QUARTERLY PROGRESS REPORT

April 1, 2019 to June 30, 2019

PROJECT TITLE: Looking Beyond Florida's 75% Recycling Goal: Development of a Methodology and Tool for Assessing Sustainable Materials Management Recycling Rates in Florida

PRINCIPAL INVESTIGATOR(S): Timothy G. Townsend

AFFILIATION: Professor, University of Florida
Department of Environmental Engineering Sciences

COMPLETION DATE: September 30, 2019 **PHONE NUMBER: 352-392-0846**

PROJECT WEB SITE: https://www.essie.ufl.edu/home/townsend/research/florida-solid-waste-issues/hc18/

Work accomplished during this reporting period:

Stakeholder Working Group Meeting

The Stakeholder Working Group Meeting was conducted on May 13th, 2019, the presentation can be found on the project website and detailed notes from the meeting are outlined below.

Stakeholder Working Group Meeting Notes

- Discussion on Lifecycle Assessment Impact Factors
  - The group agreed that:
    - At minimum the impact factors should be developed for the common waste materials found in curbside residential collection, (e.g., food waste, plastic bottles, aluminum and steel cans, etc.).
    - It was helpful to include a section in the report or the tool that describes each impact factor and its environmental implications.
    - There is a need for a tool that incorporates the impact factors and the mass estimates of waste generated in each county to measure environmental footprints.
    - Using waste LCA models developed from European and US sources are important to identify the differences in impact factors for the same material managed in the same way.
  - Comment from group: Some of the preliminary LCA factors results for the aluminum cans and PET bottles vary from each other and should be closely evaluated to identify the differences and potential areas of improvements.

- Discussion on Next Steps
  - Direction from group:
    - The methodology used to estimate each impact factor from each model needs to be properly documented. This would include describing the system included, the waste composition used to estimate the collection LCA factors, the end-uses in the remanufacturing stage, etc.
    - Since each model will be used to estimate an associated impact factor, the spreadsheet tool should then include a function that allows users to select the LCA model.

- An introductory tab should be included in the spreadsheet tool that describes the overall disposition systems boundaries (e.g., recycling, combustion, etc.) and LCA models (e.g., WARM, MSW-DST, etc.) used in the tool.

Development of Environmental Lifecycle Assessment Impact Factors

The impact factors will cover the lifecycle stages provided in the system diagram shown in Figure 1. The main models used in the study to estimate impact factors include, Waste Reduction Model (WARM), Municipal Solid Waste Decision Support Tool (MSW-DST), Solid Waste Optimization Lifecycle Framework (SWOLF) and Environmental Assessment System for Environmental Technologies (EASETECH). Figure 2-5 show the model, the type of medium it is provided in, the waste management methods, and impact categories included in each mode. Since the last progress report, another model, Waste and Resources Assessment Tool for the Environment (WRATE) may prospectively be included in the suite of models used in the study. An assessment evaluating the models waste management methods (e.g., recycling, landfilling) and material categories (e.g., food waste, plastic bottles) will be conducted to determine whether the model should be included in the study.

These models will continue to be used to meet the objectives described as part of Task 2 to calculate the following environmental LCI factors: energy use, global warming potential, water consumption, human toxicity, aquatic ecotoxicity, acidification, and eutrophication.

Again, the current list of materials that we have calculated these environmental impacts include newspaper, cardboard, office paper, magazines, 3rd class mail, phonebooks/textbooks, mixed paper, HDPE bottles, PET bottles, plastic film, mixed plastic, glass, aluminum cans, ferrous cans, yard trash, food waste, mixed MSW, and textiles. For each material the impact factors associated with the following types of end-of-life management: single stream and dual stream recycling, mixed waste processing, mass burn combustion, refuse-derived combustion, composting, anaerobic digestion, and landfilling will be completed.

An example of the recently estimated greenhouse gas (GHG) emissions or (global warming potential (GWP)) factor is shown in Figures 6 and 7 for aluminum cans and PET bottles, respectively. These values were presented at the stakeholder working group meeting and discussed.

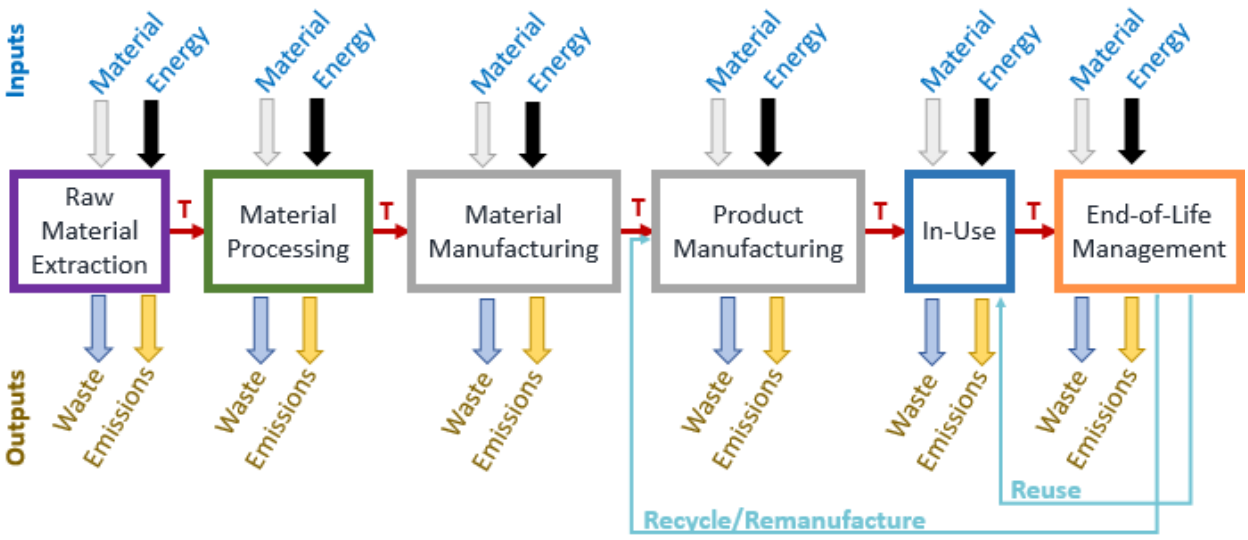

Figure 1. System diagram for the lifecycle stages included as part of the study.

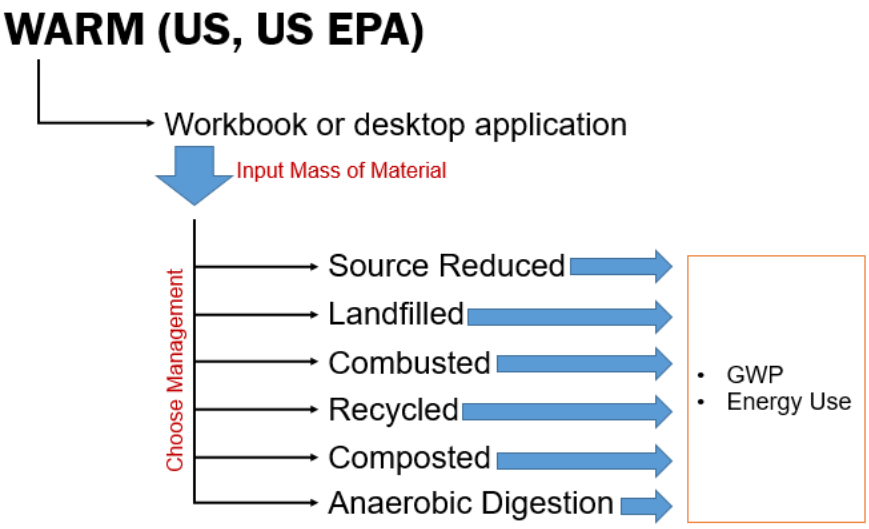

Figure 2. WARM LCA model medium provided in (i.e., workbook, desktop application), waste management methods (e.g., source reduction, landfill, etc.) and impact categories (i.e., Global Warming Potential (GWP), energy use).

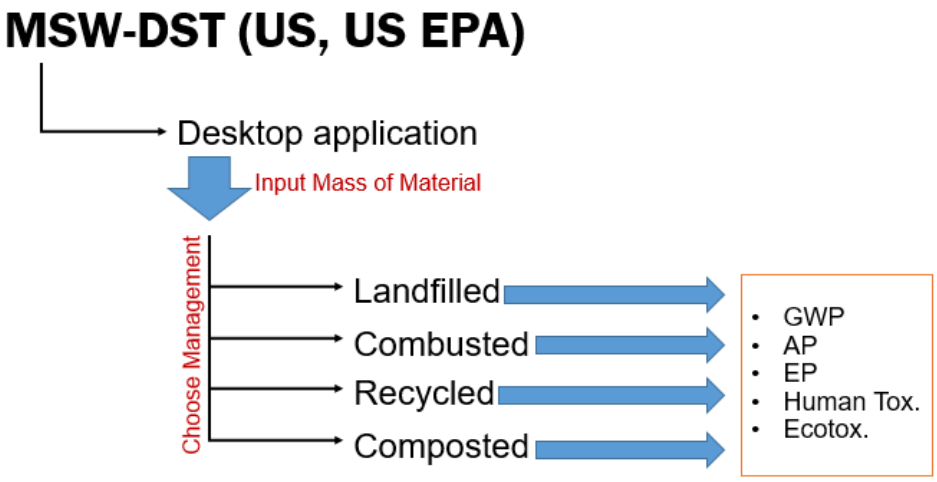

Figure 3. MSW-DST LCA model medium provided in (i.e., desktop application), waste management methods (e.g., landfill, combustion, etc.) and impact categories (i.e., global warming potential (GWP), acidification potential (AP), eutrophication potential (EP), human toxicity, ecotoxicity).

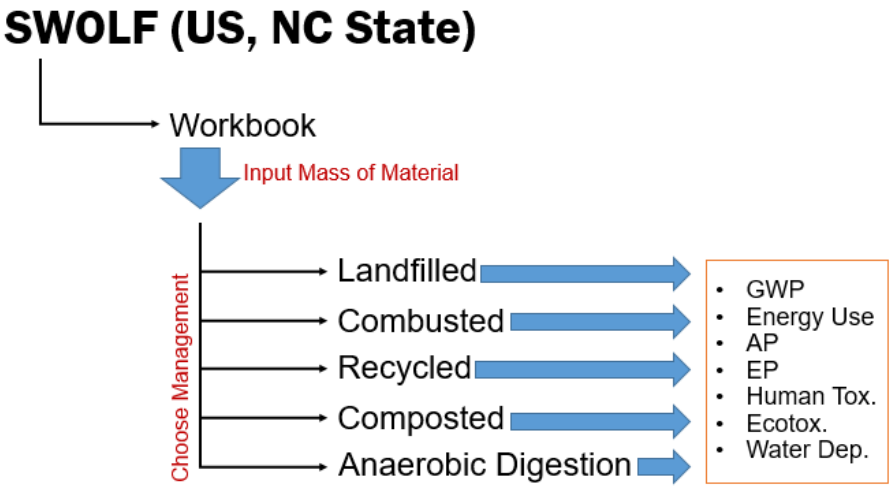

Figure 4. SWOLF LCA model medium provided in (i.e., workbook), waste management methods (e.g., landfill, combustion, etc.) and impact categories (i.e., global warming potential (GWP), energy use, acidification potential (AP), eutrophication potential (EP), human toxicity, ecotoxicity, water depletion).

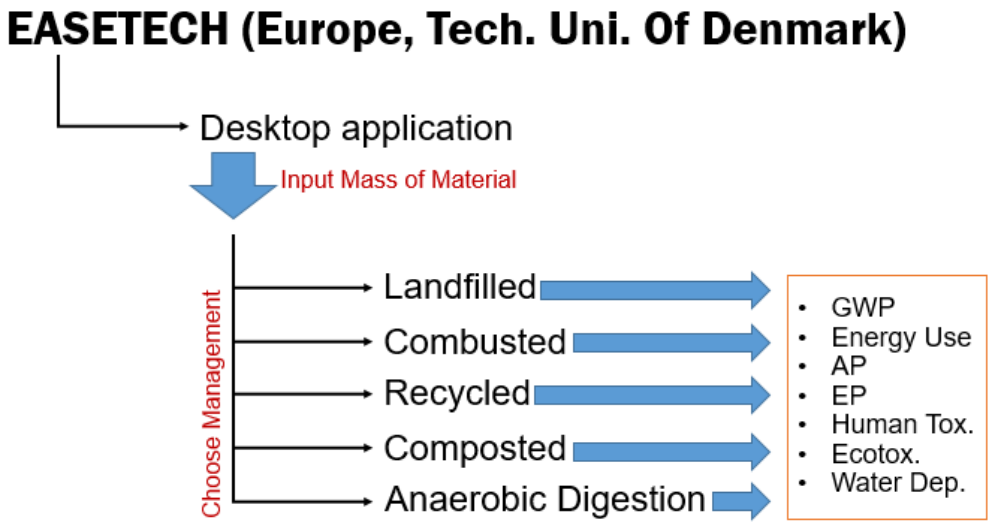

Figure 5. EASETECH LCA model medium provided in (i.e., desktop application), waste management methods (e.g., landfill, combustion, etc.) and impact categories (i.e., global warming potential (GWP), energy use, acidification potential (AP), eutrophication potential (EP), human toxicity, ecotoxicity, water depletion).

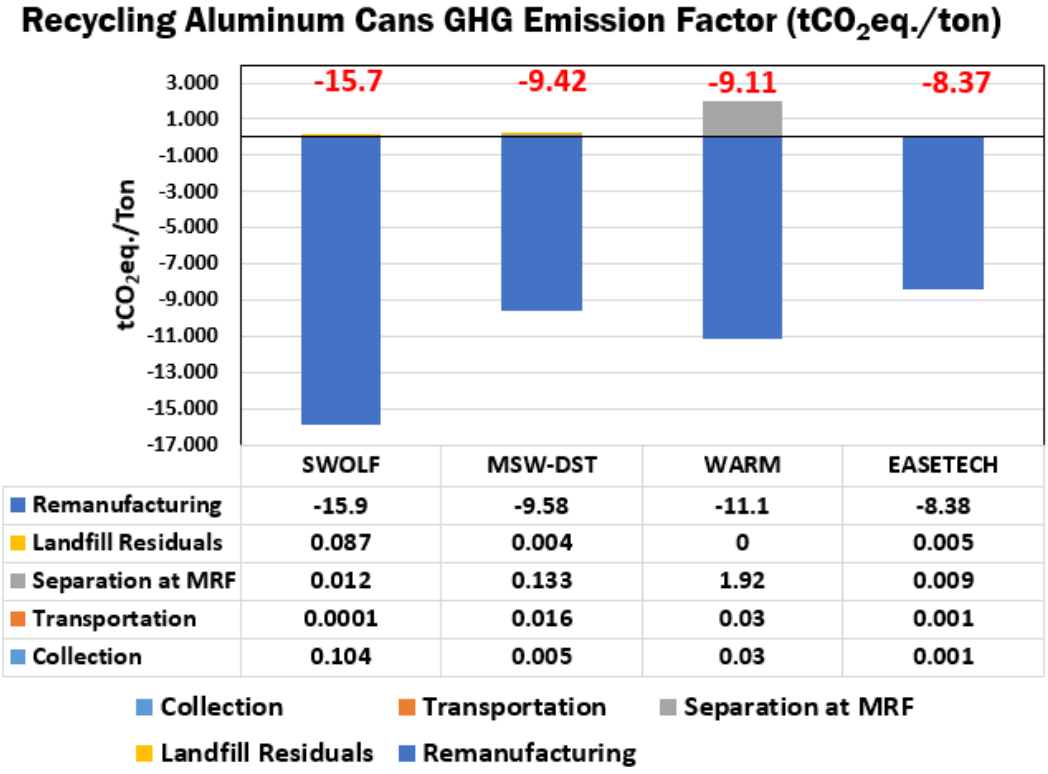

Figure 6. Example output of greenhouse gas (GHG) emissions factors shown as the red values positioned above bars for recycling aluminum cans for SWOLF, MSW-DST, WARM, and EASETECH. The values underneath each bar show the contribution of each life stage toward the total value (red value).

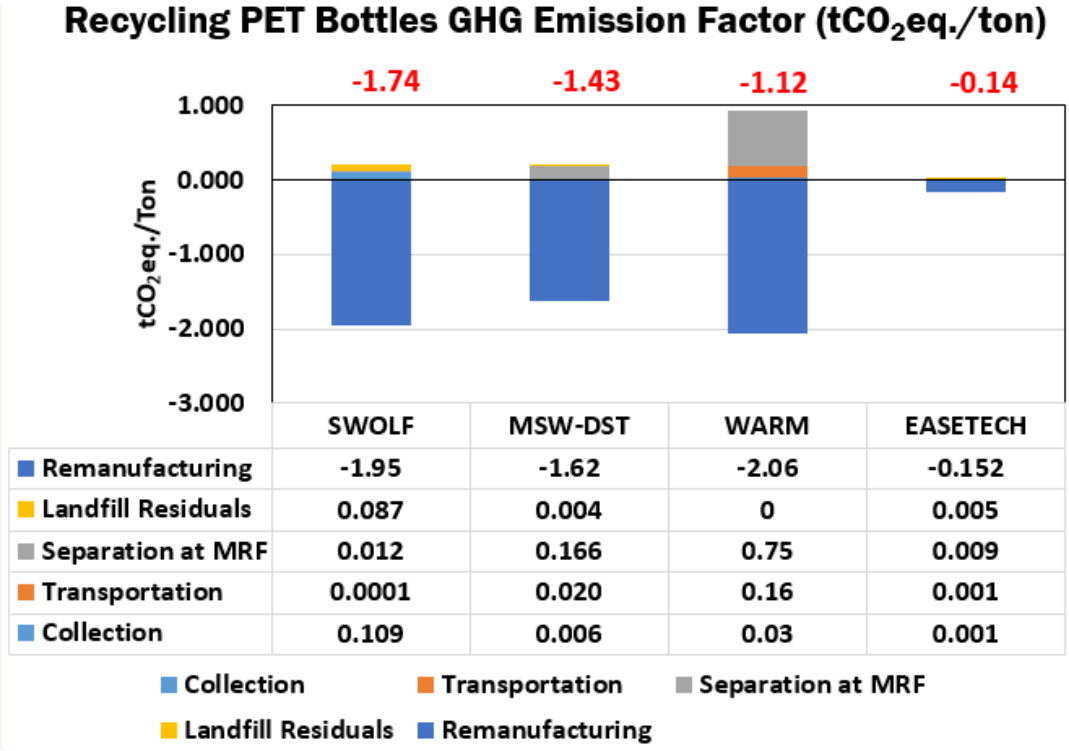

Figure 7. Example output of greenhouse gas (GHG) emissions factors shown as the red values positioned above bars for recycling PET bottles for SWOLF, MSW-DST, WARM, and EASETECH. The values underneath each bar show the contribution of each life stage toward the total value (red value).

Development of Workbook Tool

We began to develop the organizational structure of the workbook tool which will include the comments from the stakeholder working group. The proposed tool is conceptually shown in Figure 8.

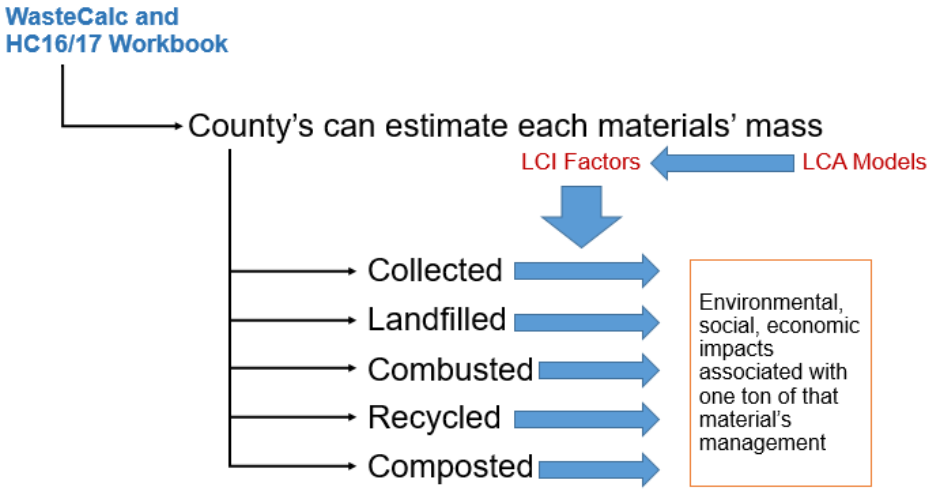

Figure 8. Proposed tool that can be used by local governments to estimate their environmental, social, and economic impacts.

Development of Economic and Social Lifecycle Assessment Impact Factors

As part of Task 2 we began collecting industry data from the stakeholder working group to be used in the creation of the social and economic impact factors, which intended to include jobs produced, total costs, and recyclability. However, based on the current data collected, the available data is limited which may result in incomplete or inaccurate estimates for these impact factors. The data will continue to be collected and processed in the next reporting period to verify whether the development of the impact factors are possible.

Work planned for the next reporting period:

Development of Environmental Lifecycle Assessment Impact Factors for Other Materials and Source Reduction

Since the last progress report the project team have decided to also explore using the UK developed waste LCA model, Waste Resources Assessment Tool (WRATE). The models functionality have not identified yet, however, based on literature the model has the potential to be used to estimate impact factors. In the next reporting period we will continue working on Task 2 using WRATE. Additionally, we will continue to review literature to estimate impact factors for construction and demolition debris, and durable goods (e.g., electronics, appliances, furniture, etc.). Also, we have identified some source reduction values for certain materials, however, none of the models directly provide estimates of source reduction values, and thus most of the materials will not have a source reduction factor.

Development of Tool as a Workbook

Work on the format and content included in the tangible tool as described in Task 3 of the project proposal will continue. Based on the context of the proposal the tool will incorporate the environmental impact categories, if data permitting the social and economic impact categories. The previously mentioned 11 impact factors may not all be developed depending upon data availability. Based on the proposal, this tool will include only include the impact factors and not any means for estimating the material mass flow at end-of-life for a Florida county.

Metrics:

Name	Rank	Department	Professor	Institution
Malak Anshassi	PhD Student	Environmental Engineering	Dr. Townsend	University of Florida
Melissa Burdier	Graduate Student	Environmental Engineering	Dr. Townsend	University of Florida

Stakeholder Working Group Meeting: The research team held a stakeholder working group meeting on May 13th, 2019.

Invited Stakeholder Working Group members include:

1. Karen Moore
2. Shannan Reynolds
3. Cory Dilmore
4. Dawn Templin
5. Suzanne Boroff
6. Kim Walker
7. Travis Barnes
8. Ana Wood
9. Alan Altman
10. Sally Palmi
11. Marc Bruner
12. Keith Howard
13. Mary Jean Yon
14. Gene Jones
15. Keyna Cory
16. Ron Beladi
17. Dave Gregory
18. Carlo Lebron
19. Tobin McKnight
20. Kevin Leo
21. Richard Tedder
22. Dawn McCormick
23. Bob Hyres
24. Kim Williams
25. James Suter
26. Kim Brunson
27. Victor Storelli
28. Tim Townsend
29. Steve Laux
30. Malak Anshassi
31. John Schert
32. Jay Bassett
33. Steve Smith
34. David Dee