



E3 CLEAN TECHNOLOGIES

Clean Water, Clean Air, Clean Energy.

# E3 Clean Technologies Inc.

## GUIRR Roundtable

October 22, 2014



# E3 Clean Technologies GreenBox™ Electrolyzers



Multiple Markets

Global Patents



Platform Technology



Disruptive  
Electrochemical  
Technology

# The Problems We Fix

NOx Exhaust Emissions



**SMOG**



**SCR**  
**GreenBox™**

Ammonia Contamination



**ALGAE BLOOMS**



**Ammonia**  
**GreenBox™**



# SCR GreenBox™ - NOx Emissions

## #1 Market : \$6.5 billion

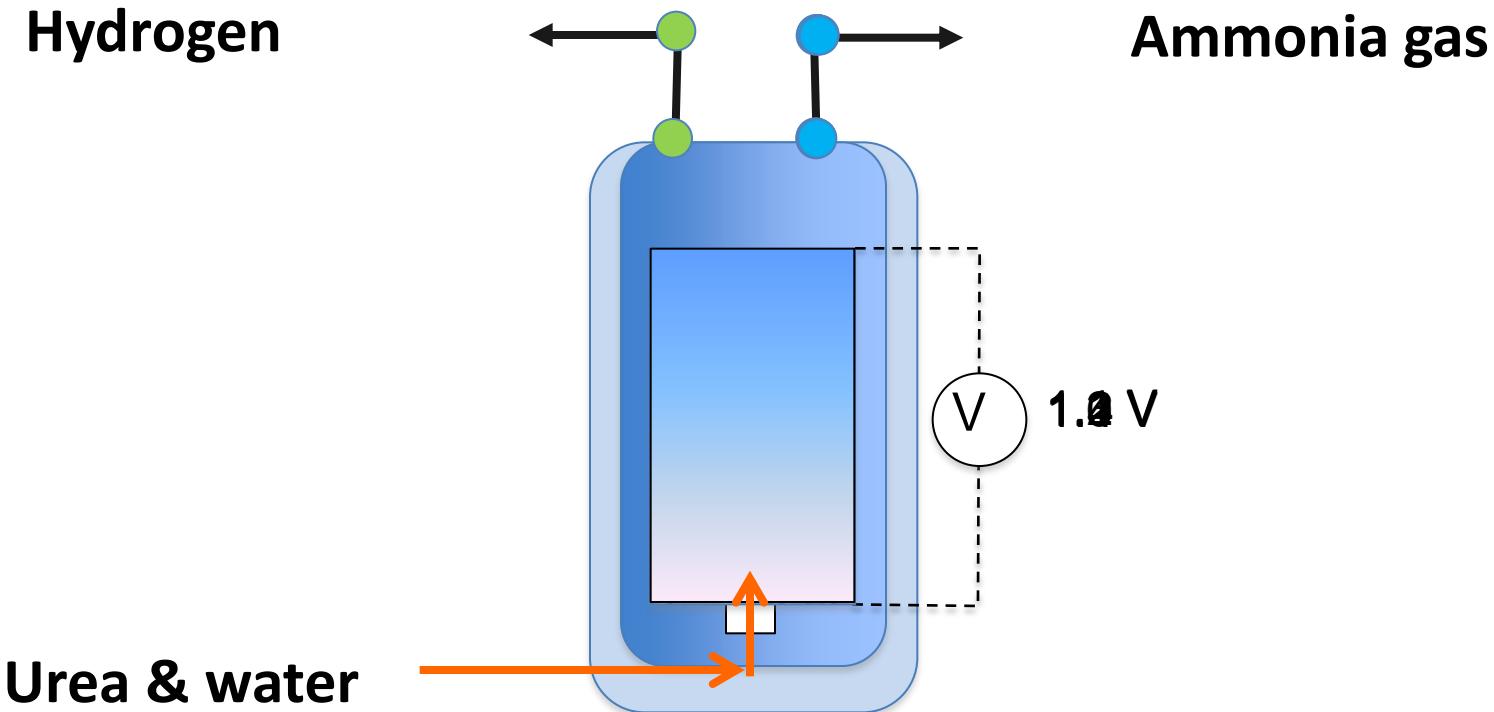


- Diesel Vehicles
  - Meets future diesel regulations
  - “Invisible” to customers
- Industrial/Power Plant
  - 50/60 Advantage
    - 50% lower capital cost
    - 60% lower operating cost

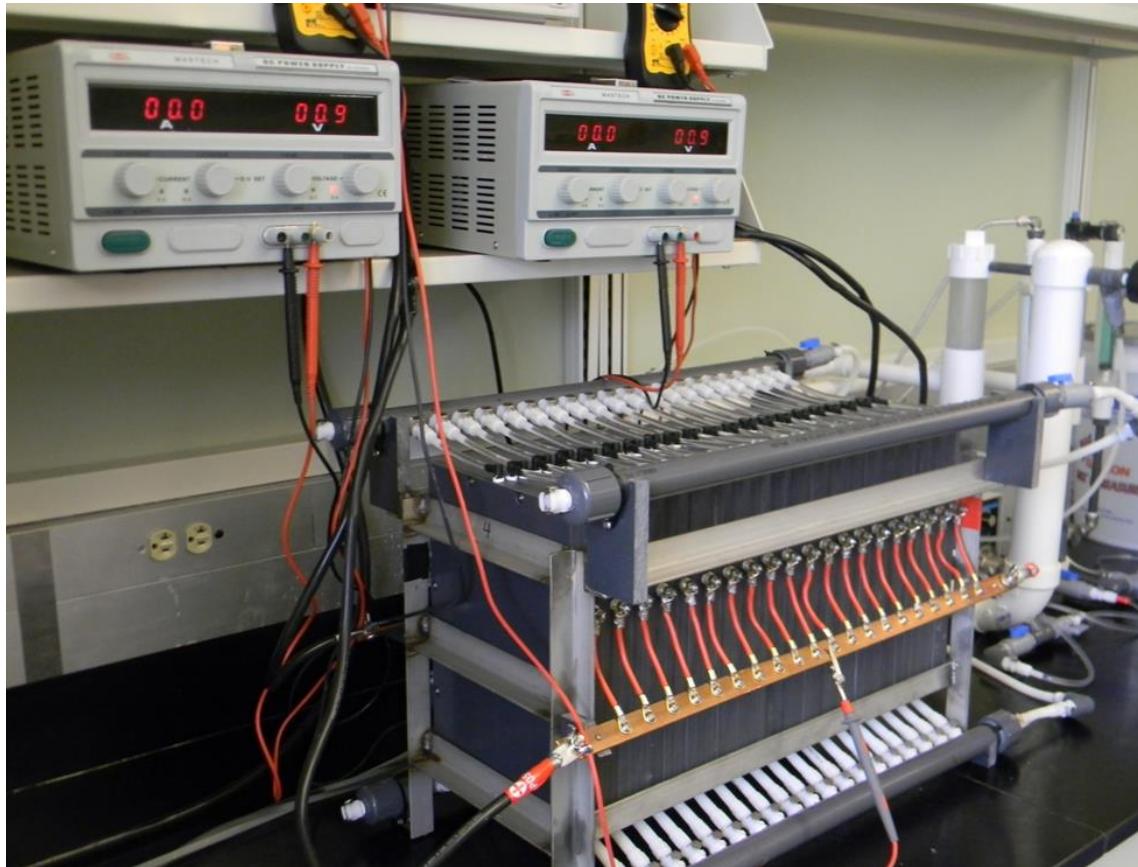


# SCR GreenBox™

## Electrolyzer Operation

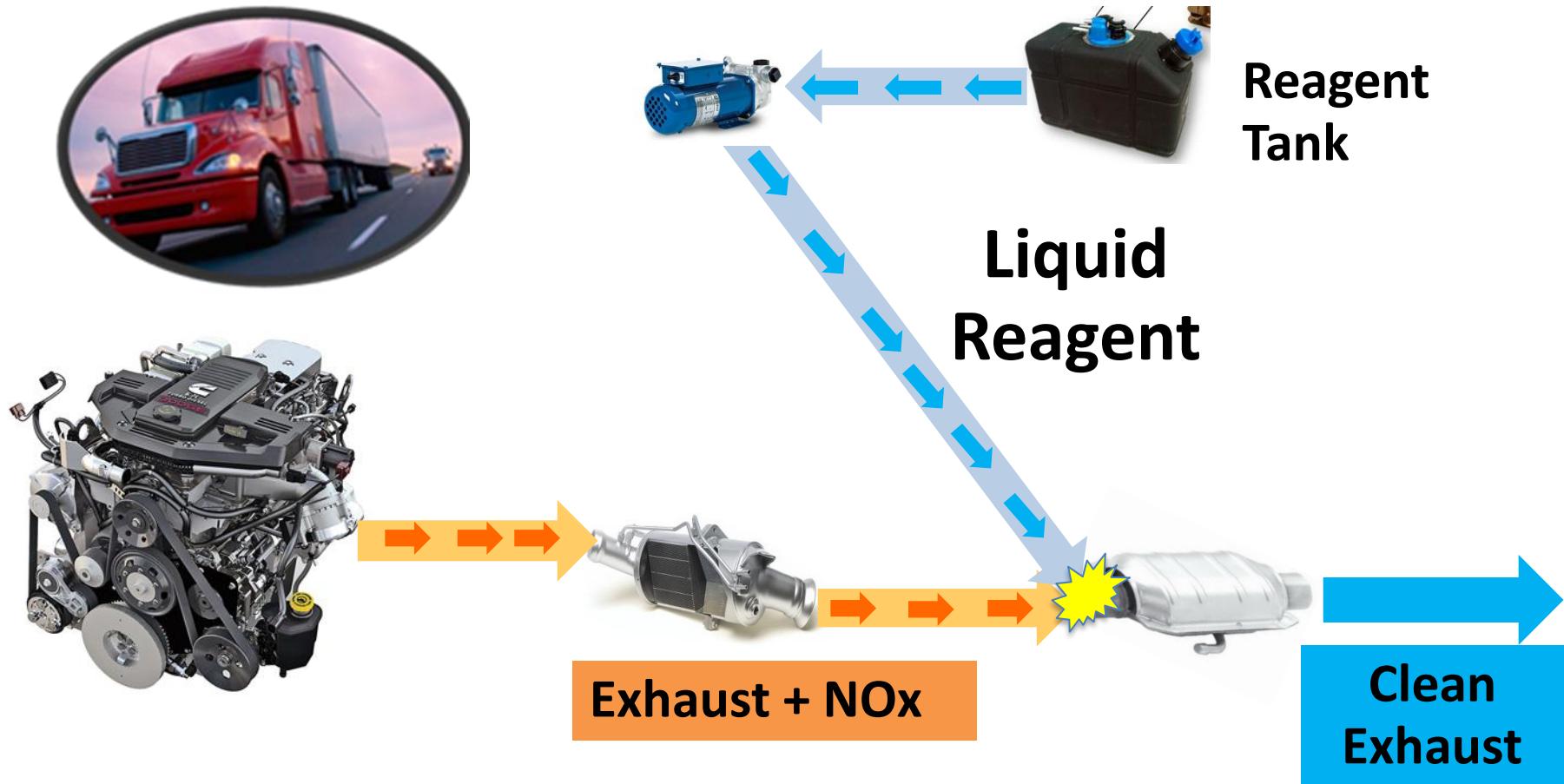


# SCR GreenBox™ Electrolyzer



# How it Works - Existing Technology

## Heavy Duty Truck Example



# E3's Technology – Gas Injection Maximizes NOx Reduction



Liquid Reagent



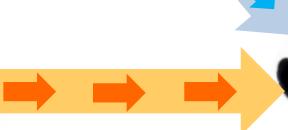
Reagent Tank



Exhaust + NOx



Ammonia Gas



Cleaner Exhaust!

# Fast-to-Market Technology

## “Critical Component”



### System Integrators

(Bosch, Tenneco...)



### End Users

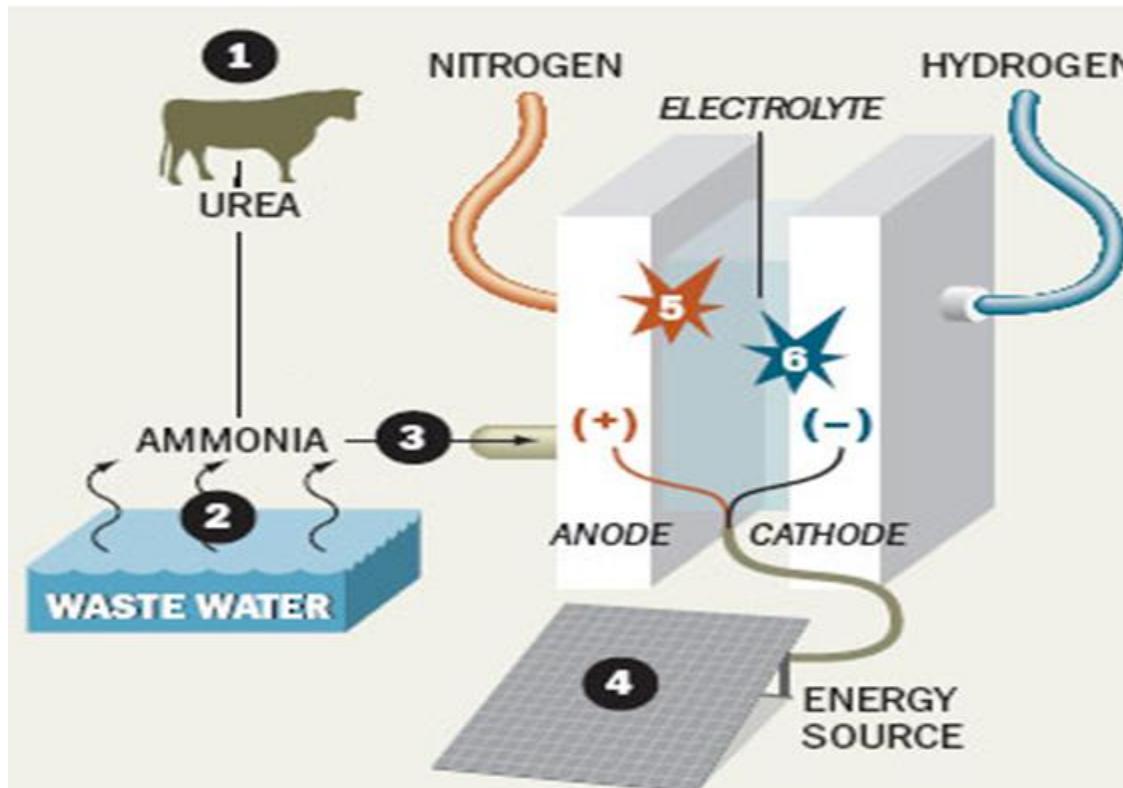
- Diesel vehicle producers
- Industrial / power plants



# Ammonia GreenBox™

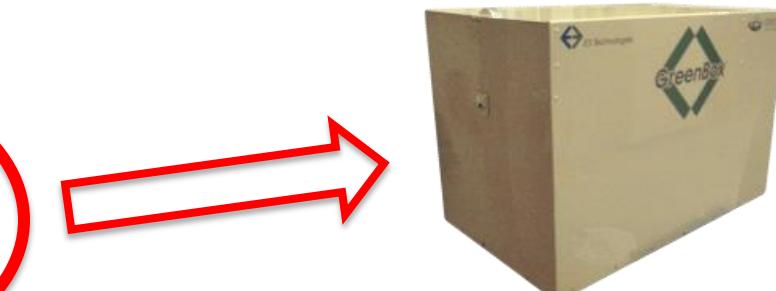
## #2 Market : \$5.5 billion

### Ammonia Converted to Hydrogen & Nitrogen



# Ammonia GreenBox™

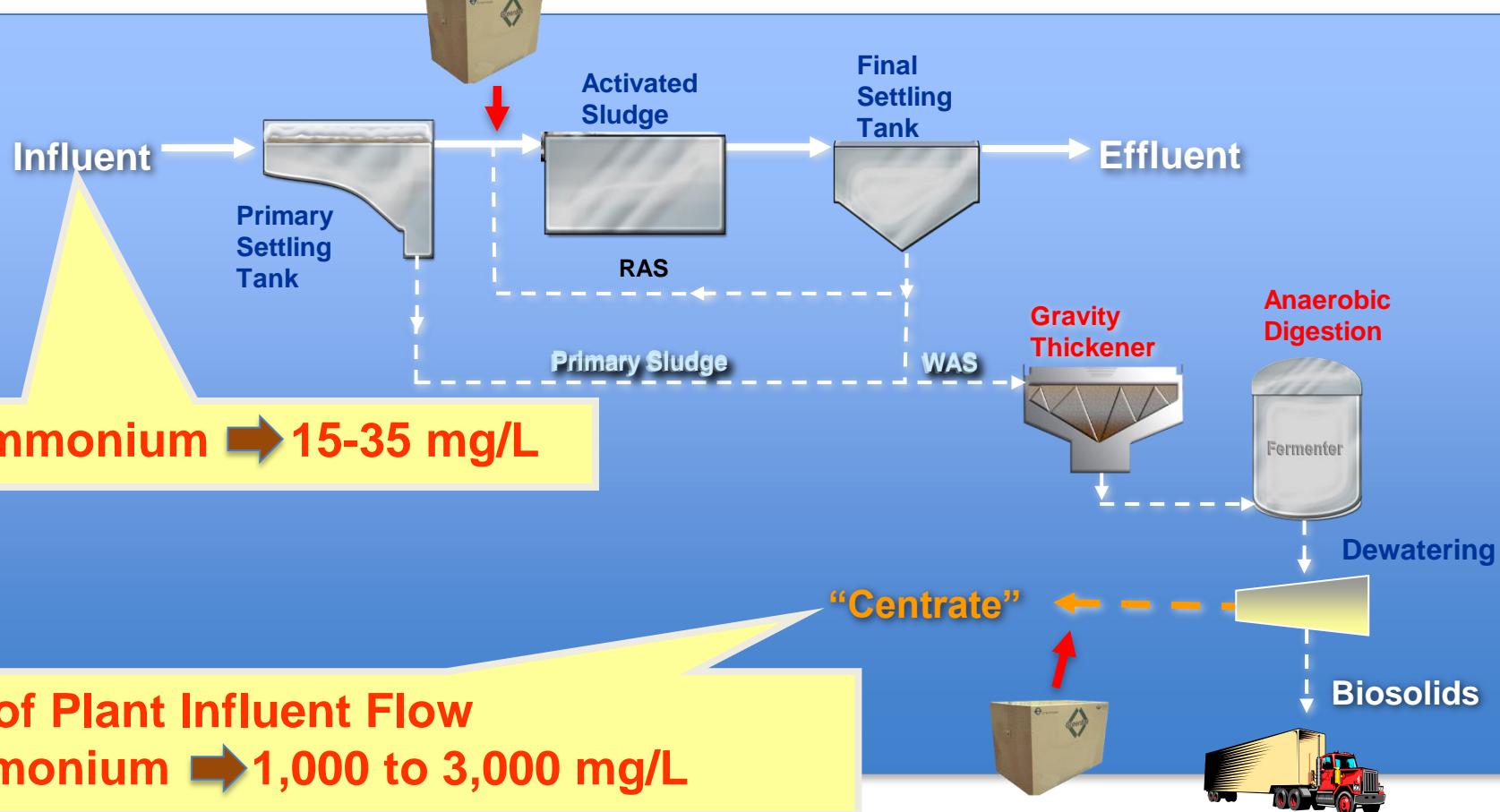
## Disruptive Waste Water Technology



### **50/70 Advantage:**

- **50% Lower Capital Cost**
- **70% Lower Operating Cost**
- **Quick/Flexible Installation**

# Ammonia GreenBox™ Installation Flexibility



# Ammonia GreenBox™ Configuration Flexibility

## Mobile Ammonia GreenBox™- Ohio Municipal waste water plant



# Ammonia GreenBox™ Hydrogen Fuel Production



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## Technical Approach

The novel approach pursued in this research utilizes three sustainable technologies in concert—anaerobic membrane bioreactors (AnMBRs), clinoptilolite ion exchange, and GreenBox™ ammonia electrolysis. The synergistic combination of these technologies will enable the first anaerobic treatment system that is capable of removing ammonia, a critical pollutant in municipal waste streams that is conventionally degraded using energy-intensive aeration processes. The component technologies are currently at an

# Ammonia GreenBox™ Hydrogen Fuel Production

US Department of Defense H<sub>2</sub> Demonstration System





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# THANK YOU

## Kent Shields

<http://e3cleantechologies.com/>