Carbon Footprints for Public Transportation Agencies in Florida

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Objectives

- Summarize project to estimate carbon footprints for Florida's public transportation agencies
  - What we learned about the footprints
  - What we learned from the process
  - Suggestion for additional research

Background (Project planned in 2009)

- It was anticipated that some policy would be adopted to reduce greenhouse gas (GHG) emissions
- An earlier project in Florida had estimated
  - CO_2 emissions from fixed-route transit revenue vehicles
  - Possible offsets earned by mode shift from driving to transit
- Some grant programs were requesting applicants to estimate GHG baselines and reductions
- Project was planned to assist Florida's transit agencies position themselves for these changes
  - Common baseline
  - Familiarization with data requirements for complete footprint

Reporting protocols

- The Climate Registry
  - Calendar year
  - Three “scopes”
  - Six gases
  - Extensive library of emission coefficients and examples
  - *de minimis* provisions
- American Public Transportation Association
  - Follow Climate Registry protocol
  - Include any services reported to National Transit Database

Three "Scopes" to a Carbon Footprint

- Scope 1 (required)
  - Equipment and fuel directly controlled by the reporting organization
- Scope 2 (required)
  - Electricity, district heat/cooling whose use is controlled by the organization but which is purchased from others
- Scope 3 (optional)
  - Emissions from organization's supply chain or use of its products/services

SIX GASES TO A COMPLETE CARBON FOOTPRINT

- CO_2 (carbon dioxide)
- CH_4 (methane)
- N_2O (nitrous oxide)
- HFCs (hydrofluorocarbons)
- PFCs (perfluorocarbons)
- SF_6 (sulfur hexafluoride)
- NOT CFCs (controlled by Montréal Protocol)
  - Collected but reported separately for consistency

ACTIVITIES, DATA, SCOPES, GASES

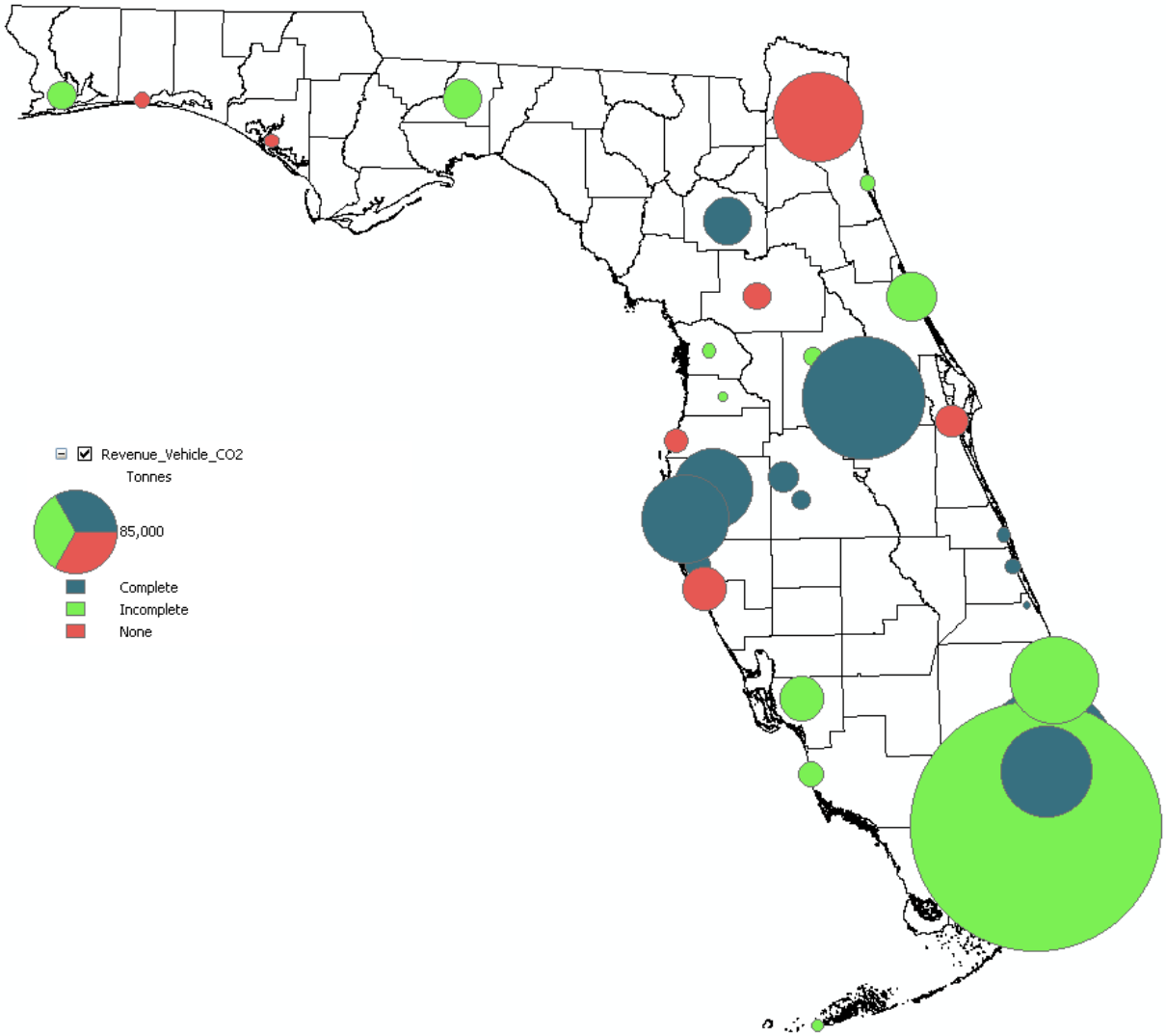
		Scopes			Gases				
Activity/source	**Quantities**	1	2	NTD	CO_2	CH_4	N_20	HFCs	CFCs
Revenue vehicles	fuel*	■		■	■				
Revenue vehicles	electricity		■	■	■	■	■		
Revenue vehicles	mileage†	■				■	■		
Non-revenue vehicles	fuel*	■			■				
Non-revenue vehicles	electricity		■		■	■	■		
Non-revenue vehicles	mileage†	■				■	■		
Heating/cooling	fuel‡	■			■	■	■		
Heating/cooling	electricity		■		■	■	■		
Heating/cooling	refrigerants							■	■
Lighting	electricity		■		■	■	■		
Vehicle/facility maintenance	fuel‡	■			■	■	■		
Vehicle/facility maintenance	electricity		■		■	■	■		
Vehicle/facility maintenance	refrigerants							■	■

*by type

†by vehicle class/age/fuel

‡by equipment type/fuel

Data received



INCOMPLETE DATA (1)

- Refrigerants were most common omission
  - 4 agencies reported they do not record use
  - 4 others did not provide it
  - Seems to be hard for agency staff to understand
- 6 omitted some or all data on nonrevenue vehicles
- 5 omitted fuel use for paratransit

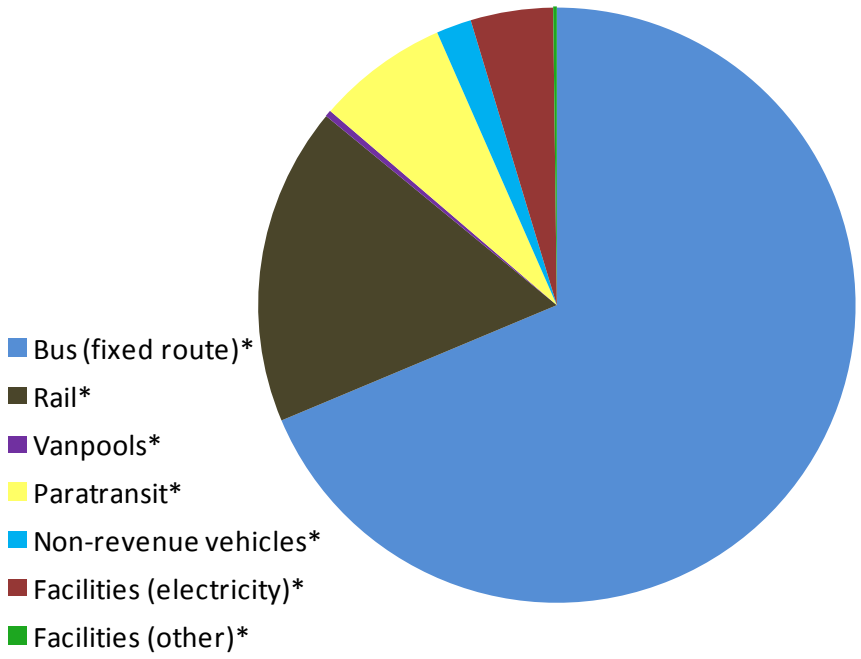
INCOMPLETE DATA (2)

- 5 omitted mileage for fixed-route revenue vehicles
- 3 omitted electricity
- 1 reported everything *except* revenue-vehicle fuel use

DATA SUMMARY (1)

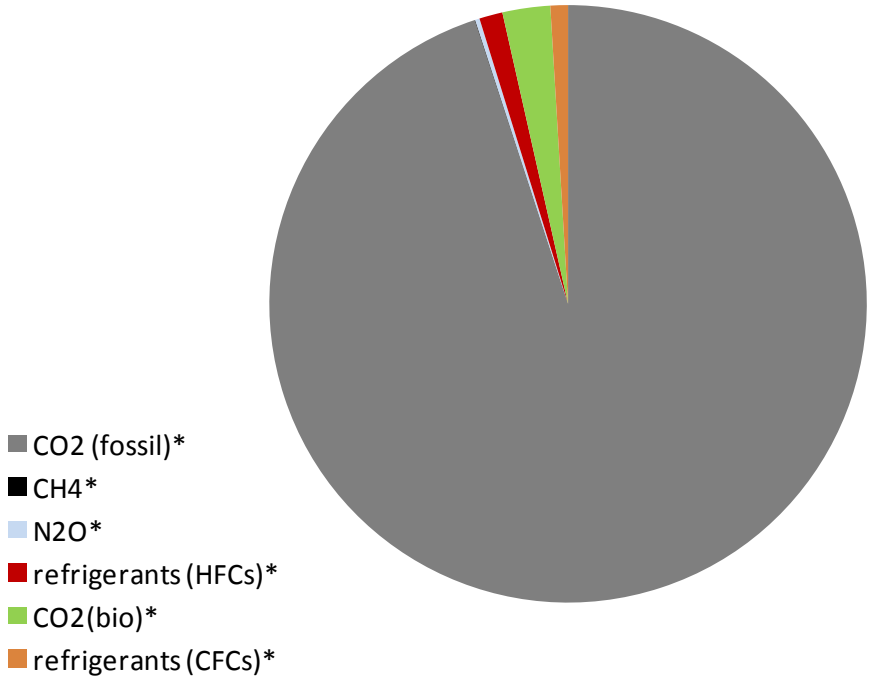
Carbon Footprint, by Activity

From all data provided to CBT II



Carbon Footprint, by Gas

From all data provided to CBT II



SELECTED COMPONENTS OF FOOTPRINTS

% of footprint			
Footprint component	**For all data reported**	**Complete footprints, unweighted**	**Complete footprints, weighted**
CO_2 from biological sources	2.6	1.2	2.5
refrigerants	2.2	5.4	3.9
non-motive electricity	4.5	6.4	7
other facility energy	0.2	0.3	0.4
non-revenue vehicles	1.9	2.2	2.1
CH_4+N_2O	0.3	0.3	0.3
total CO_2	97.5	94.3	95.9
total revenue vehicle CO_2	91.0	85.6	86.5
"carbon overhead"	8.8	14.2	13.2

ESTIMATING MISSING DATA

- NTD 2009 submissions for unreported revenue fuel use (unavailable at start of study): 71,618 $MTCO_2(e)$
- Average carbon footprint for this would be 9,525 $MTCO_2(e)$
- Average percentages for components missing in the incomplete footprints yields 20,342 $MTCO_2(e)$

- Estimated total 101,485 $MTCO_2(e)$ unreported
- Plus two agencies that didn't report to study or NTD
- 465,860 $MTCO_2(e)$ reported is probably 75-80% of total for 31 agencies
- Actual total ~0.5% of surface highway transportation footprint in Florida

Offsets (Partial Scope 3)

- FDOT asked us to apply the offset model from their earlier study to our results
  - Earlier study estimated that 34-47% of ridership ride transit by choice, depending on system size
- For 12 complete footprints, the earlier model estimates this ridership offsets
  - ~66% of emissions of fixed-route and vanpool operations
  - ~55% if carbon overhead is included

Process lessons (1)

- Agency data systems seem tightly designed around fiscal-year and NTD reporting
  - Alternative reporting periods, or requests for data not reported to NTD, involve extra work
  - Despite clear requests for calendar-year data, 15 agencies provided *fiscal*-year data
  - Several provided monthly data for two fiscal years
  - Carbon footprint reporting (and trading) are based on calendar year

PROCESS LESSONS (2)

- Some agency heads referred us to planning, others to maintenance
  - Planners tended to provide more complete data (getting some of it from maintenance)
- Some agencies require internal review before releasing their footprint data
  - It can take weeks to arrange the necessary reviews

Process lessons (3)

- We assumed that agencies had clear hierarchical managerial structures
  - Some small paratransit agencies are collaborations among different jurisdictions and partners
  - It was not always easy to identify the "person in charge," get a clear decision on whether the agency would participate, or find the person who had the necessary data

Process lessons (4)

- Carbon Registry protocol is generally clear but has a few ambiguities
  - Unclear how to assign some vehicles to classes to choose emissions/mile coefficients
  - Estimation for fuel blends (gasoline-ethanol, biodiesel) would benefit from a good worked example
  - Overly conservative for hybrid buses
  - Some inconsistent formatting
- Registry staff were helpful and requested our suggestions for improvements

Process lessons (5)

- Check biofuels
  - Is “biodiesel” reported as a blend or as something the agency purchased to blend with diesel
  - Check “gasoline” for ethanol
- Refrigerant data are hard to collect
  - Some agencies record amount added to vehicle A/C but not how much was removed
  - Some do but had trouble understanding that we wanted the difference

PROCESS LESSONS (6)

- Trace gases CH_4 and N_2O are VERY small part of the footprint but require disproportionate effort
  - This may be easier for an agency calculating its own footprint than for an outside research team

Process lessons (7)

- The first time is the hardest
  - You have to ask about unlikely possibilities (e.g., purchased cooling) to verify whether they occur
    - This makes the effort appear more formidable to agencies
  - Footprint concepts and data are new to many agencies
  - You can't prepare good software to assist the process until you understand where the problems are

RECOMMENDATION

- If an agency just wants to monitor its footprint
  - Use fiscal-year data (simpler)
  - Ignore CH_4 and N_2O (simpler, negligible omission)
- If an agency needs to report its footprint (regulations, trading), it may not be allowed to use these simplifications

Caution when using these results (1)

- These footprints are neither life-cycle (well-to-wheel), nor tailpipe (tank-to-wheel) emissions
  - Well-to-wheel involves Scope 3
    - Backward along the supply chain
    - Agency's Scope 3 is fuel producer's Scopes 1 and 2
  - Tank-to-wheel excludes carbon overhead

CAUTION WHEN USING THESE RESULTS (2)

- The footprints could change if
  - Heating of vehicles and facilities were important
  - Electricity generating mix were different
  - Fuel mix were different (e.g., Florida agencies used almost no compressed natural gas)

ADDITIONAL RESEARCH NEEDED

- How representative are Florida's transit footprints?
  - Replication in other states
  - Scenario or sensitivity analysis of Florida data