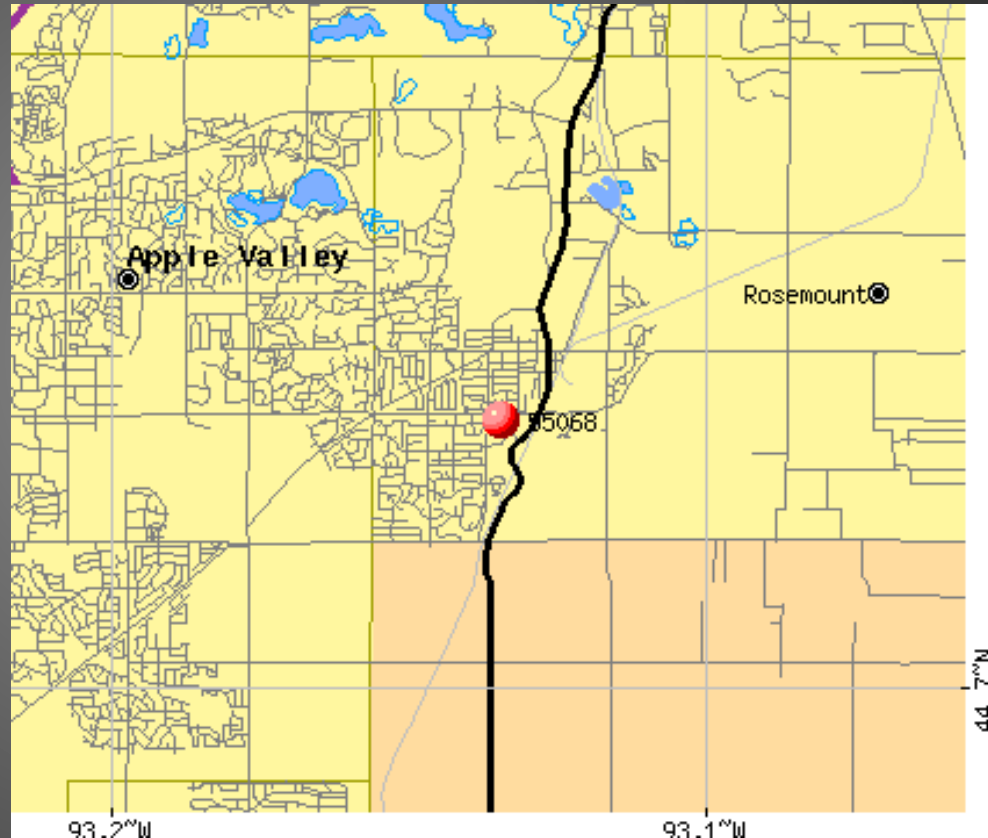
- Centerline VMT counting
- Creates an average snapshot of Rosemount daily VMT per capita (20.5)
- Doesn't account for freight

Met Council

- Lane mileage VMT counting
- Accounts for miles on either side of the centerline
- Suggests that there may be some double counting occurring and also includes freight traffic

Top 3 Locations Rosemount Residents are Traveling using the MET Council Method

1. Apple Valley
2. Farmington
3. Lakeville



Suggestions for Rosemount Transportation Improvements

- Make public transport more cost effective – providing a free shuttle service for *Flint Hills* employees
- Increase spots/availability in “Park and Ride” lot
- Bus Rapid Transit (BRT)
- Increase business within the city vicinity to decrease on vehicle travel
- Encourage workplace **carpooling** groups within city businesses

Double Bus Traffic?

- **Local Route 420** travels 9 miles per one-way trip
 - Another bus- same degree of ridership
 - 60 people x 9 miles= 540 miles
- **Express 476** bus increased by 20%
 - 80 people x 32 miles= 2,560 miles
- Data informs us that this is **not** a significant decrease in VMT, confirming that there would have to be a behavioral change

Business as Usual/Suggestions

Current Status

- Currently, only 1 bus commutes between Apple Valley and Rosemount
- The 2 other express buses that service Rosemount only travel to and from Minneapolis

Areas to Improve

- Increase bus routes within boundary of Rosemount and Apple Valley
- Expand MVTA service between Lakeville and Farmington

Additional Sector Recommendations

- Water
- Food

Water Recommendation

High Efficiency Toilets

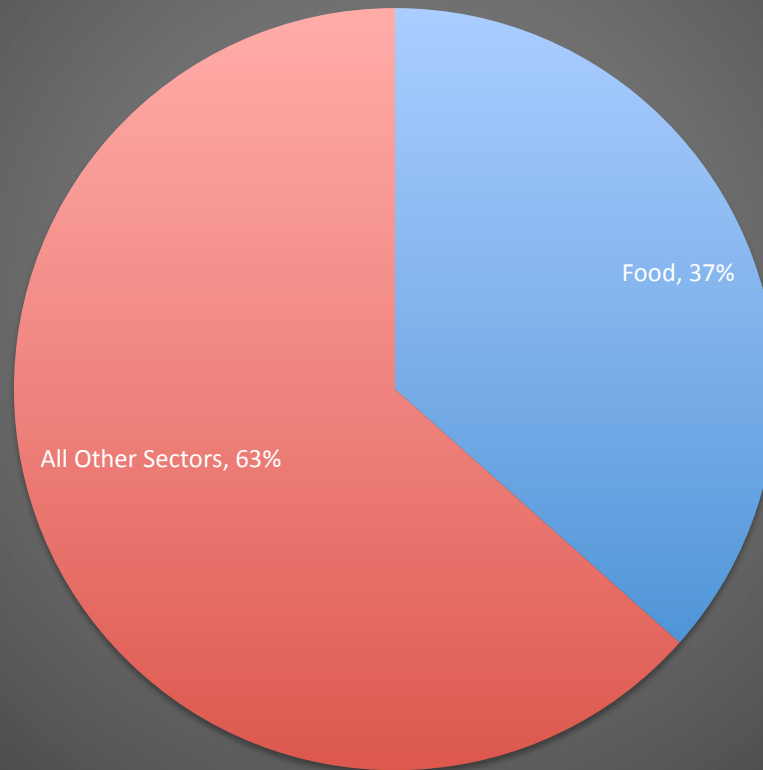
- Small piece of overall emissions but toilets significant within this sector
 - 30% of indoor residential water consumption, on average
- 1.6 gallons/flush previous standard
- 1.28 gallons/flush high efficiency toilets
 - 20% reduction in water use

Program Design: High Efficiency Toilets

- Voluntary
 - Estimate 3% participation
 - .006% overall GHG reduction
- Universal adoption
 - .2% overall GHG reduction

Food Recommendation

Food Share of GHG Emissions, 2009 (tonnes CO₂e)



Healthy Eating Campaign

- Promoting healthy diet
 - Focus on decreasing red meat consumption
- Public awareness campaign
- Estimated decrease of 0.6 T CO₂ e/capita
- 3.2% total GHG emissions reduction

Additional Recommendations

Household Apple Trees

- Increase property value
- Lowers heating and cooling costs
- Sequesters carbon
- Yields apples!



falling fruit – Map the urban harvest!

Map	About	Data	Activity	+ Add source	
1	id	type_ids	lat	lng	unv
2	244645	252	39.95009	-75.1738	f
3	244936	252	40.03509	-75.316	f
4	246334	97	39.99842	-75.2711	f
5	246960	282	40.0258	-75.3094	f
6	246975	282	40.19378	-75.4545	f
7	247017	282	40.02113	-75.2974	f
8	247121	282	40.03751	-75.2717	f
9	247405	282	40.06398	-75.2982	f
10	247663	282	40.05631	-75.2998	f
11	248157	113	39.95067	-75.2476	f
12	250493	253	40.02285	-75.2192	f
13	250499	253	40.00536	-75.218	f
14	250598	253	39.94516	-75.1497	f
15	251207	115	45.51443	-122.617	t
16	251465	138	45.59765	-122.74	f
17	251743	172	45.57149	-122.643	t
18	252341	172	45.51435	-122.636	t
19	253287	252	45.5277	-122.699	f
20	253491	73	45.4669	-122.649	t
21	254614	114	45.46224	-122.659	t
22	254812	114	45.59931	-122.735	t
23	254909	114	45.46284	-122.646	t
24	255320	114	45.51112	-122.643	t
25	255397	114	45.5139	-122.627	t
26	255814	92	45.59393	-122.745	t

locations +



FRUITS *of the* **CITY**



Apple Tree Initiative

- Planting apple trees would only save fractions of a percent on GHG emissions over a 5 year period
- After 5 years, the trees start fruiting and the GHG emission reduction per year goes up considerably.
- Planting apple trees is cheap and easy in bulk, and the trees provide additionally benefits to sequestering carbon

Apple Tree Wedge

Direct sequestration + heating/cooling savings + food production savings (tCO₂e)

	Year 5**	Year 10	Year 20
1 apple tree	0.0	0.2	1.1
100 apple tree	2.9	20.5	115.0
500 apple tree	14.7	102.6	575.0

Community Gardens

- Increases walkability
- Increases fruit/vegetable intake
- Lowers food importation
- Increases community resiliency
- Yields delicious food!

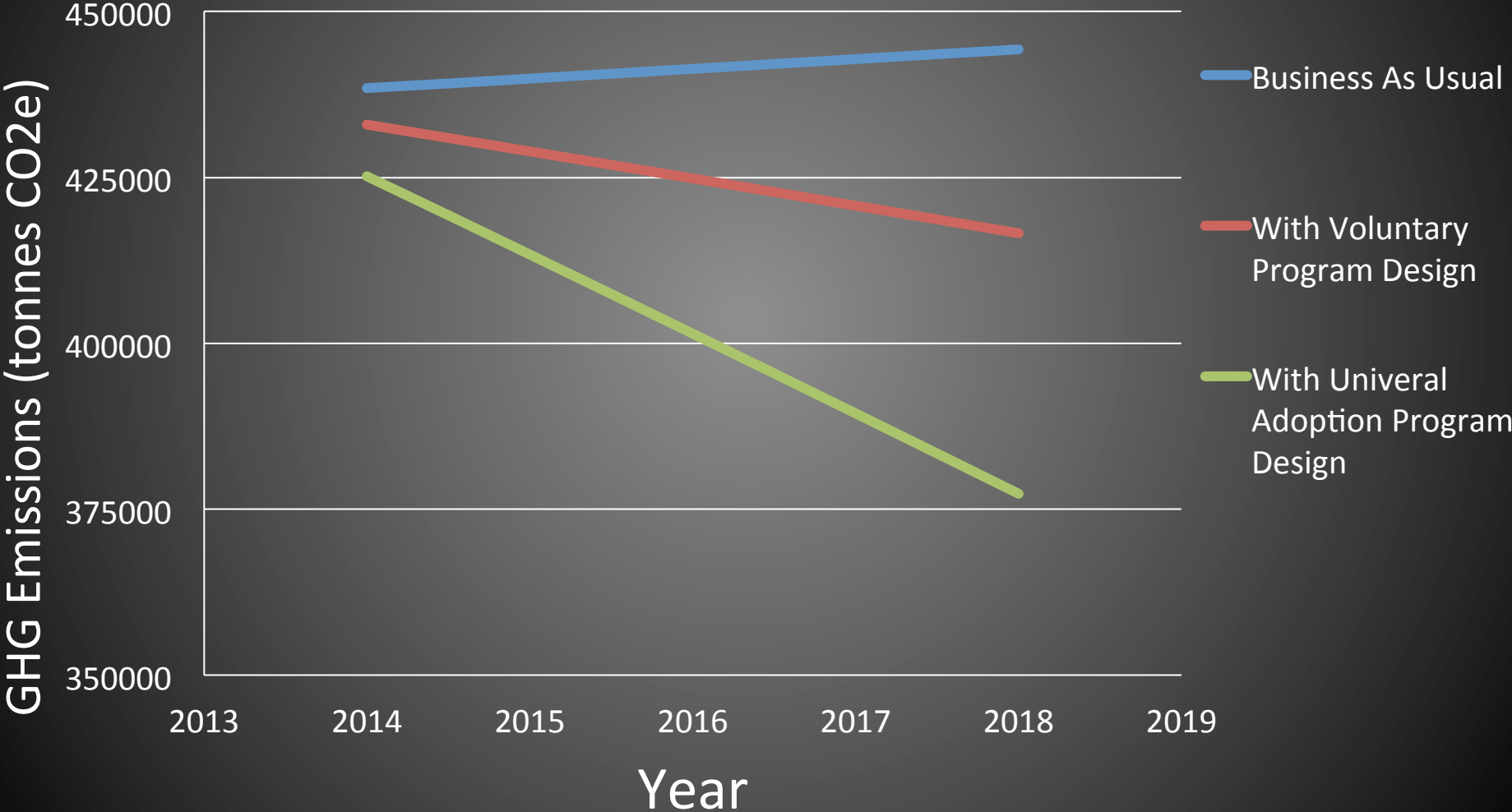


Community Garden Wedge

		5	10	20
	1 year	year	year	year
1 garden	0.07	0.35	0.7	1.4
5 gardens	0.35	1.75	3.5	7
10 gardens	0.7	3.5	7	14

Little Changes Can Make a Big Difference

Chart Title



Community Garden Wedge

- Community gardens also only shave fractions of percent off of GHG emissions
- They are cheap, can be funded by gardeners, and require little maintenance by the city
- Numerous undeveloped lots can be used for community gardens until other development plans appeal to the city.

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