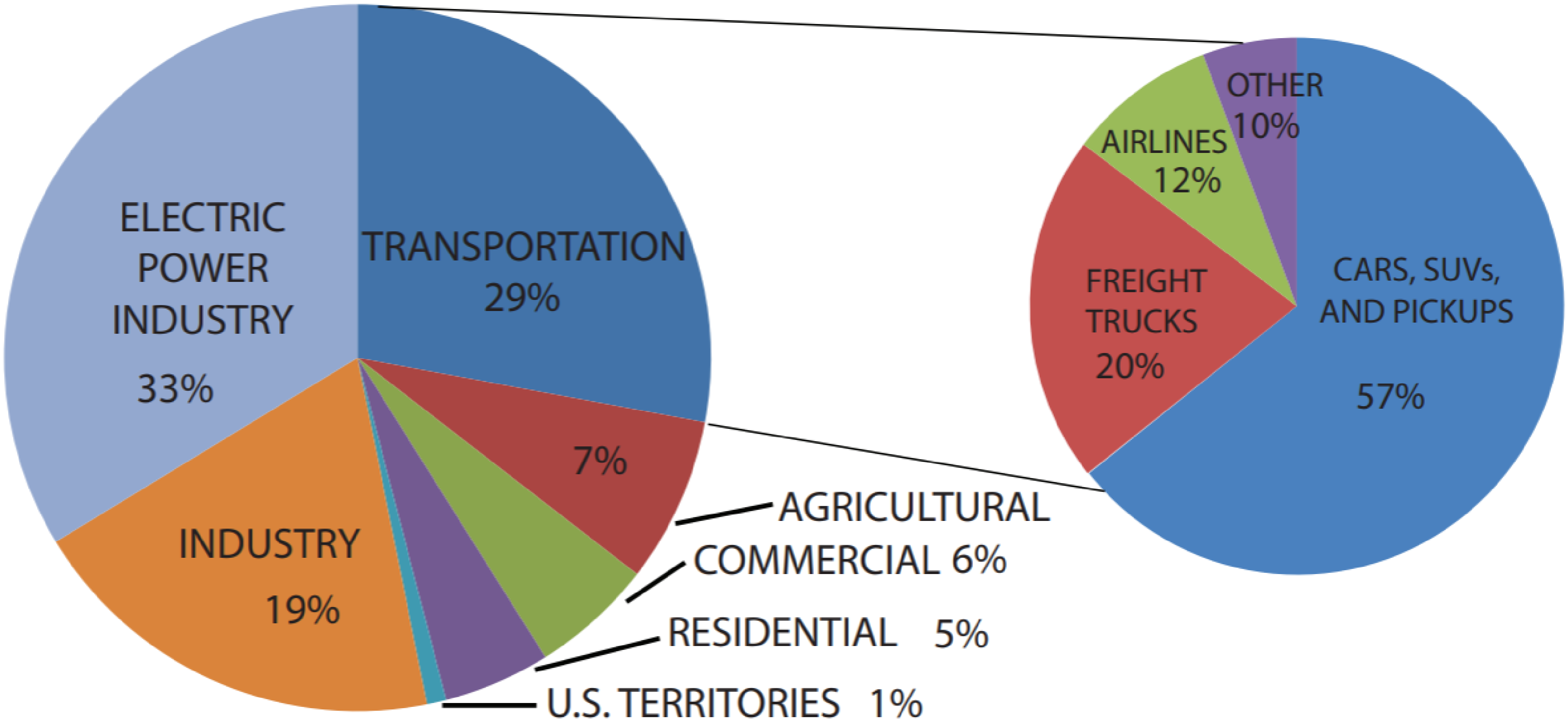
Transit and Sustainability

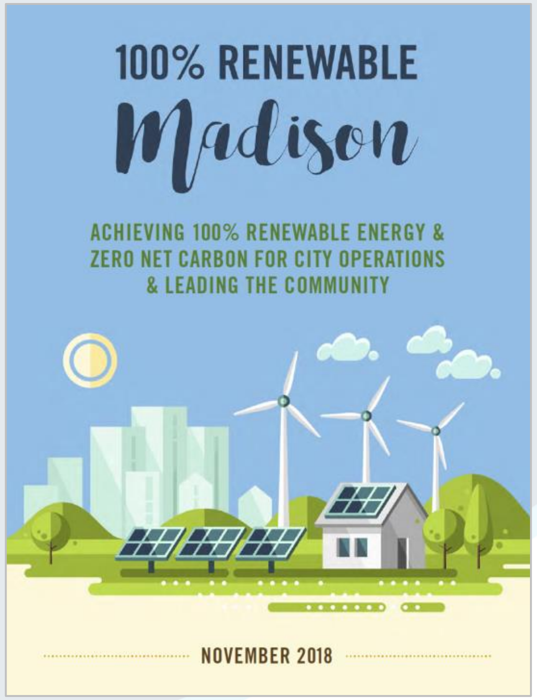
FIGURE 1

Transportation Accounts For 29% of U.S. Greenhouse Gas Emissions.

Source:
U.S. Environmental Protection Agency, *Inventory of Greenhouse Gas Emissions and Sinks: 1990-2007*, April 2009.

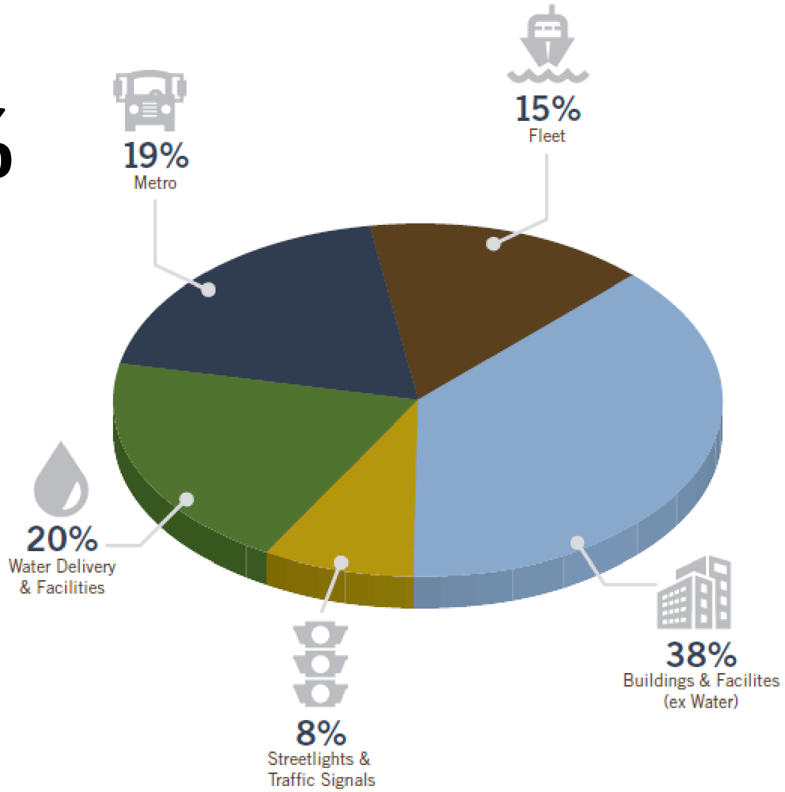


SCENARIO 3 **100% Renewable Energy and Zero Net Carbon by 2030**	**All Scenario 1 & 2 Measures** **Efficiency (Demand)** HVAC Retrofits Plug Load Management Strategies Building Envelope Improvements **Renewable Generation (Supply)** Behind-the-Meter Solar (Phase 2) **Transportation** 100% Electric Buses Mid-Duty EV Procurement Heavy Duty CNG Procurement **Policy** RECs and Carbon Offsets	• 55% carbon reduction with 25% self-generated renewable energy • 45% RECs and carbon offsets • $95M investment over 13 years; IRR 17% • Cost savings to city of $78M by 2030 • Reduce total carbon emissions by 426,000 tons by 2030 • Societal co-benefits range from $21M - $162M by 2030



Metro 19%

FIGURE A-2. BASELINE CARBON EMISSIONS FOR CITY OPERATIONS BY CATEGORY*



***Excludes landfill, city employee commute, and City-owned housing emissions. Source: HGA based on ICLEI*

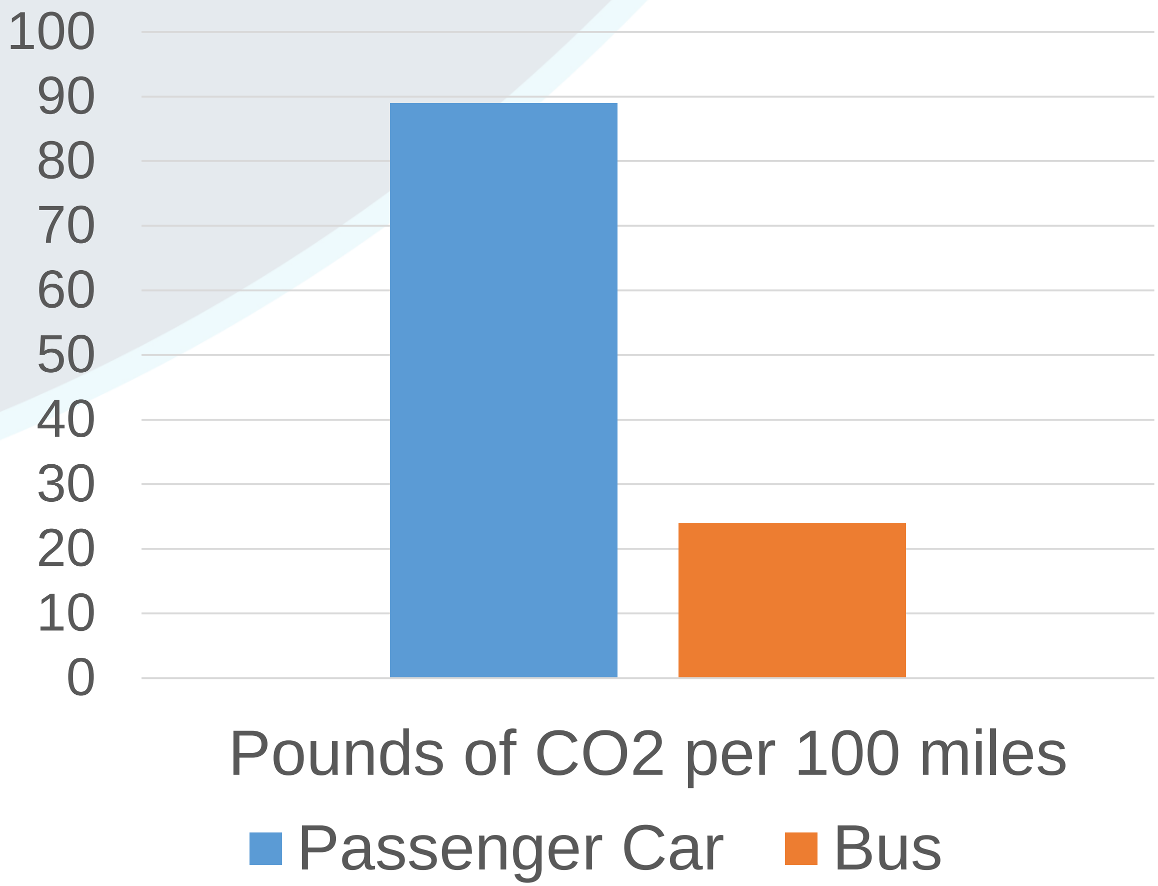
Figure A-3 illustrates baseline carbon emissions for municipal operations by fuel type in 2018, the baseline year for the report, including electricity (57%), diesel (29%), natural gas (9%) and gasoline (5%).

FIGURE 2-14. FUEL MIX SCENARIO 3: 100% RENEWABLE ENERGY AND ZERO NET CARBON BY 2030

	Unit	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CO_2 Emissions (Baseline)	ton	81,141	81,699	82,261	82,829	83,402	83,981	84,565	85,155	85,750	86,351	86,957	87,570	88,188
CO_2 Reduction (Demand)	ton	1,416	5,640	9,796	13,882	17,900	21,849	22,644	23,531	24,508	25,577	26,736	27,986	29,328
	%	2%	7%	12%	17%	21%	26%	27%	28%	29%	30%	31%	32%	33%
CO_2 Reduction (Supply)	ton	5,597	7,478	9,136	10,582	11,824	12,871	14,073	15,181	16,191	17,099	17,902	18,594	19,171
	%	7%	9%	11%	13%	14%	15%	17%	18%	19%	20%	21%	21%	22%
CO_2 Remaining	ton	74,128	68,581	63,329	58,365	53,679	49,261	47,848	46,443	45,051	43,675	42,319	40,989	39,689
	%	91%	84%	77%	70%	64%	59%	57%	55%	53%	51%	49%	47%	45%
RECs Electricity	ton	39,337	36,869	34,698	32,813	31,206	29,866	30,513	31,166	31,831	32,513	33,214	33,939	34,694
	%	48%	45%	42%	40%	37%	36%	36%	37%	37%	38%	38%	39%	39%
RECs Natural Gas	ton	6,774	6,310	5,847	5,384	4,922	4,461	4,533	4,607	4,681	4,756	4,832	4,908	4,985
	%	8%	8%	7%	7%	6%	5%	5%	5%	5%	6%	6%	6%	6%
RECs Gasoline	ton	5,145	4,675	4,204	3,734	3,263	2,792	2,395	1,997	1,600	1,202	804	407	0
	%	6%	6%	5%	5%	4%	3%	3%	2%	2%	1%	1%	0%	0%
RECs Diesel	ton	22,872	20,726	18,580	16,434	14,288	12,142	10,407	8,673	6,939	5,204	3,470	1,735	0
	%	28%	25%	23%	20%	17%	14%	12%	10%	8%	6%	4%	2%	0%

Source: Navigant

Metro reducing emissions from the private sector



Source: CGGC, based on mpg figures from (Barnitt, 2008) and CO_2 per gallon of fuel from (EPA, 2009).

10,000 new riders per workday reduces CO2 emissions by 6,000 tons/year

40 pass/bus, 3 mile average trip, weekdays only

This reduction would represent 1/3 of Metro's emissions

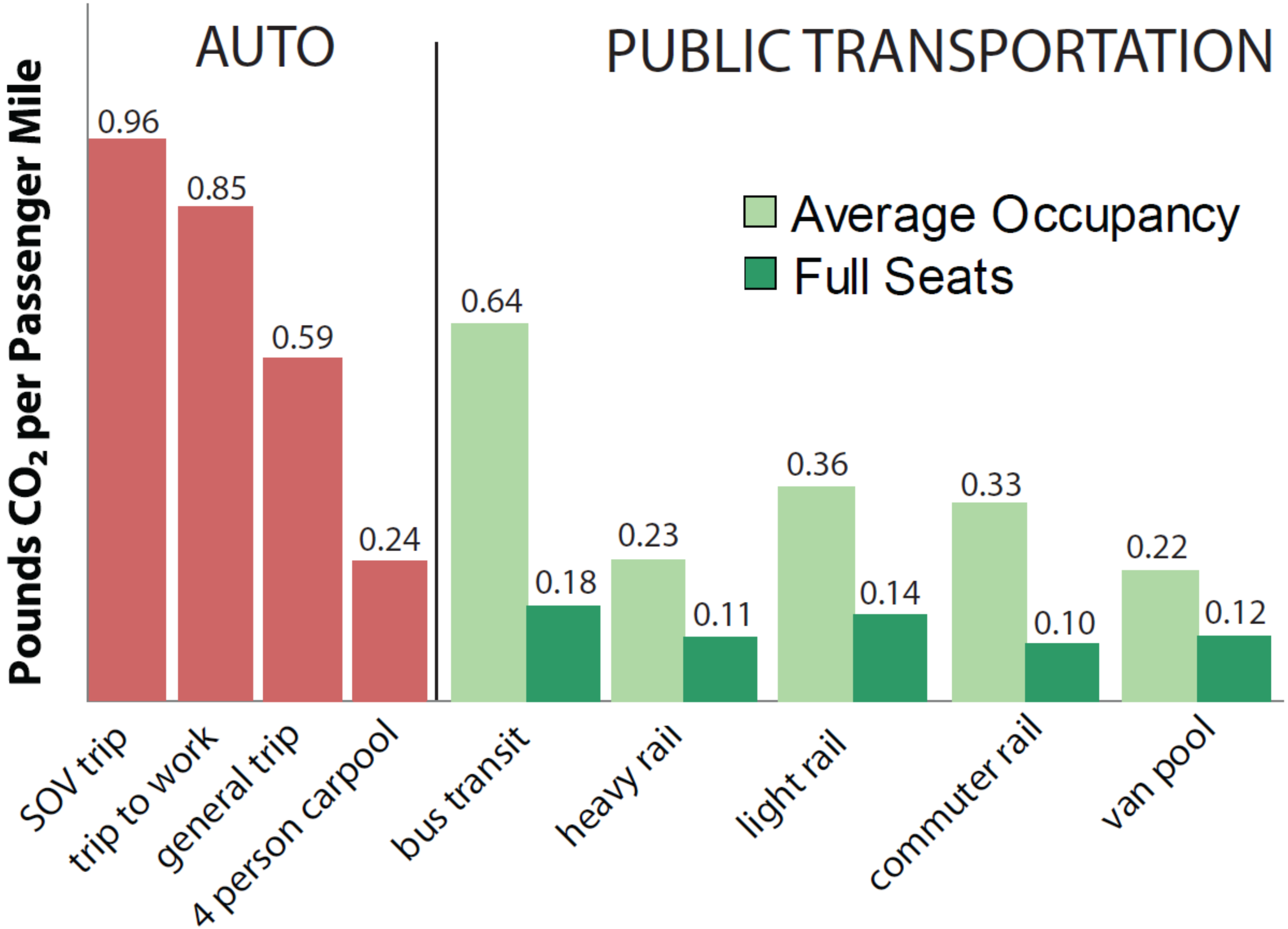


FIGURE 3

Estimated CO_2 Emissions per Passenger Mile for Average and Full Occupancy

Sources:
See Appendix II for data sources and methodology.

Notes: The average number of passengers for private auto trips is 1.14 for work trips and 1.63 for general trips.

Average U.S. Single Occupany Vehicle: 0.964 pounds CO_2/passenger mile

Heavy Rail Systems

State	Heavy Rail Common Name	Pounds CO2 / passenger mile	% of total heavy rail passenger miles traveled in the U.S.	KWH/ seat mile (Efficiency of Vehicle)	Average % of seats full (Ridership)	Pounds CO2/MWH for eGRID subregion (carbon content)
NY	New York City Subway	**0.147**	59.3%	0.107	59%	815
DC	Washington Metro	**0.347**	9.7%	0.101	33%	1,139
CA	San Francisco BART	**0.085**	8.6%	0.069	32%	399*
IL	Chicago "L"	**0.573**	7.0%	0.133	36%	1,538
GA	Atlanta MARTA	**0.245**	3.5%	0.064	39%	1,490
MA	Boston "T"	**0.336**	3.3%	0.167	46%	928
PA	Philadelphia SEPTA	**0.374**	2.5%	0.151	46%	1,139
NJ	New Jersey PATH	**0.302**	2.1%	0.249	94%	1,139
CA	Los Angeles Metro	**0.282**	1.3%	0.248	64%	724
FL	Miami-Dade Transit	**0.656**	0.8%	0.137	28%	1,319
NJ	New Jersey PATCO	**0.519**	0.6%	0.128	28%	1,139
MD	Baltimore Metro	**0.919**	0.4%	0.137	17%	1,139
OH	Cleveland Rapid	**0.805**	0.3%	0.168	32%	1,538
NY	Staten Island Railway	**0.346**	0.3%	0.110	26%	815
National Average Weighted by Passenger Miles		**0.224**	**99.7%**	**0.109**	**47%**	

Source: Calculated from Federal Transit Administration 2008 National Transit Database (NTD), U.S. Department of Energy carbon dioxide conversion factors, U.S. Environmental Protection Agency eGRID.

SOV Vehicle = 0.96 lbs/carbon/mile

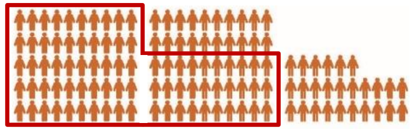
TRANSPORTATION

Sustainable Infrastructure

Moving people, not just cars

Less required in public infrastructure investment

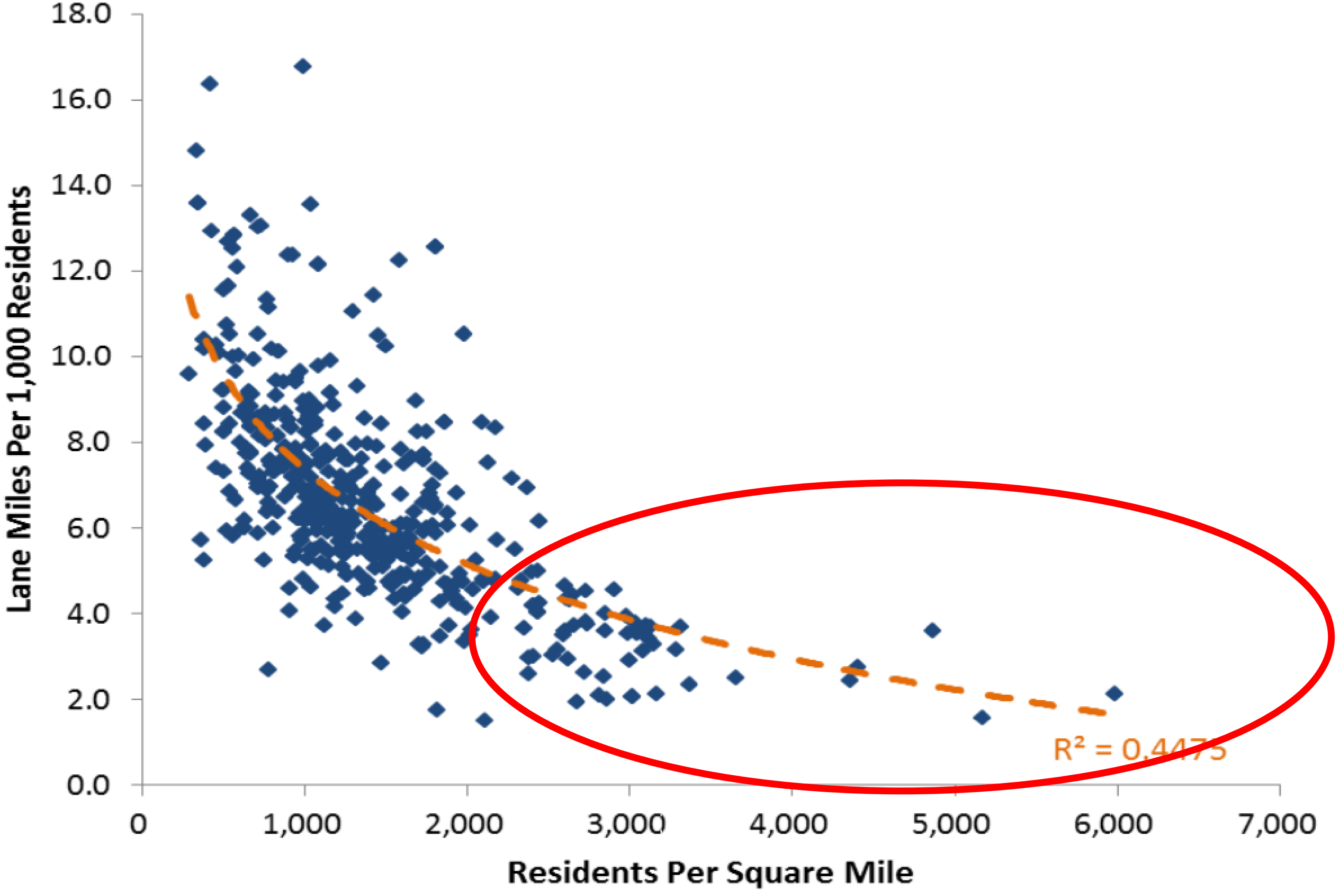
126 People move through this roadway during each light cycle. 80 in transit.



235 People on a road with transit-only lanes move through this roadway during each light cycle. 204 in transit.

Sustainable Land Use

Figure 7 **Urban Density Versus Roadway Supply** (FHWA 2012, Table HM72)



Per capita roadway supply declines with density (Each dot represents a U.S. urban region.)

Transit helps:

- **Increase density which:**
- **Reduces land consumption**

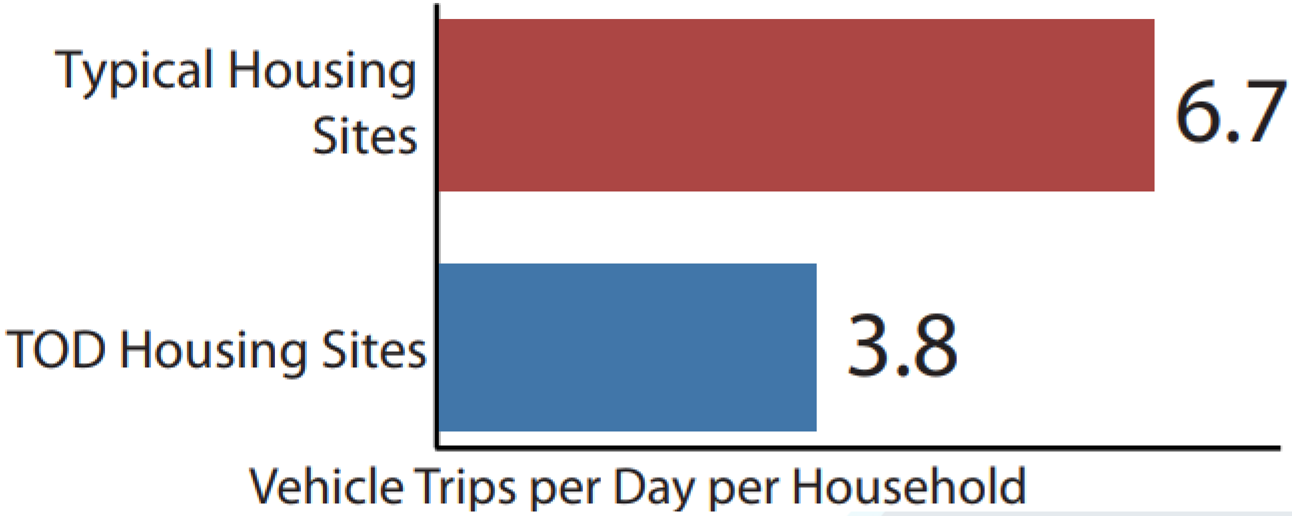
TRANSPORTATION

Density and Trips

FIGURE 5

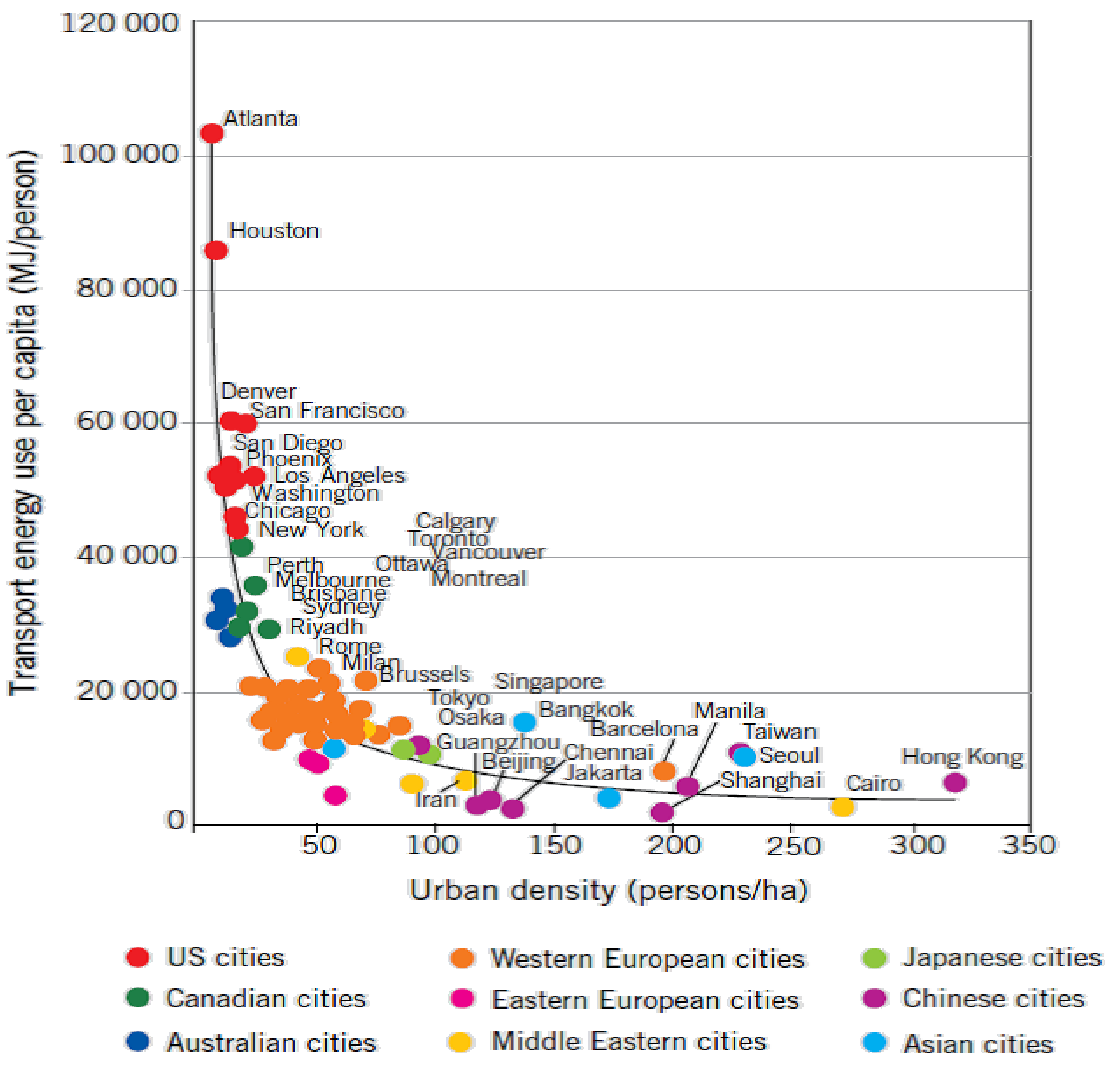
Vehicle Trips per Day of Transit Oriented Development (TOD) Housing Sites versus Typical Housing Sites

Source: *TCRP 128: Effects of TOD on Housing, Parking and Travel, 2008.*



Density and Energy Use

Fig. 4. Urban density and transport-related energy consumption



Source: International Association of Public Transport Providers, 2005[11]

Department of Transportation and Metro is committed to helping to achieve a 100 % renewable future.

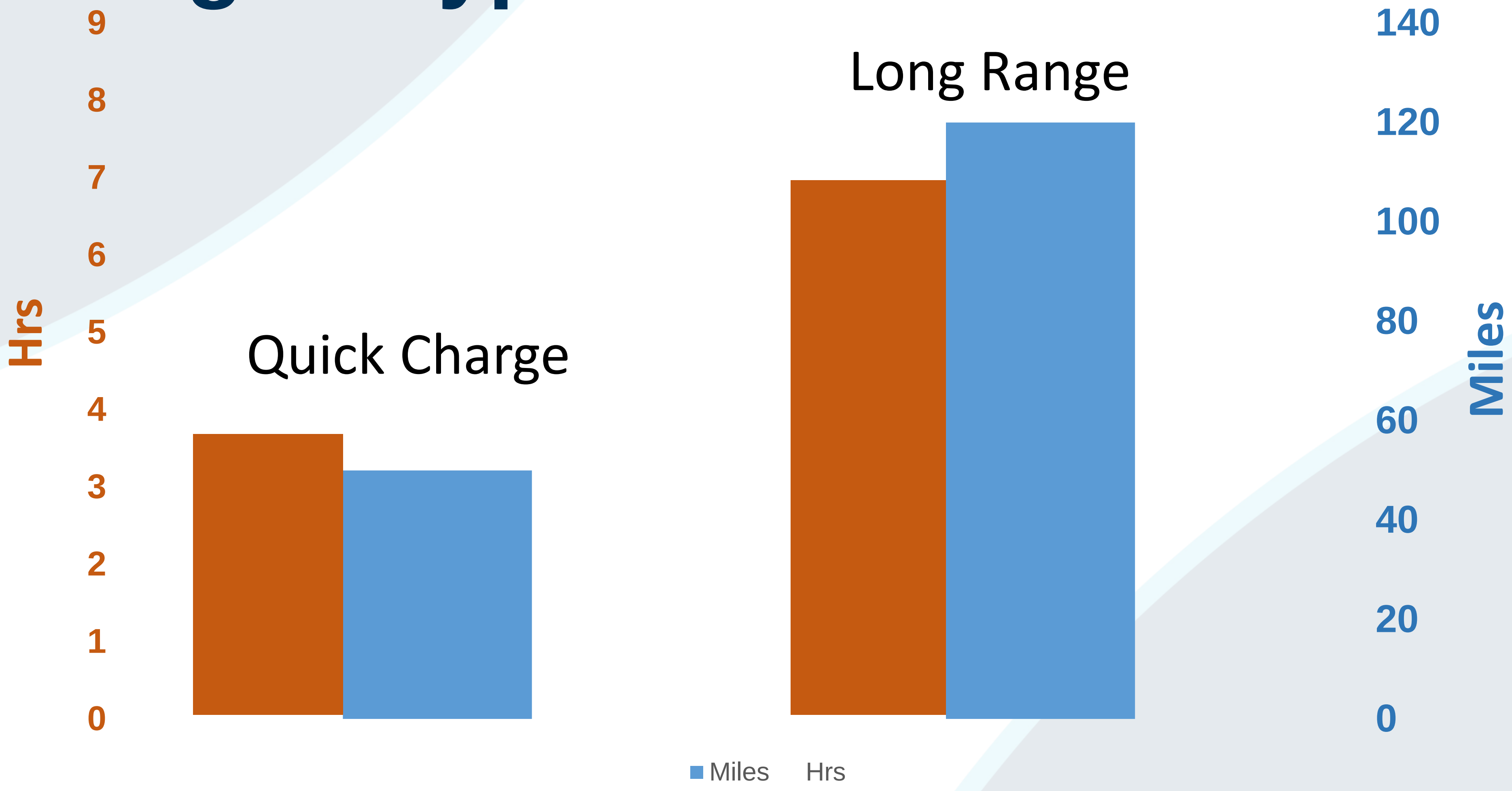
But its more than just flipping a switch

Challenges

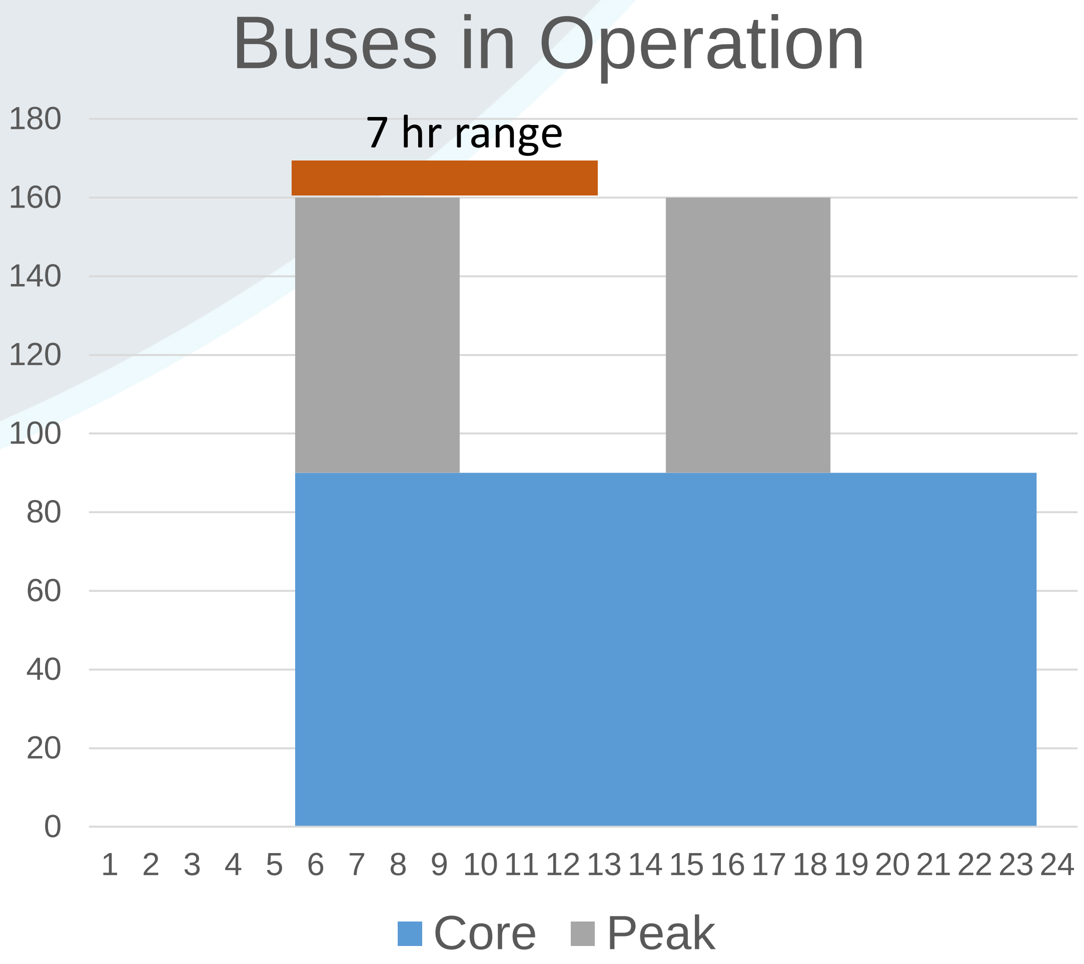
Size

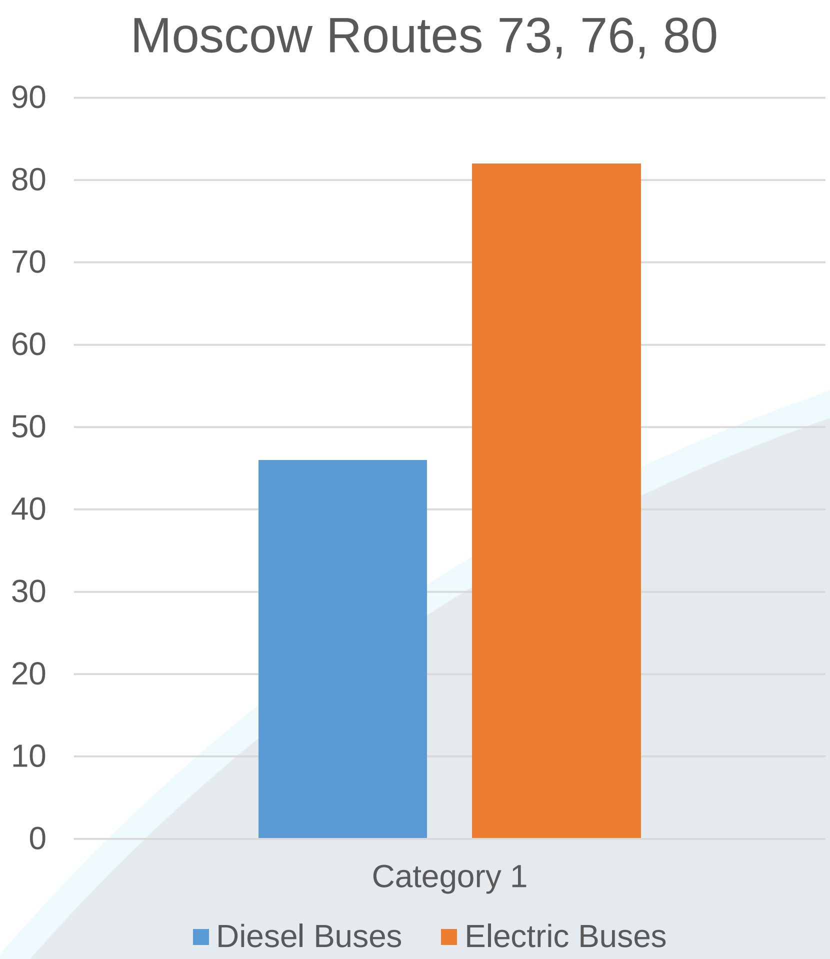
34
35
14
13
32
33
13
34
Internal Clearance
To be addressed in 2019

Range – Types of Buses

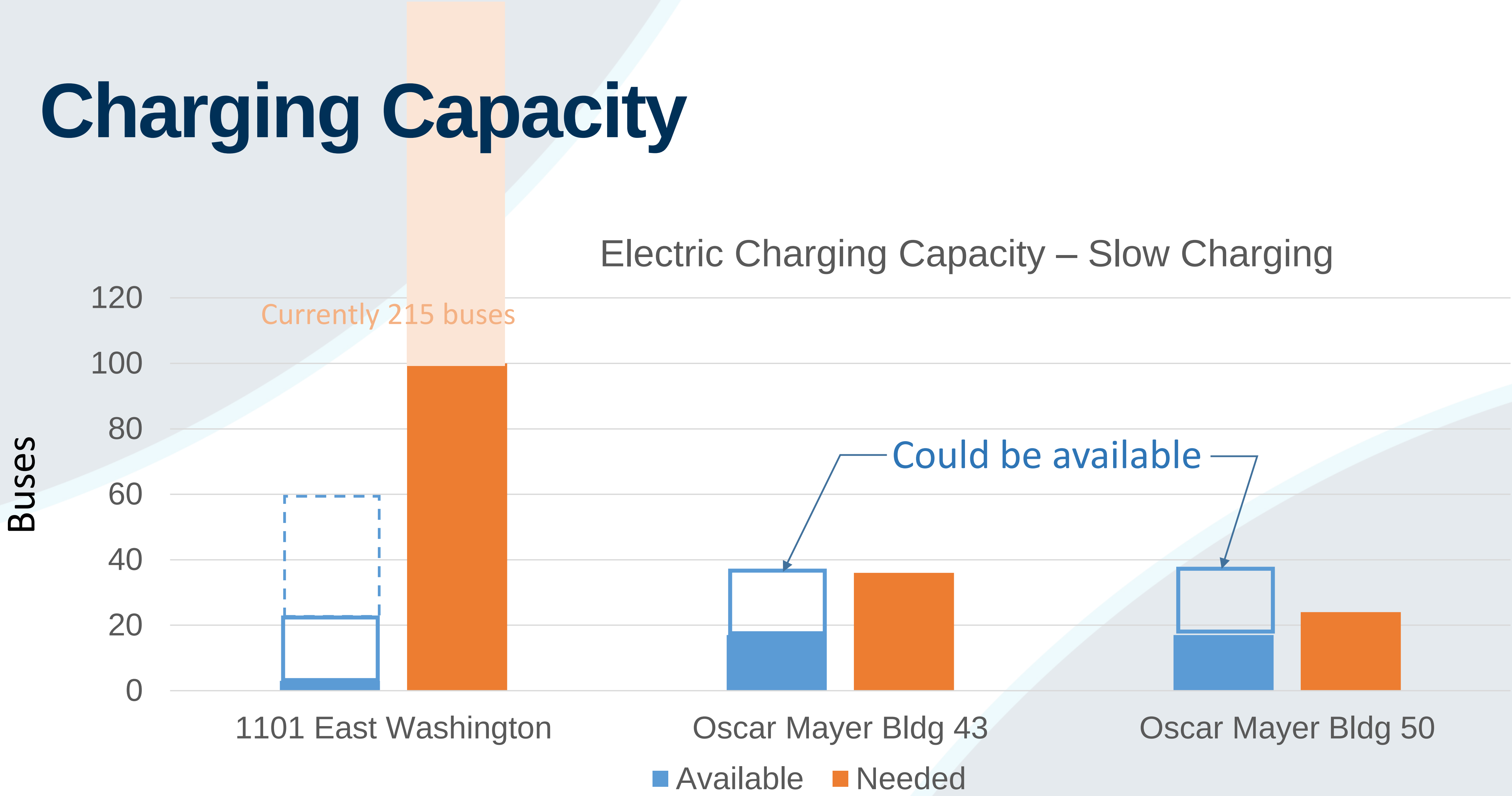


Range


Buses in Operation
7 hr range
180
160
140
120
100
80
60
40
20
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Core
Peak


Moscow Routes 73, 76, 80
90
80
70
60
50
40
30
20
10
0
Category 1
Diesel Buses
Electric Buses

Charging Capacity



1200 amp service – building needs

2000 amp service + possibility for 2000 more amps

2000 amp service + possibility for 2000 more amps

Changing Charging Speed

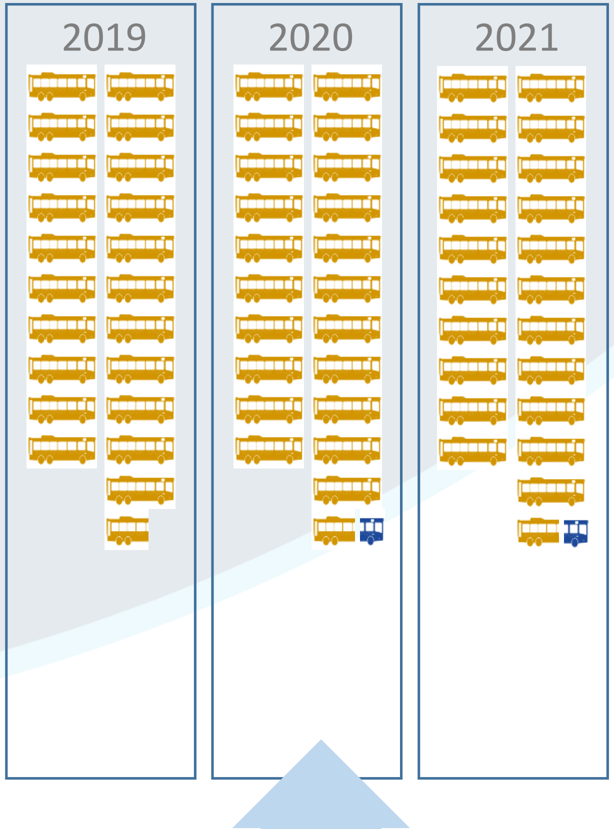
Amps x Volts = Watts

Rapid chargers reduce the number of buses that can be charged at a time.

They hold promise on how Metro blocks routes

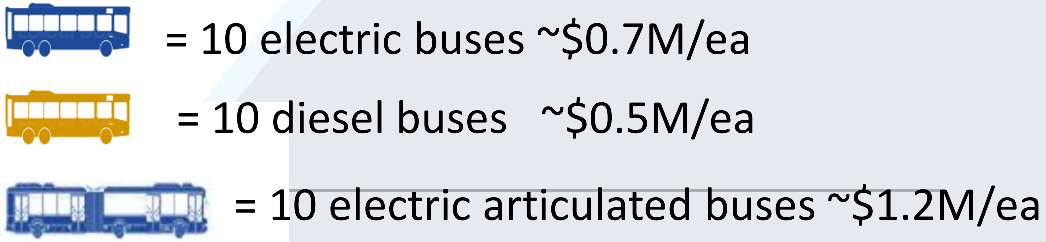
Replacement Cycle

Bus Replacement Schedule



EW retrofitted to allow electric buses in building, with capacity to charge 3 buses

s



Department of Transportation and Metro is committed to helping to achieve a 100 % renewable future.

We are working on how to flip the switch