Jill Hamilton

President, Sustainable Energy Strategies, Inc.

Health and Emissions Benefits using the B100

OPTIMUS TECHNOLOGIES

REDUCE FUEL COSTS. REDUCE EMISSIONS. EASILY.

Biodiesel Fuel System Technology Overview

Colin Huwyler, CEO | c.huwyler@optimustec.com | 412.727.8228 x2

Revised 11.7.22

OPTIMUS COMPANY OVERVIEW

VECTOR SYSTEM OVERVIEW

The Optimus system integrates into existing heavy-duty vehicles and enables DPF/SCR equipped engines to operate on 100% biodiesel. The technology optimizes the use of biodiesel for all operations while never inhibiting the use of diesel fuel. The system's operation is fully autonomous and requires no change in driver behavior or engagement from the operator.

VECTOR FUEL TANK

USER INTERFACE

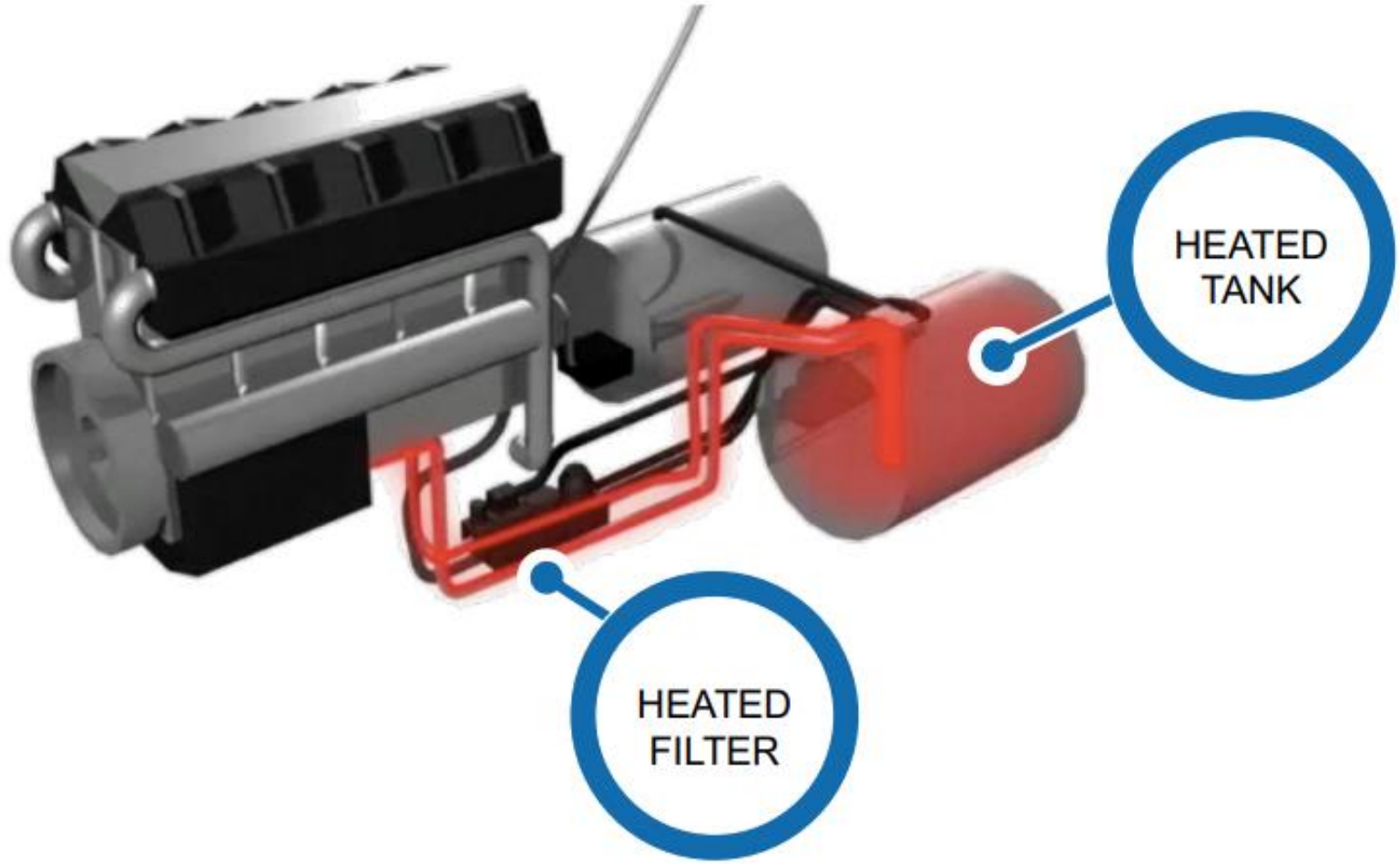
ELECTRONIC CONTROL UNIT

VECTOR MANIFOLD

*Patented

VECTOR SYSTEM OVERVIEW

Waste engine heat is utilized to condition the biodiesel.



VECTOR SYSTEM OVERVIEW

VECTOR SYSTEM OVERVIEW

USER INTERFACE

SMARTFUEL – REFUELING TECHNOLOGY

Turnkey skid mounted refueling platforms.

Clean Fuels
ALLIANCE AMERICA

PUBLIC HEALTH BENEFITS FROM SWITCHING TO BIODIESEL (TRINITY STUDY)

Steve Dodge, Director of State Regulatory Affairs

BMBD BENEFITS IN REGULATOR-SPEAK

	B100	RD100	B20 RD80	B50 RD50
GHG	Up to 79% less carbon emissions.	Up to 79% less carbon emissions.	Up to 79% less carbon emissions.	Up to 79% less carbon emissions.
PM	80% particulate matter reduction.	5-28% particulate matter reduction.	29% particulate matter reduction.	56% particulate matter reduction.
BTX	75% fewer aromatic compounds.	30% fewer aromatic compounds.	39% fewer aromatic compounds.	53% fewer aromatic compounds.
CO	42% less carbon monoxide.	18% less carbon monoxide.	23% less carbon monoxide.	30% less carbon monoxide.
NO_x	NOx neutral.	11.5% NOx reduction.	9% NOx reduction.	6% NOx reduction.

Good

- Metrics in the language of regulators

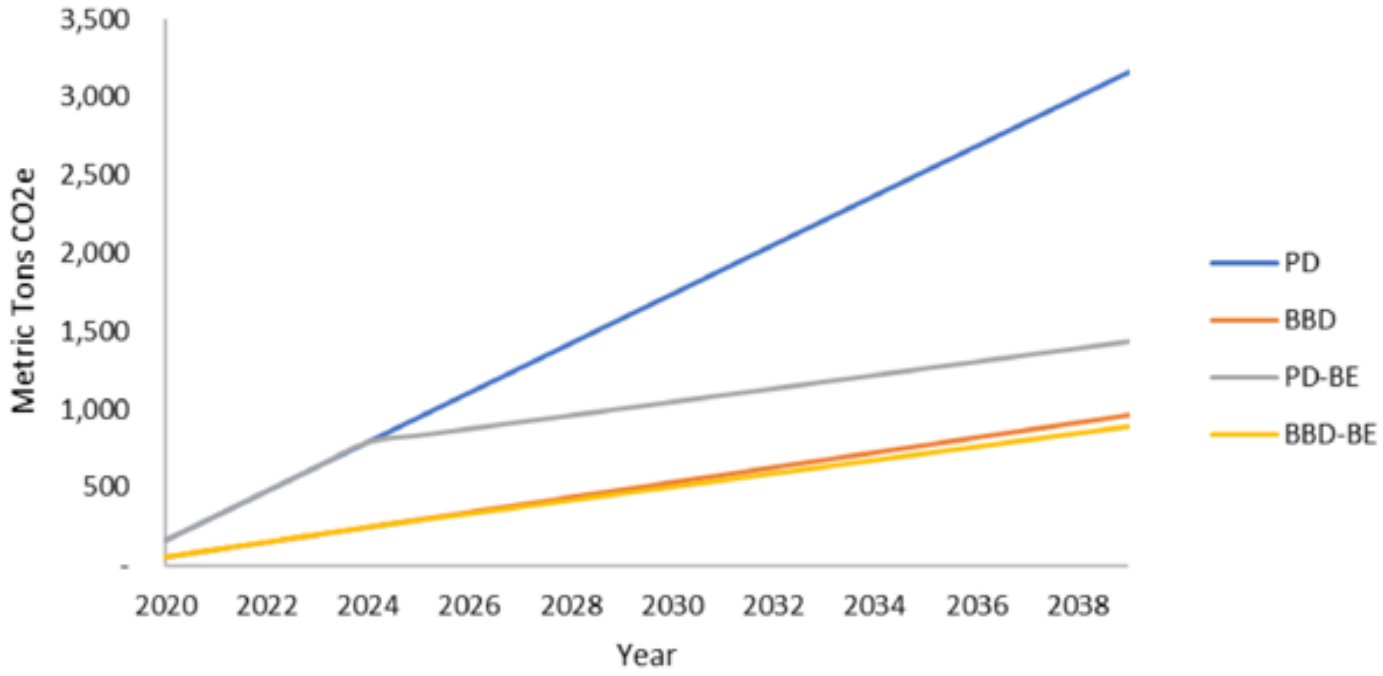
Bad

- Wonky, uncompelling
- EJ communities, lay persons do not relate

Clean Fuels ALLIANCE AMERICA

Clean Fuels ALLIANCE AMERICA

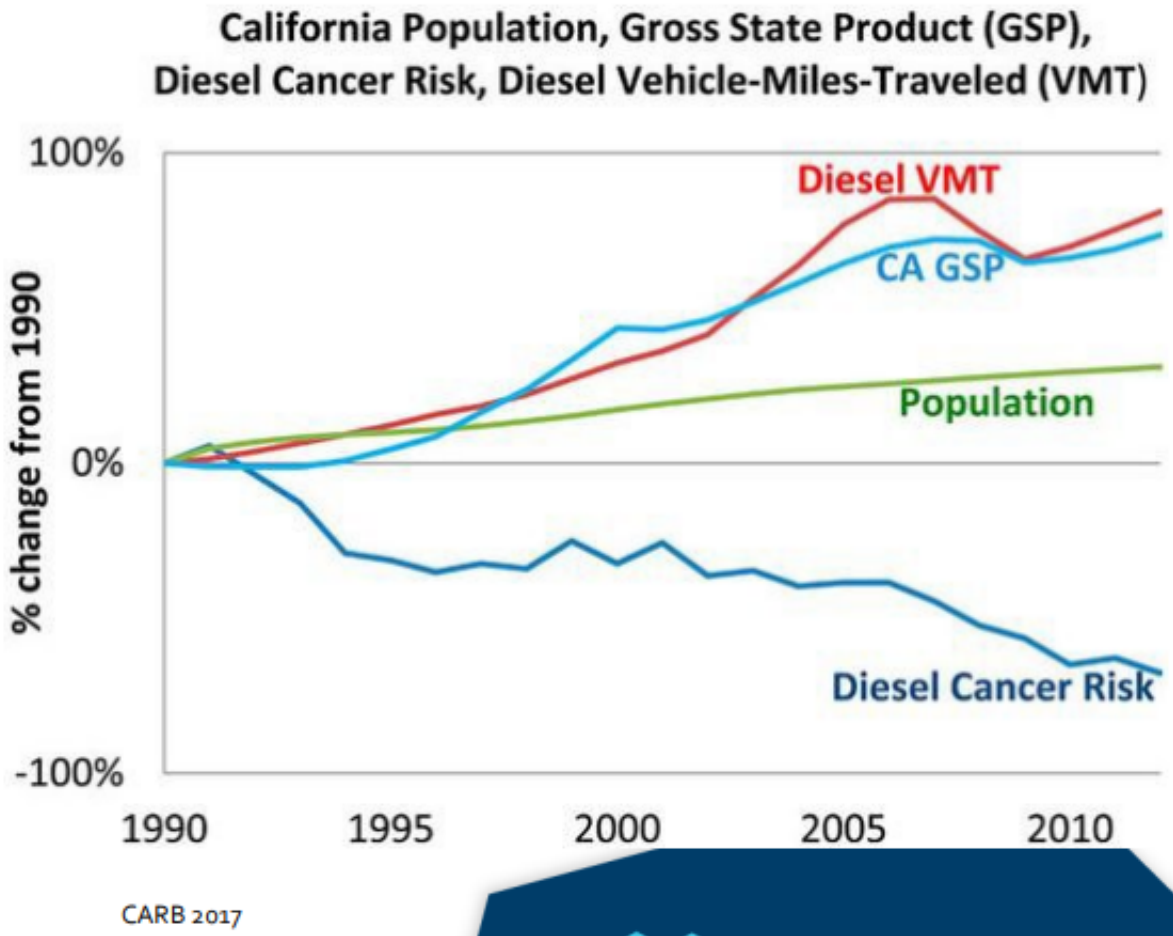
TWO ACES



- We need effective carbon reductions for existing and new diesel engines today.
  - Even with aggressive electric vehicle policy.
- Addressing carbon today is necessary to reach a carbon neutral 2050.

THE IMPORTANCE OF REDUCING DIESEL PM

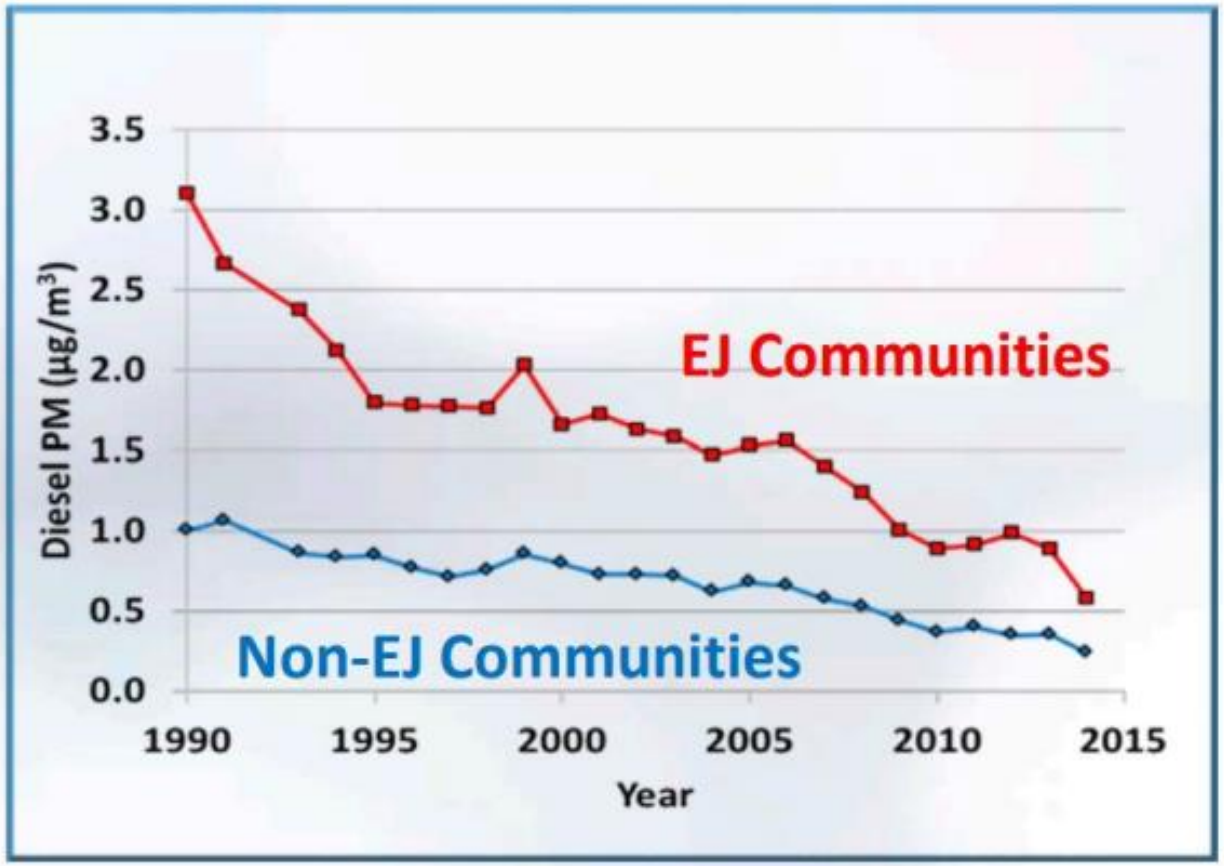
- Diesel trucks 97% of HDV fleet, 20% of Northeast homes
- Even in California:
  - Engine, VMT, and fuel improvements have reduced cancer risk by 68% since 1990
  - But diesel PM still accounts for ~70% cancer risk from air exposure
- Significant health concerns, e.g., premature deaths, asthma attacks, loss of workdays
- PM emissions unregulated in space heating market (Northeast)



CARB 2017

Clean Fuels ALLIANCE AMERICA

PARTICULATES: A GROWING EJ CONCERN



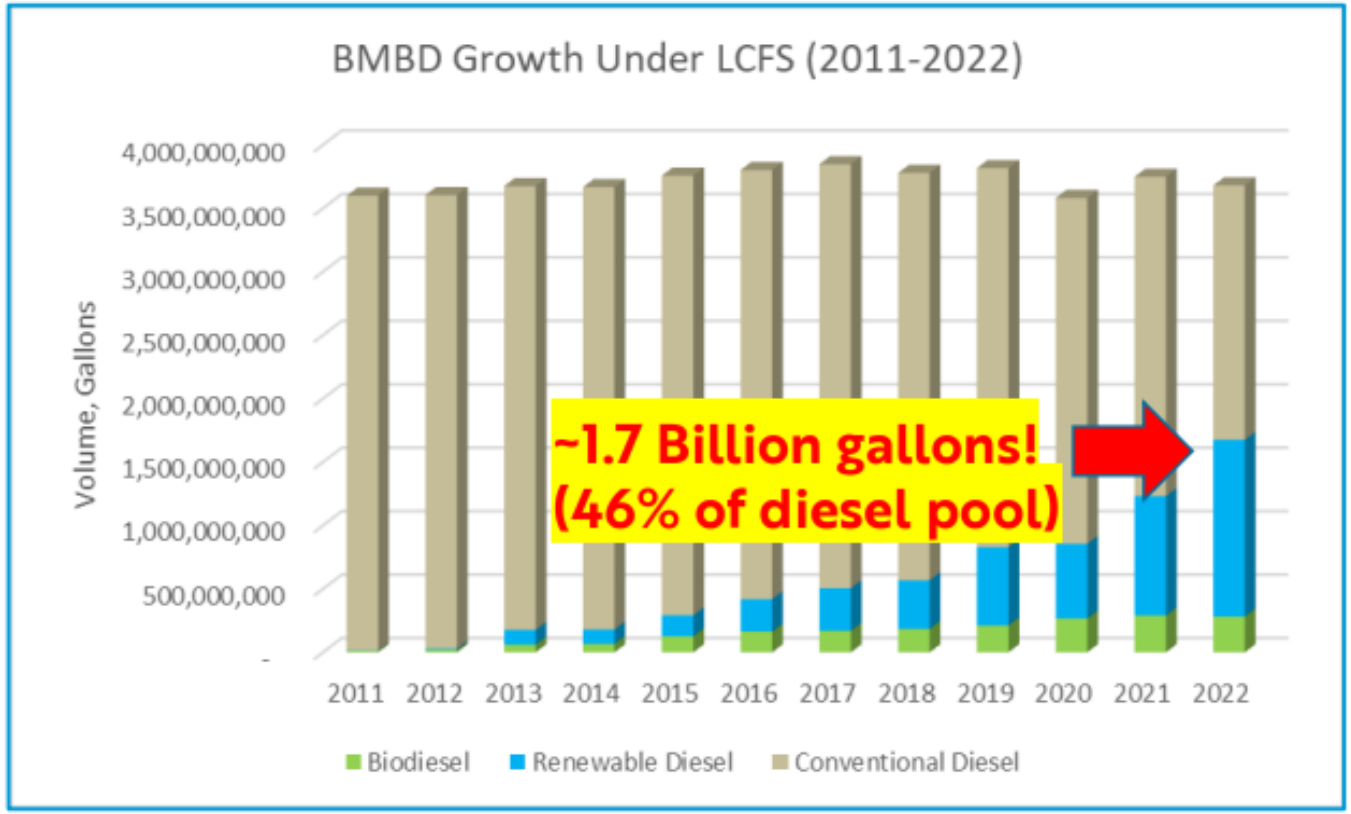
- Both EJ and non-EJ communities have seen dramatic decrease in diesel PM
- But large gap remains between EJ and non-EJ communities
- Concerns resulting in dramatic increase:
  - EJ funding, projects
  - Focused legislation, regulations
  - Presence at EPA, state boards/councils

Clean Fuels ALLIANCE AMERICA

Clean Fuels ALLIANCE AMERICA

Decarbonizing Heavy-Duty Sector While Transitioning to Electricity

- Biodiesel & Renewable Diesel (Biomass-based Diesel or BMBD):
  - 1.675 Billion gallons in 2022
  - 46% of diesel fuel (displaced 6.8 Bgal since 2011)
  - 45% of LCFS reductions (more than electricity, RNG, hydrogen combined)
  - 52.4 MMT since 2011, 42% of total reductions
  - Equivalent to removing 2.6 million vehicles in 2022 or avoiding 30.4 billion miles driven



Source: CARB LCFS Dashboard, April 2023

TRINITY STUDY AUTHOR

Trinity Consultants

- Well-established environmental, health and safety consulting firm
- 69 offices across the U.S., Canada, United Kingdom, Ireland, Australia, and China
- Over 40 years expertise in air dispersion modeling and health risk assessments

Trinity Consultants

Clean Fuels ALLIANCE AMERICA

STUDY QUESTIONS POSED

- What are the benefits to a typical person if the nearby transportation or heating oil uses of petroleum diesel were switched to 100% biodiesel (B100)?

- What are those benefits at the census tract level to a typical person living in an EJ community?

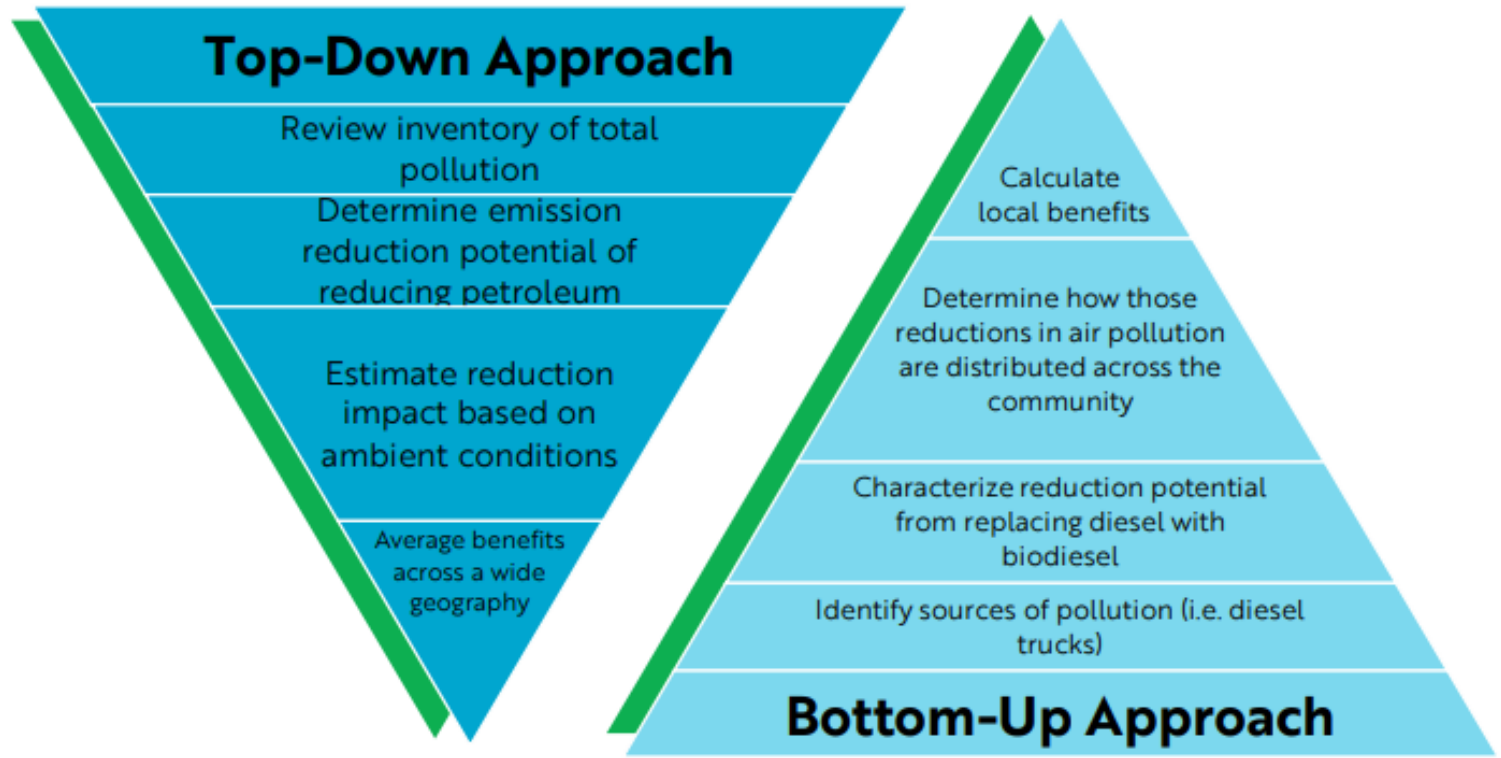
- How to quantify and express those benefits in metrics more relevant to lay persons, particularly EJ residents?

Clean Fuels ALLIANCE AMERICA

Clean Fuels ALLIANCE AMERICA

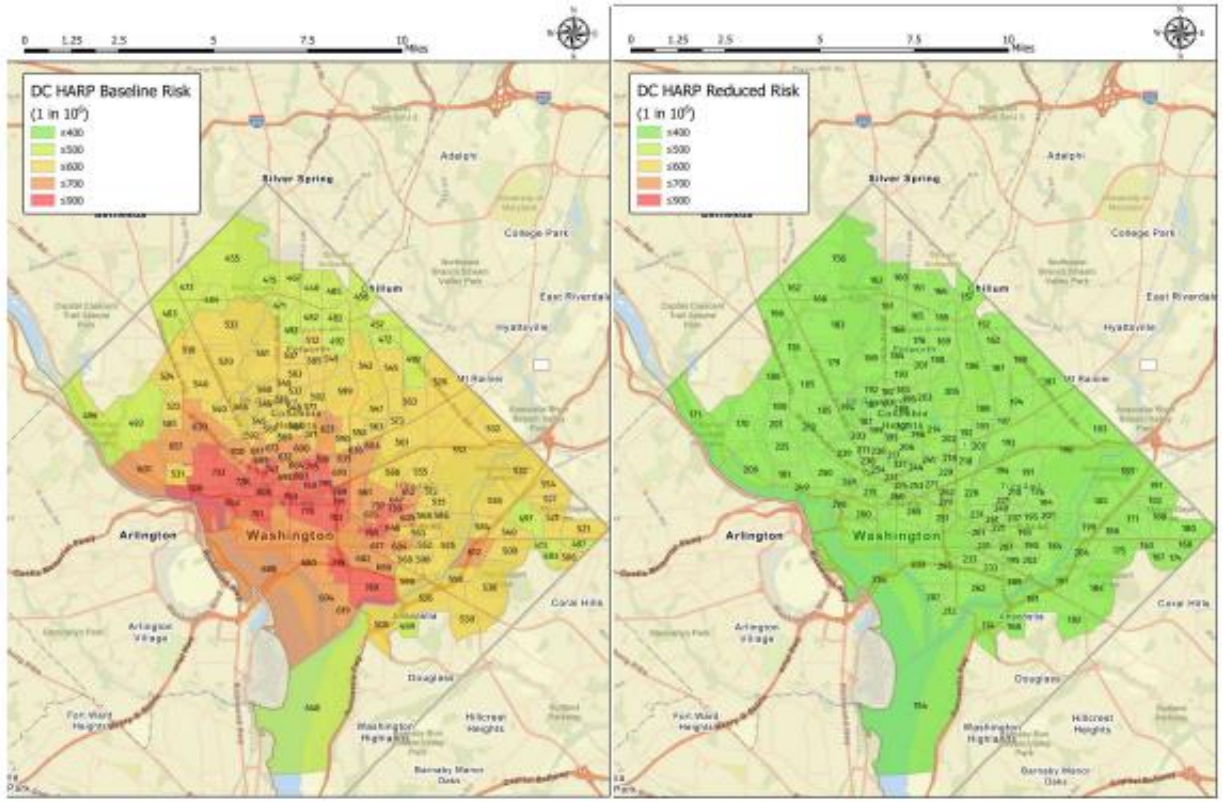
WHAT MAKES THIS STUDY UNIQUE?

- Utilizes sector specific, technical emission factors to construct inventory
- Emission factors and characteristics are used in a dispersion model
- Dispersion model determines the impact to locality at the neighborhood/census tract level
- Advantages:
  - Identify sources of emissions compared to inventory
  - Allows for direct estimates of change in emission due to inclusion of specific 'control'
  - Helps understand how physical conditions (geography) can contribute to pollution



B100 BENEFITS: DISTRICT OF COLUMBIA

Cancer Burden Pre/Post-Switch to B100 (Up to 193 fewer cases)



Value of Health Benefits from using Biodiesel in the District of Columbia (Per Year)		
Health Impact Endpoint	**Reduced Incidence**	**Benefit Value**
Acute Myocardial Infarction Nonfatal	100.6	$3,303,129
Asthma Symptoms Albuterol use	**12,987.1**	**$4,488**
ER visits All Cardiac Outcomes	12.3	$14,299
ER visits respiratory	28.1	$24,598
HA All Respiratory	3.1	$54,807
HA Alzheimers Disease	10.5	$133,287
HA Cardio- Cerebro- and Peripheral Vascular Disease	4.3	$68,492
HA Parkinsons Disease	1.7	$22,980
HA Respiratory-2	0.6	$0
HA Respiratory-2 HA All Respiratory	3.7	$0
Incidence Asthma	**98.8**	**$4,414,345**
Incidence Hay Fever/Rhinitis	619.3	$371,503
Incidence Lung Cancer	4.7	$59,160
Incidence Out of Hospital Cardiac Arrest	0.6	$20,552
Incidence Stroke	1.9	$63,297
Minor Restricted Activity Days	**33,036.1**	**$2,298,710**
Mortality All Cause	**32.1**	**$249,689,228**
Work Loss Days	**5,679.9**	**$1,467,432**
Total		**$262,010,307**

Clean Fuels ALLIANCE AMERICA

B100 - Climate Pollution Reduction Grant

1. Request $10 million for Rebate or Retrofit Program
    1. Rebates are for retrofits up to $35,000 each.
    2. 3-5 tank and dispenser upgrades $250,000-$500,000 each
2. Overview of the Optimus B100 Vector System
    1. Overview of Optimus Vector B100 System
    2. Emissions Benefits of 250 vehicle retrofits – includes 46 Circulator Buses

Sustainable Energy Strategies Inc.

B100 Retrofit Concept

- $10 Million to Retrofit Diesel Vehicles
- Target 250 Legacy Diesels
  - $35,000 x 250 = $8.75 million
  - $250,000 x 5 = $1.25 million for infrastructure
- Total Request: $10 million
- Estimated Emissions Reductions

Emissions Benefits

To

$10 million Retrofit and Infrastructure Program

EPA Climate Pollution Reduction Grant

- $10 Million to Retrofit Diesel Vehicles
- Target 250 Legacy Diesels
  - $35,000 x 250 = $8.75 million
  - $250,000 x 5 = $1.25 million
- Total Request: $10 million
- Estimated Emissions Reductions
- Vehicle types replace: 25 Refuse Haulers, 25 Short Haulers, 40 Cir. Buses, 25 Dumpers, 50 Dump Trucks, 85 Construction

Emissions Reductions in Pre-2010 Diesels (per gallon)(more if vehicle is replaced):

1. NOx: Neutral
2. PM2.5: 47.19%
3. HC: 67.36%
4. CO: 48.11%
5. CO2: 76.4% (100% Scope 1 emissions)
6. Fuel: 90% Displacement

Emission Results and Health Benefits for Project: EPA Climate Pollution Reduction Grant

Emission Results | Health Benefits

Emission Results

Here are the combined results for all groups and upgrades entered for your project.[1]

Annual Results (short tons)[2]	NO_x	PM2.5	HC	CO	CO_2	Fuel[3]
Baseline for Upgraded Vehicles/Engines	34.879	0.984	1.884	8.094	11,745.0	1,044,000
Amount Reduced After Upgrades	4.512	0.463	1.241	3.068	8,975.6	797,831
Percent Reduced After Upgrades	12.9%	47.0%	65.9%	37.9%	76.4%	76.4%
Lifetime Results (short tons)[2]						
Baseline for Upgraded Vehicles/Engines	337.885	9.823	18.628	72.352	98,100.0	8,720,000
Amount Reduced After Upgrades	45.123	4.627	12.406	30.678	74,972.6	6,664,230
Percent Reduced After Upgrades	13.4%	47.1%	66.6%	42.4%	76.4%	76.4%
Lifetime Cost Effectiveness ($/short ton reduced)						
Capital Cost Effectiveness[4] (unit & labor costs only)	$193,915	$1,890,896	$705,289	$285,218	$117	
Total Cost Effectiveness[4] (includes all project costs)	$193,915	$1,890,896	$705,289	$285,218	$117	

[1] Emissions from the electrical grid are not included in the results.

[2] 1 short ton = 2000 lbs.

[3] In gallons; fuels other than ULSD have been converted to ULSD-equivalent gallons.

[4] Cost effectiveness estimates include only the costs which you have entered.

Emissions Results for EPA Climate Pollution Reduction Grant

This assumes Circulator buses are part of the program with only five years remaining.

Remaining Life of Retrofitted Vehicles

Remaining Life

Group 2: Municipal | Short Haul - Combination | Class 6-7 (Delivery) Other Fuel Option (Upgrade to B100)	10 years
Group 3: DDOT Circulator Buses: Transit Bus | Class 8 Other Fuel Option (Upgrade to B100)	5 years
Group 5 - Dumpers - Offroad: Municipal | Dumpers/Tender Other Fuel Option (Upgrade to B100)	10 years
Group 6: Dump Trucks: Municipal | Short Haul - Single Unit | Class 6-7 (Utility) Other Fuel Option (Upgrade to B100)	10 years
Group 7: Construction | Short Haul - Single Unit | Class 8 (Utility) Other Fuel Option (Upgrade to B100)	10 years
Group 1 Refuse Trucks: Municipal | Short Haul - Combination | Class 8 (Utility) Other Fuel Option (Upgrade to B100)	10 years

Remaining Life is an estimate of the years the vehicles will be operating in the District before retiring and replaced with another technology.

This assumes the DDOT Circulator Buses are part of the program and that each has five years left.

DPW DERA Emissions Results on B100

This project retired 12 dirty diesels with 12 new B100

Project: 22 DERA GWRCCCC Biodiesel Project

Emission Results | Health Benefits

Emission Results

Here are the combined results for all groups and upgrades entered for your project.[1]

Annual Results (short tons)[2]	NO_x	PM2.5	HC	CO	CO_2	Fuel[3]
Baseline for Upgraded Vehicles/Engines	3.351	0.228	0.263	1.110	98.3	8,736
Amount Reduced After Upgrades	3.163	0.223	0.180	1.057	75.1	6,674
Percent Reduced After Upgrades	94.4%	97.7%	68.3%	95.2%	76.4%	76.4%
Lifetime Results (short tons)[2]						
Baseline for Upgraded Vehicles/Engines	26.790	1.901	2.297	9.784	950.0	84,445
Amount Reduced After Upgrades	25.171	1.855	1.586	9.314	725.8	64,516
Percent Reduced After Upgrades	94.0%	97.6%	69.1%	95.2%	76.4%	76.4%
Lifetime Cost Effectiveness ($/short ton reduced)						
Capital Cost Effectiveness[4] (unit & labor costs only)	$104,722	$1,421,326	$1,661,969	$283,029	$3,632	
Total Cost Effectiveness[4] (includes all project costs)	$98,317	$1,334,396	$1,560,322	$265,719	$3,410	

[1] Emissions from the electrical grid are not included in the results.

[2] 1 short ton = 2000 lbs.

[3] In gallons; fuels other than ULSD have been converted to ULSD-equivalent gallons.

[4] Cost effectiveness estimates include only the costs which you have entered.

This project cost $2,474,780 to replace 12 HDVs. GHGs = Full LCA

18 DC DPW & DDOT
Replacement Vehicles

2024 DERA Submitted Project

Emission Results and Health Benefits for Project: 2024 GWRCCC DERA B100 Project

Emission Results | Health Benefits

Emission Results

Here are the combined results for all groups and upgrades entered for your project.[1]

Annual Results (short tons)[2]	NO_x	PM2.5	HC	CO	CO_2	Fuel[3]
Baseline for Upgraded Vehicles/Engines	2.426	0.229	0.192	1.147	483.8	43,006
Amount Reduced After Upgrades	2.193	0.227	0.180	1.001	369.6	32,857
Percent Reduced After Upgrades	90.4%	99.2%	94.0%	87.3%	76.4%	76.4%
Lifetime Results (short tons)[2]						
Baseline for Upgraded Vehicles/Engines	30.338	2.877	2.379	14.442	5,866.0	521,422
Amount Reduced After Upgrades	27.544	2.853	2.236	12.736	4,481.6	398,367
Percent Reduced After Upgrades	90.8%	99.2%	94.0%	88.2%	76.4%	76.4%
Lifetime Cost Effectiveness ($/short ton reduced)						
Capital Cost Effectiveness[4] (unit & labor costs only)	$186,220	$1,797,567	$2,293,646	$278,458	$1,145	
Total Cost Effectiveness[4] (includes all project costs)	$186,220	$1,797,567	$2,293,646	$389,887	$1,145	

[1] Emissions from the electrical grid are not included in the results.

[2] 1 short ton = 2000 lbs.

[3] In gallons; fuels other than ULSD have been converted to ULSD-equivalent gallons.

[4] Cost effectiveness estimates include only the costs which you have entered.

EPA Diesel Emissions Quantifier for Circulator Buses

This project would retrofit 46 diesels with B100 system.

Emission Results and Health Benefits for Project: DC Circulator – Diesel/Optimus Replacement Full Vehicle

Emission Results | Health Benefits

Emission Results

Here are the combined results for all groups and upgrades entered for your project.[1]

Annual Results (short tons)[2]	NO_x	PM2.5	HC	CO	CO_2	Fuel[3]
Baseline for Upgraded Vehicles/Engines	7.823	0.012	0.144	5.568	5,583.8	496,340
Amount Reduced After Upgrades	0.000	0.000	0.000	0.000	5,583.8	496,340
Percent Reduced After Upgrades	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
Lifetime Results (short tons)[2]						
Baseline for Upgraded Vehicles/Engines	46.936	0.070	0.864	33.406	33,503.0	2,978,040
Amount Reduced After Upgrades	0.000	0.000	0.000	0.000	33,503.0	2,978,040
Percent Reduced After Upgrades	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
Lifetime Cost Effectiveness ($/short ton reduced)						
Capital Cost Effectiveness[4] (unit & labor costs only)	$0	$0	$0	$0	$48	
Total Cost Effectiveness[4] (includes all project costs)	$0	$0	$0	$0	$48	

[1] Emissions from the electrical grid are not included in the results.

[2] 1 short ton = 2000 lbs.

[3] In gallons; fuels other than ULSD have been converted to ULSD-equivalent gallons.

[4] Cost effectiveness estimates include only the costs which you have entered.

This project cost $1.68 million to retrofit 48 Transits. GHGs = Full LCA

Questions?

Please speak with:

Jill Hamilton
President
SESI
703-322-4484
jhamilton@sesi-online.com

Sustainable Energy Strategies Inc.