

Grand Challenge Proposal: Enhancements in Recycling & Waste Management in Birmingham and in Alabama (N. Rama Krishna, Ph.D., Professor (retired, working part time), BMG Department, UAB, E-mail: nrk@uab.edu; Phone: 4-5695)

Mr. Ray Clark, the Vice Chair of the Solid Waste Authority for the City of Birmingham, very recently observed “*The latest numbers I have seen is that Birmingham recycles about 1%. Cities like Philadelphia recycle about 15%. A really robust program in a city should recycle about 30-35%. Then you get to a city like San Francisco where you have recycling at the 70% range. With that you pull out every tool in the toolbox including ordinances and regulations. We (Birmingham) are nowhere near that point,*” (<https://bhamnow.com/2018/02/22/recycling-alabama/>). **This low 1% recycling is indeed alarming, and points to the need to significantly enhance the environment-friendly recycling and waste management efforts in Birmingham.**

Some Representative Recycling Centers in Alabama:

The Alabama Recycling Coalition (www.alrecyclingexpo.com) lists a rather large number of non-profit organizations, for-profit companies, as well as city and university recycling centers actively participating in recycling efforts in Alabama. The following is a representative list:

(1) Alabama Environmental Council (AEC, www.aeconline.org) a venerable 50-year old, membership-based 501(c)(3) non-profit organization. AEC recycles plastics (primarily #1 and #2), metal, paper, electronics, glass, batteries, cigarette waste, fluorescent light bulbs, etc. They also provide recycling education and pick up of materials for schools for free. The city does not pick-up from businesses or loft/apartment dwellers so AEC fills those voids with a business pick-up program as well as providing the community recycle center with a drop-off service.

(2) Representative For-Profit Companies: Protec Recycling (in Birmingham, electronics), Birmingham Recycling & Recovery (aluminium cans, cardboards and paper, plastics #1 and #2), JCR Recycling (in Cullman, paper, plastics #1, #2, #4, #5, and #6), KW Plastics (in Troy, it is the world’s largest recycler of plastics #2 and #5, according to its website), Carastar Recycling (various types of paper). Stores like Best Buy (electronics), Target (bottles, plastics), and Publix (paper and plastic bags) also offer recycling bins to customers, and do their own recycling.

(3) Waste Management Services: Alabama has several for-profit Waste Management companies listed in the NYSE, e.g., WastePro-USA used by UAB (www.wasteprousa.com), Waste Management (www.wm.com/us), just to name a couple. These companies own and operate major landfills and incinerators to dispose of solid waste. They offer multiple services such as curb-side pickup of trash (both industrial and house-hold trash), special pick up of aluminium cans, plastics #1 and #2, and paper for recycling at for-profit companies listed above.

Challenges and Problems:

- (1) Effective January 1st, 2018, China has stopped accepting plastics waste from USA, creating a **major crisis** in plastics recycling all over the USA (and, *let us not forget the ever growing plastics island, already twice the size of the State of Texas, floating in the Pacific ocean !*).
- (2) Most plastic recycling centers in Alabama focus on plastics #1 and #2 (JCR Recycling takes #4, #5, #6, and KW Plastics takes #5 also). The remaining plastics tend to end up in landfills.
- (3) Trying to separate out the recyclable plastics #1 and #2 from plastics #3 to #6 is a challenge for most consumers (frankly, locating the tiny triangular sign with a number in it is a pain !).
- (4) There is only one location in Alabama (Albertville Recycling Center) that accepts Styrofoam.

- (5) About 50% of compostable trash (leaves, food, organics etc) is ending up in landfills due to the absence of ADEM-certified commercial composting facilities.
- (6) Currently, there is no incentive for people in Alabama to recycle. The few people who take the trouble to recycle bottles, plastics etc are usually people who might have watched **Al Gore's "An Inconvenient Truth"**, a fabulous documentary about man-made global warming, or genuinely worry about the overflowing landfills. It may be likely that some people find it convenient to simply dump all their waste including recyclable items into trash cans (i.e., out of sight; out of mind) and unknowingly contribute to the overflowing landfills.
- (7) The landfills and the incinerators operated by the waste management companies unfortunately can potentially contribute harmful greenhouse gases and toxic chemicals that pollute air and ground water.

Grand Challenge Proposal:

The above current status with the Recycling and Waste Management in Alabama points to a major vacuum (and an opportunity) for UAB to fill-in through its Grand Challenge Program, and make a major environmental impact in Alabama. The following are some ideas for consideration:

- (1) **Develop New Technologies and Equipment for Large-Scale Recycling:** Engage the expertise of faculty and staff engineers and scientists at UAB (see suggested Team Members on page 3), to develop more efficient technology and equipment for large-scale recycling of glass, plastics, metals and other materials (e.g., equipment to pulverize glass, melt glass and metals at high temperatures, better incinerators that do not pollute the air), make new usable products out of these by processing, chemical modifications of some trash items for easy degradation, converting trash materials to biodegradable forms, etc).
- (2) **Bacterial Degradation of Plastics:** Following the 2016 work of Japanese scientists, researchers in US and UK (*PNAS*, 4/17/2018; PMID: 29666242) developed a mutant enzyme of PETase from the bacterium *Ideonella sakaiensis* 201-F6 **that degrades and assimilates plastic #1 in just a few weeks (versus 450 years in landfills)**. Implement this technology in Alabama. Extend it to other plastics (#2 to #6) by identifying additional strains of bacteria that would digest them. Develop commercial facilities for bacterial digestion of plastics.
- (3) **Initiate Degree Programs:** UAB can consider starting some degree programs (BS or MS) in recycling/ waste management to generate a continuing supply of personnel with expertise in these areas. The CCEE Department at UAB would be a natural fit for this program.
- (4) **Develop For-Profit Enterprises in Recycling and in Composting:** Alabama could benefit from several more "For-Profit Enterprises" in recycling/ waste management. Develop "ADEM-certified commercial composting facilities". Figure out strategies to create them, and staff them by recruiting students who graduate from the above BS and MS degree programs, with full-time employment and benefits, to get them committed for the long term.
- (5) **Offer Incentives to Recycle Trash:** Most people are less likely to throw their trash into the landfills if they know that they can earn extra cash by selling their trash. Figure out strategies (cash incentives) to get people to sort out separately the plastics, glass, metals, batteries etc and sell them each.
- (6) **Pass the Alabama Bottle Bill Law:** Work with the Alabama microbreweries, City and State Legislation in passing a Bottle Bill Law (i.e., 5 cents or 10 cents refundable deposit for each returned beer bottle). These bottles can be resold to the local breweries. This is an excellent incentive to recycle beer bottles. Currently, only 10 states in the US have such a law (Note: the Bottle Bill Law contributed \$151 Million to the GDP of Massachusetts).

Suggested Team Members:

Acknowledgments: This concept proposal has benefitted from the excellent feedback from Mr. Jon Paolone (former Coordinator, UAB Recycling Center), Prof. Robert Peters (UAB, CCEE Department), Dr. Julie Price (UAB, Biology), Ms. Ashlyn Manzella (UAB, EITD) and Ms. Felicia Buck (Executive Director, AEC). They are all listed below as suggested Team Members.

This ambitious and multifaceted UAB Grand Challenge Proposal will benefit from the enthusiastic team effort of experts, civic leaders, and organizations suggested below:

- (1) Prof. Robert W. Peters, Dept. of Civil, Construction, and Environmental Engineering (CCEE), UAB (Note: Dr. Peters has agreed to serve as a Team Member)
- (2) J. Ashlyn Manzella, Engineer II, EITD, UAB
(Note: Ms. Manzella has agreed to serve as a Team Member)
- (3) UAB Engineering and Innovation Tech (EITD)
- (4) Dr. Julie Price, Sustainability Program, Dept of Biology, UAB
(Note: Dr. Price has agreed to serve as a Team member).
- (5) Prof. Stephen Watts, Dept of Biology, UAB
- (6) Department of Mechanical Engineering, UAB
- (7) Department of Chemistry, UAB
- (8) Department of Biochemistry and Molecular Genetics, UAB
- (9) Department of Environmental Health Sciences, UAB
- (10) UAB Upper Administration
- (11) Felicia Buck, Executive Director, Alabama Environmental Council.
(Note: Ms. Buck has agreed to serve as a Team Member)
- (12) Other Environmental Health-oriented Groups in the community at large.
- (13) Leadership from the City of Birmingham
- (14) Leadership from the State of Alabama
- (15) Mr. Jon Paolone, Former Recycling Coordinator at UAB
- (16) Jefferson County Department of Health
- (17) Ray Clark, Vice Chair of Solid Waste Authority of the City of Birmingham
- (18) Alabama microbreweries