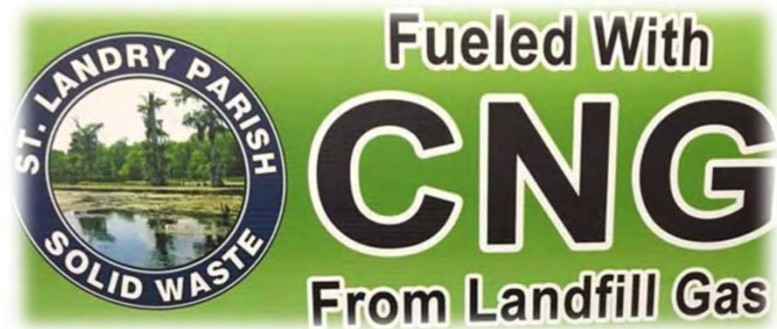


# *Renewable Natural Gas: Advancing energy independence*



# Why consider RNG initiative?

- Momentum nationally and internationally on RNG and biomethane
- Growing industry that GMI can support and amplify
- Biogas is a flexible renewable fuel
  - Thermal, CHP, fuel, feedstock
- Clean air benefits of transportation fuel switching are strong
- Capitalize on current policy shift globally to decarbonize energy and the economy

# Global RNG Supporters



# U.S. Policy and Market Actions

- *Federal Renewable Fuel Standard*
- *California and Washington Low Carbon Fuel Standard*
- *NW Natural 'Smart Energy' Program*
- *Short-Lived Climate Pollutant Reduction Strategy,*  
California Air Resources Board (April 2016)
  - “... to reduce methane emissions by **40 percent** below current levels by 2030.”
  - “... 50 percent below 2013 levels by 2030 for anthropogenic black carbon emissions...” (diesel emissions)

# Sacramento Biodigester, CA

- Fleet of Atlas Recycling recycling collection trucks fueled by compressed natural gas (CNG) from organics digester biogas.





# St. Landry Parish Landfill, LA

- Parish vehicles and Progressive Waste fleet (via satellite fueling station) fueled by CNG produced from landfill gas.



# Grand Junction, CO Wastewater Plant

- Garbage and bus fleets fueled with upgraded biosolids digester biogas.





# Seneca Meadows Landfill, NY

- 25,000 gge/day injected to pipeline for sale nationally as vehicle fuel and as source for green energy production.





# Smithfield/Ruckman Farms, MO

- Hog production facilities; RNG sold to Duke Energy for green electricity production.

**Smithfield**<sup>®</sup>



# Fair Oaks Farms, IN

- Upgraded dairy manure biogas used to fuel 45 milk delivery trucks.

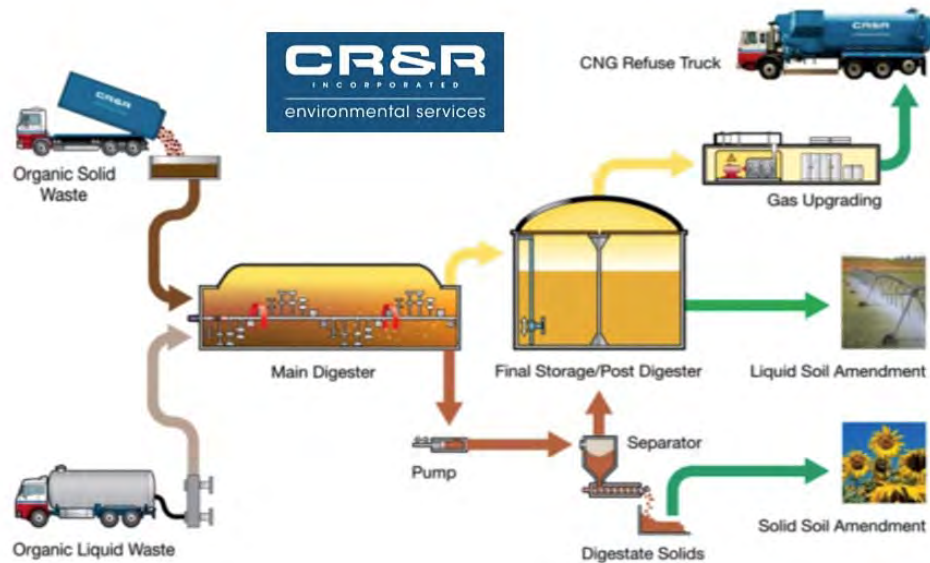


# CR&R Environmental, CA

- Upgraded digester biogas from source-separated organics used to fuel truck fleet and pipeline injection.

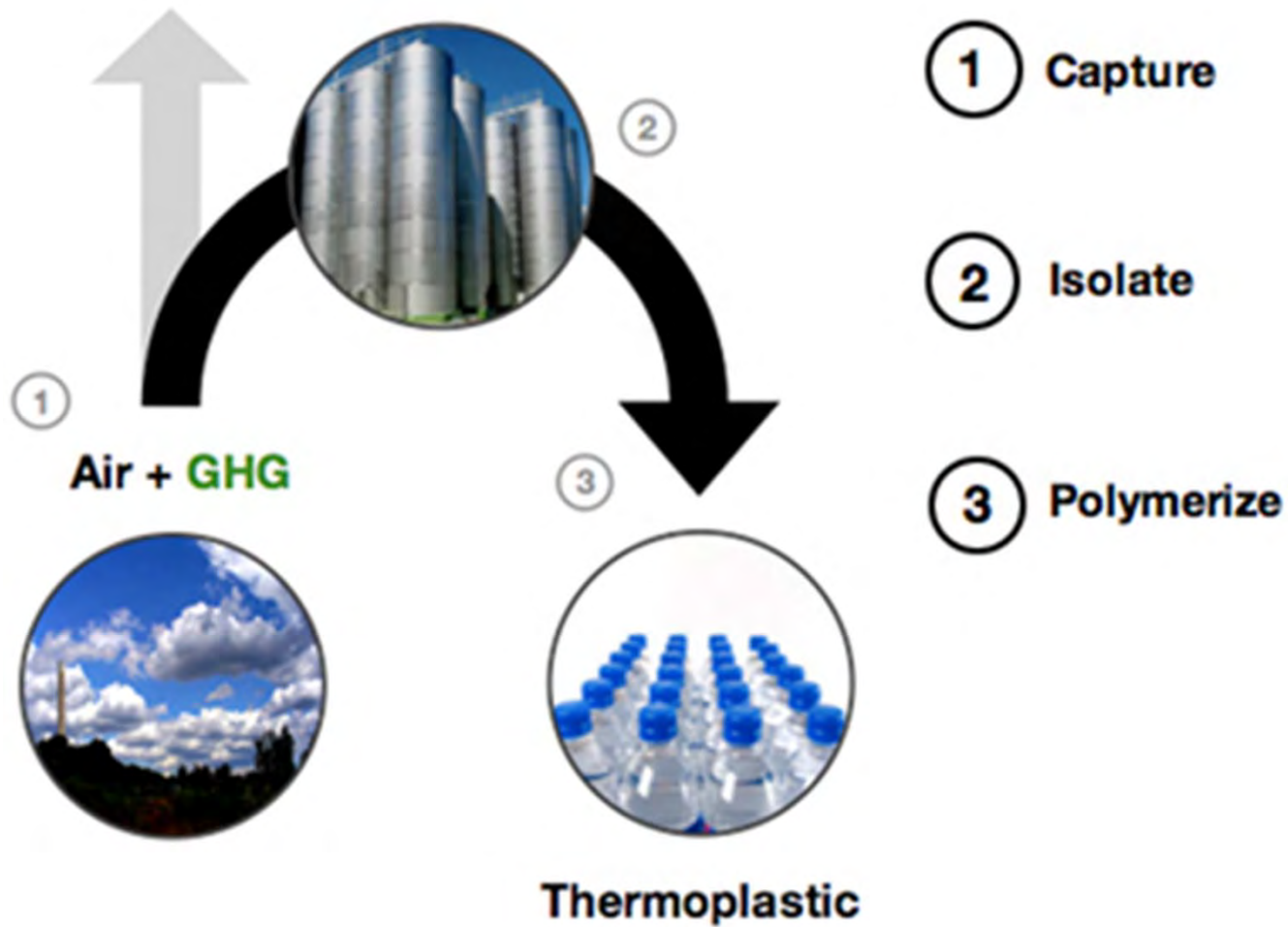


## ANAEROBIC DIGESTION - FLOW CHART





# RNG as Feedstock for Bio-Products



# Specific Opportunities

- RNG Use Pathways
  - Pipeline injection, direct vehicle fueling, satellite delivery, directed biogas or biomethane
- Landfills
  - Evaluate project 'switching' to RNG
  - Capture more methane through BMPs
  - Place organics digester system at landfill – leverage existing energy investment or allow for installation
  - Switch to higher or better biogas use
- Wastewater plants with AD
  - Organics management (sewer or collection) – methane mitigation and energy offsets; energy independence
- Organics digesters
  - Methane mitigation and energy offsets