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Liberty-Empire Non-Road Electrification Technology Assessment

Prepared by ICF

November 2020

CONFIDENTIAL DATA MARKED AS SUCH

Overview

- **Program Design**
- **Non-Road Electrification Assessment Appendix**
  - Process Summary
  - Market Assessment
  - Program Cost Effectiveness
  - Cost Benefit Analysis Assumptions
  - Individual Technology Cost Benefit Analysis

Non-Road Program Design

Material Handling

Electric Forklift Incentive

- Incentives to convert or expand forklift fleets to electric
- Build a trade ally network that supports Liberty's program goals, provide dealer sales trainings, and offer dealer sales performance incentive funding (SPIFs)
- Identify targets, conduct direct customer outreach and education about the benefits of electric equipment and managed charging options, provide fleet consultations

Electric-Standby Truck Refrigeration Infrastructure

- Incentives to install infrastructure to support E/S TRUs
- Identify targets, conduct outreach, provide fleet consultations, and educate customers about the technology benefits.

Truck Stop Electrification

- Incentives to install infrastructure to support truck top electrification
- Meet with stakeholders to support TSE opportunities

Non-Road Program Design

Intermodal Equipment

Custom Intermodal Equipment Incentive

- Includes but not limited to drayage trucks, top and side handlers, gantry cranes, loaders
- Custom incentives are based on a dollar per annual kWh load of the equipment being added and are used on larger pieces of equipment that will have more variable load impacts
- Conduct outreach and educate customers
- Facilitate stakeholder meetings and equipment demos
- Fleet consultations can be more in-depth and involve metering studies for larger equipment.

Non-Road Program Design

Agricultural Equipment

Agricultural Well Conversion Incentive*

- Direct farm engagement to incentivize conversions from diesel irrigation pumps to electric pumps
- Help increase utility engagement in a tough to engage sector
- Based on the industry's seasonality program can have distinct periods of opportunity

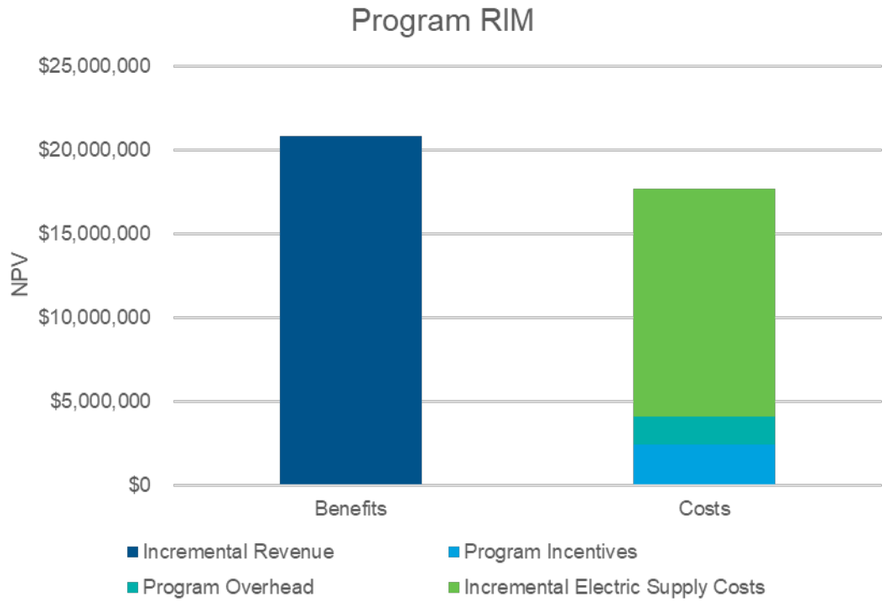
* While not included as part of this program design, a more favorable line extension payback policy to accommodate electric well would improve outcomes of this program component

Non-Road Program Potential

	MATERIAL HANDLING					INTERMODAL			AGRICULTURE
	Forklift - Conven.	Forklift - Rapid	TRU - Box	TRU - Trailer	TSE	Cranes	Drayage Trucks - Conven.	Drayage Trucks - Rapid	Well Pumps
Incentive per unit	**$ 2,500**	**$ 2,500**	**$ 900**	**$ 4,200**	**$ 2,300**	**$ 30,000**	**$ 5,000**	**$ 8,000**	**$ 5,000**
Year 1	43	14	8	4	4	-	2	-	10
Year 2	86	28	15	7	8	1	5	1	20
Year 3	115	38	20	10	11	1	6	1	27
Year 4	144	47	25	12	14	1	8	1	34
Year 5	144	47	25	12	14	1	8	1	34
Gross Program Participants	**532**	**174**	**93**	**45**	**51**	**4**	**29**	**4**	**125**
Gross Coincident On-Peak Demand (kW)	**326**	**2,480**	**-**	**-**	**130**	**720**	**290**	**272**	**5,625**
Gross Combined Non-Coincident Demand (kW)	**4,788**	**2,610**	**744**	**630**	**153**	**720**	**580**	**320**	**6,250**
Total kWh (at end of Year 5)	**14,523,600**	**4,367,400**	**1,116,000**	**900,000**	**353,940**	**1,200,000**	**1,450,000**	**320,000**	**6,250,000**
GHG Emissions Reduced (MT Lifetime)	**32,014**	**9,627**	**6,294**	**5,076**	**7,489**	**9,067**	**1,719**	**379**	**10,116**
Nox Emissions Reduced (MT Lifetime)	**37**	**11**	**44**	**36**	**33**	**49**	**39**	**9**	**168**

	Annual kWh	Incentives	Program Delivery	TOTAL Program
Year 1		$ 235,700	$ 494,322	**$ 730,022**
Year 2	5,056,120	$ 509,300	$ 363,957	**$ 873,257**
Year 3	6,639,640	$ 670,800	$ 373,510	**$ 1,044,310**
Year 4	8,228,060	$ 830,600	$ 385,625	**$ 1,216,225**
Year 5	8,228,060	$ 830,600	$ 398,451	**$ 1,229,051**
TOTAL	**28,151,880**	**$ 3,077,000**	**$ 2,015,865**	**$ 5,092,865**

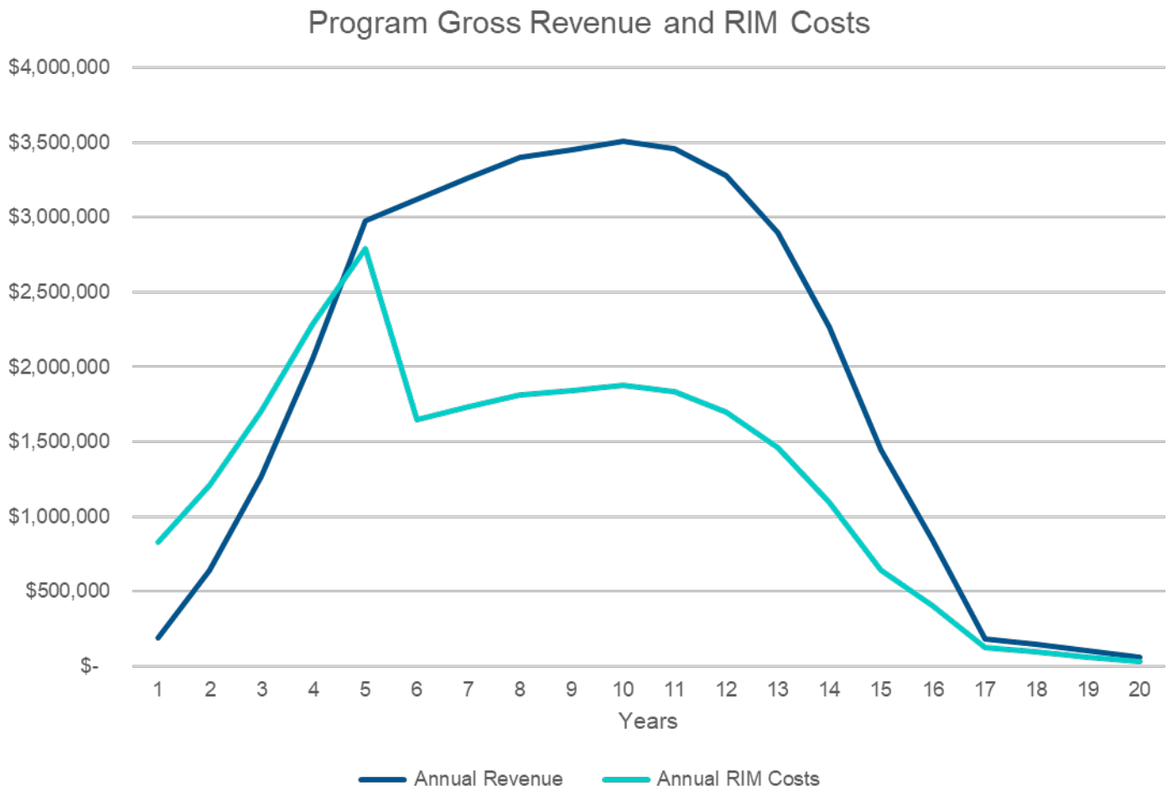
	Annual		Lifetime	
	GHG	NOx	GHG	NOx
Site Emissions Reductions (MT)	32,462	55	383,761	637
Source Emissions Increases (MT)	25,844	13	301,981	210
Net Emissions Reductions (MT)	**6,618**	**42**	**81,780**	**427**



Non-Road Program Potential

NTG Ratio	80%
Discount Rate	7.3%
NPV RIM Benefits	$20,852,476
NPV RIM Costs	$14,967,325
RIM Benefit Cost Ratio	1.39
NPV RIM Net Benefits	$5,885,150

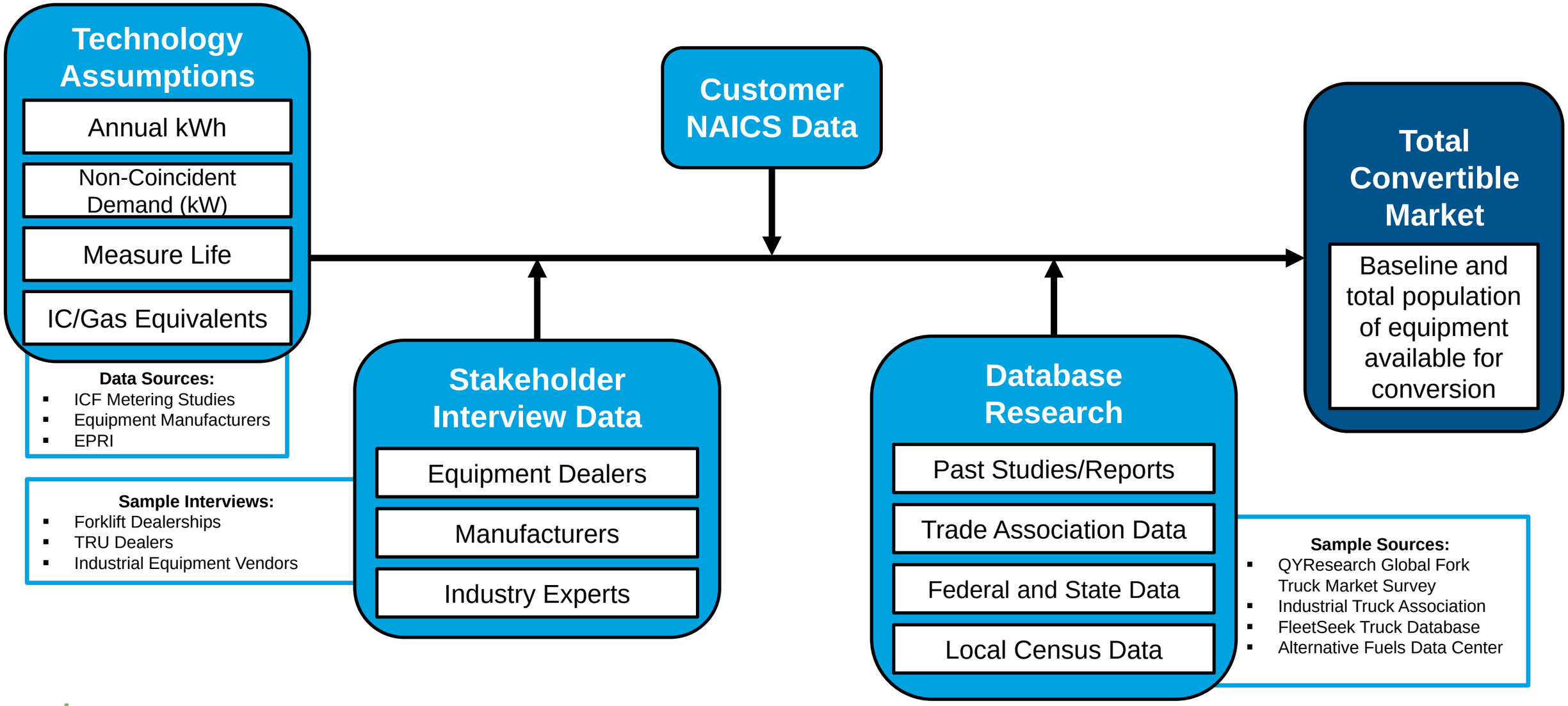
Year	Cumulative Units	Cumulative kWh	Incremental Electricity Supply Costs	Gross Incremental Revenue (AC Escalation)	Incentives	Program Overhead	Gross RIM Costs	Gross RIM Benefits	Gross Incremental Margin
1	85	2,329,060	$122,481	$239,486	$235,700	$494,322	$828,007	$191,589	($636,419)
2	256	7,385,180	$418,536	$799,004	$509,300	$363,957	$1,208,086	$639,203	($568,883)
3	485	14,024,820	$827,064	$1,583,526	$670,800	$373,510	$1,705,961	$1,266,821	($439,140)
4	771	22,252,880	$1,342,395	$2,575,665	$830,600	$385,625	$2,290,142	$2,060,532	($229,610)
5	1,057	30,480,940	$1,953,859	$3,724,826	$830,600	$398,451	$2,792,139	$2,979,861	$187,723
6	1,057	30,480,940	$2,059,581	$3,899,297			$1,647,665	$3,119,438	$1,471,773
7	1,057	30,480,940	$2,166,219	$4,078,330			$1,732,975	$3,262,664	$1,529,689
8	1,057	30,480,940	$2,270,316	$4,253,342			$1,816,253	$3,402,673	$1,586,420
9	1,057	30,480,940	$2,305,953	$4,315,431			$1,844,762	$3,452,345	$1,607,583
10	1,057	30,480,940	$2,346,346	$4,388,805			$1,877,076	$3,511,044	$1,633,967
11	1,045	29,880,940	$2,290,240	$4,322,958			$1,832,192	$3,458,366	$1,626,174
12	1,019	28,550,940	$2,120,683	$4,096,763			$1,696,547	$3,277,410	$1,580,864
13	916	25,119,640	$1,825,597	$3,618,431			$1,460,477	$2,894,745	$1,434,267
14	737	19,569,040	$1,366,821	$2,833,423			$1,093,457	$2,266,739	$1,173,282
15	511	12,855,740	$806,386	$1,810,438			$645,108	$1,448,350	$803,242
16	283	7,204,840	$506,374	$1,053,013			$405,099	$842,410	$437,311
17	54	1,253,940	$159,224	$229,944			$127,379	$183,956	$56,576
18	53	953,940	$120,383	$181,441			$96,307	$145,153	$48,846
19	52	653,940	$79,134	$129,712			$63,307	$103,770	$40,462
20	51	353,940	$36,565	$76,504			$29,252	$61,203	$31,952
21	47	326,180	$34,468	$72,117			$27,574	$57,694	$30,119
22	39	270,660	$29,256	$61,211			$23,405	$48,969	$25,565
23	28	194,320	$21,181	$44,317			$16,945	$35,454	$18,509
24	14	97,160	$10,681	$22,348			$8,545	$17,878	$9,333



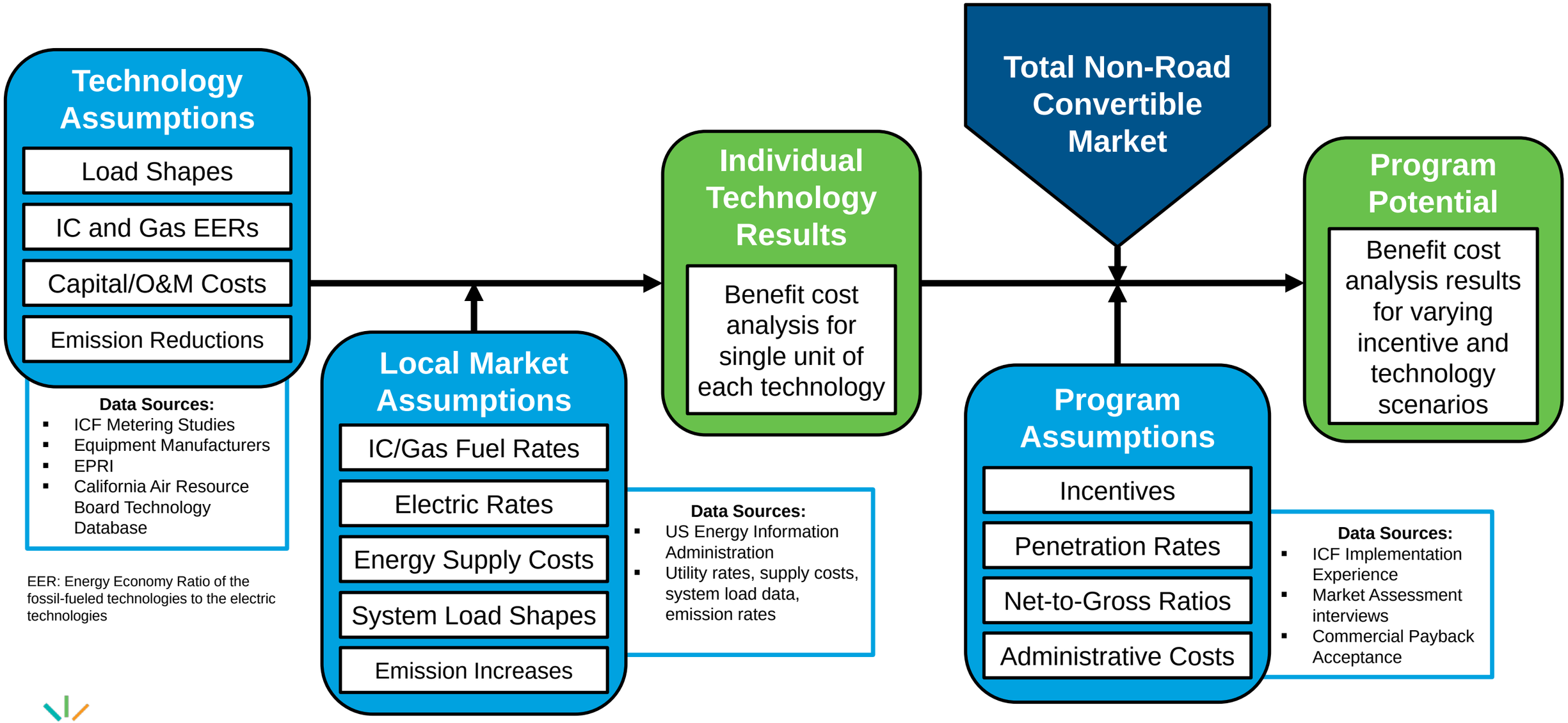
Non-Road Electrification Assessment Appendix

- Process Overview
- Market Assessment
- Cost Benefit Analysis Assumptions
- Individual Technology Cost Benefit Analysis Results
- Program Cost Benefit Analysis Results

BE Market Assessment Process: Non-Road



Benefit Costs Analysis Process



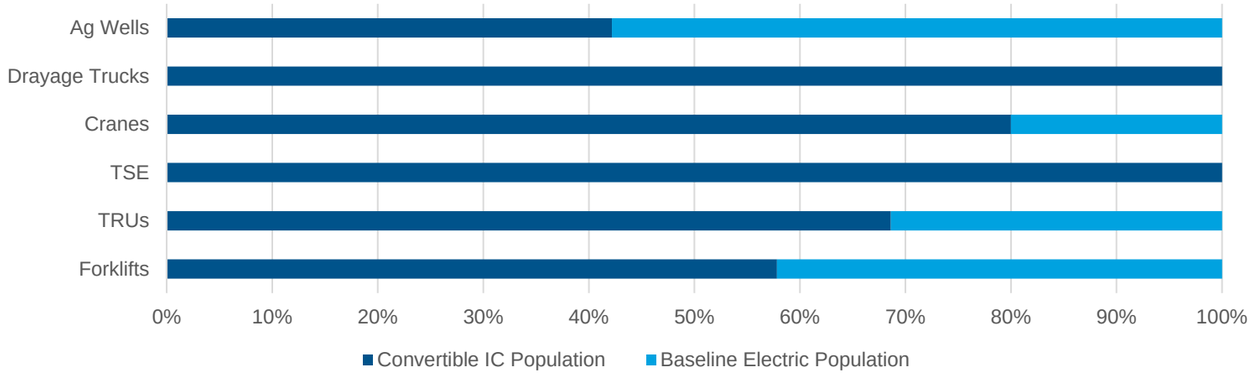
NON-ROAD MARKET ASSESSMENT

Market Assessment: Non-Road

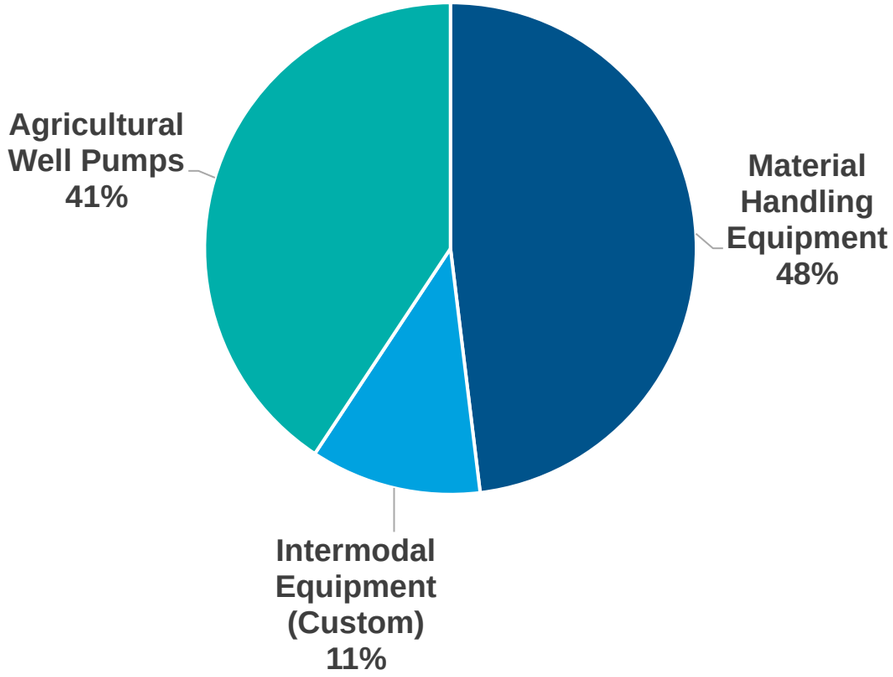
	Existing Convertible Population
	Units
Material Handling Equipment	**2,243**
Forklift - Conven.	770
Forklift - Rapid	250
TRU - Box	429
TRU - Trailer	277
TSE	517
Intermodal Equipment (Custom)	**135**
Cranes	8
Drayage Trucks - Conven.	95
Drayage Trucks - Rapid	32
Agricultural Well Pumps	**704**
Ag. Well Pumps	704
TOTAL	**3,082**

Confidential

Existing Electric Population



Liberty Utilities Convertible Market Load Growth Potential By Industry

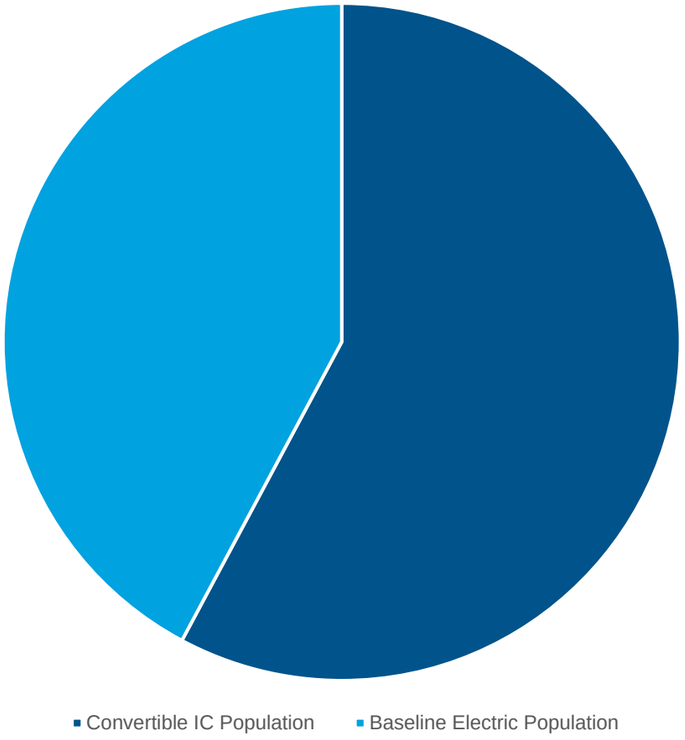


NON-ROAD MARKET ASSESSMENT

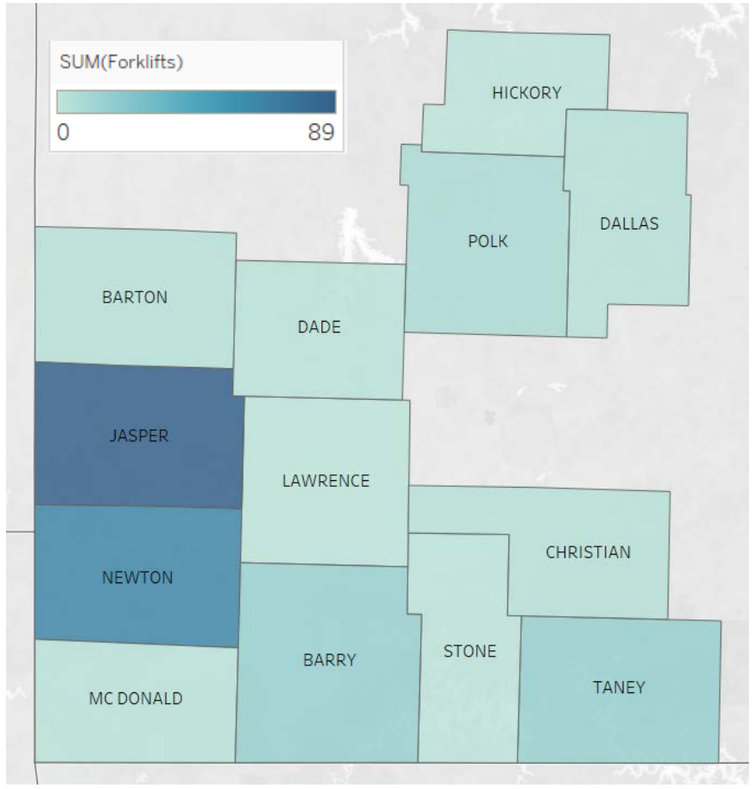
Material Handling Potential: Forklifts

	Existing Convertible Population		Baseline Electric Population	
	Units		Units	
Forklift - Conven.	770	Confidential	564	Confidential
Forklift - Rapid	250		180	

Liberty Utilities Estimated Forklift Population



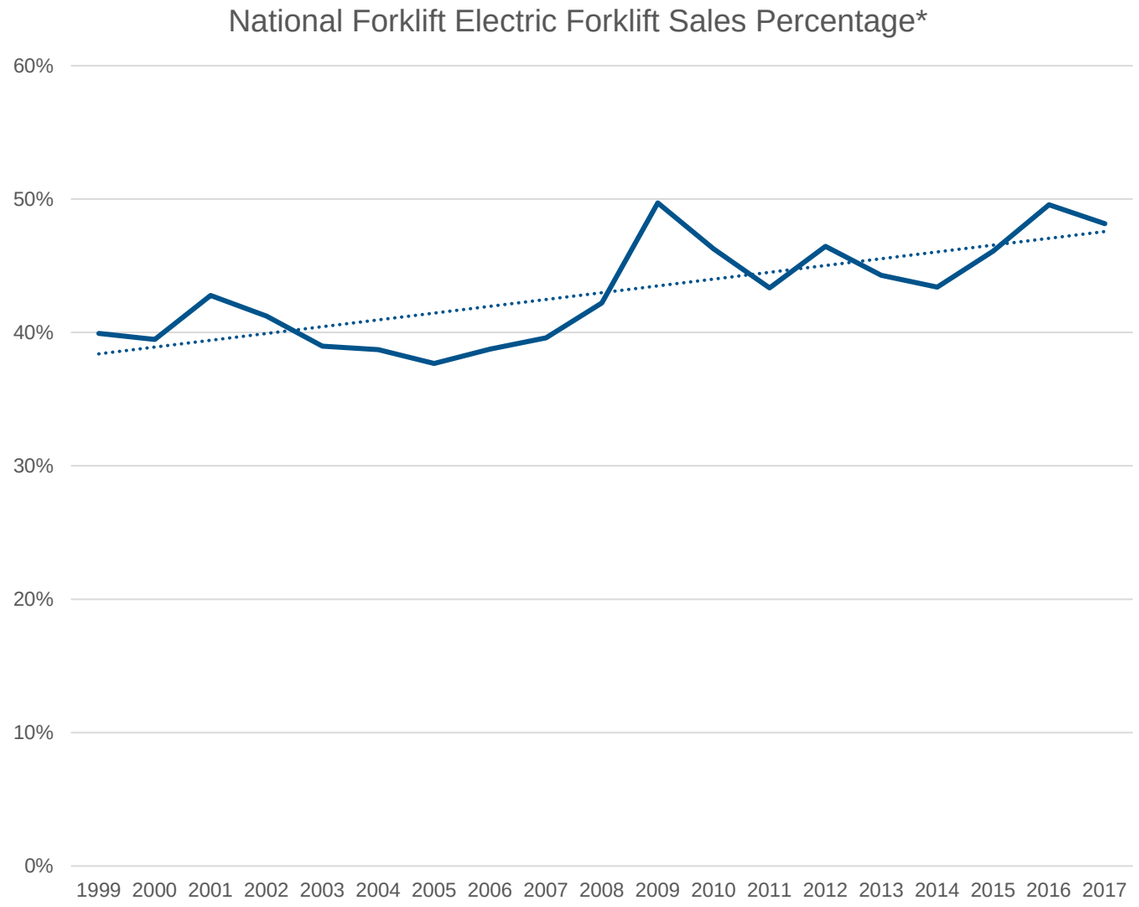
2018 Total Annual Forklift Sales By County*

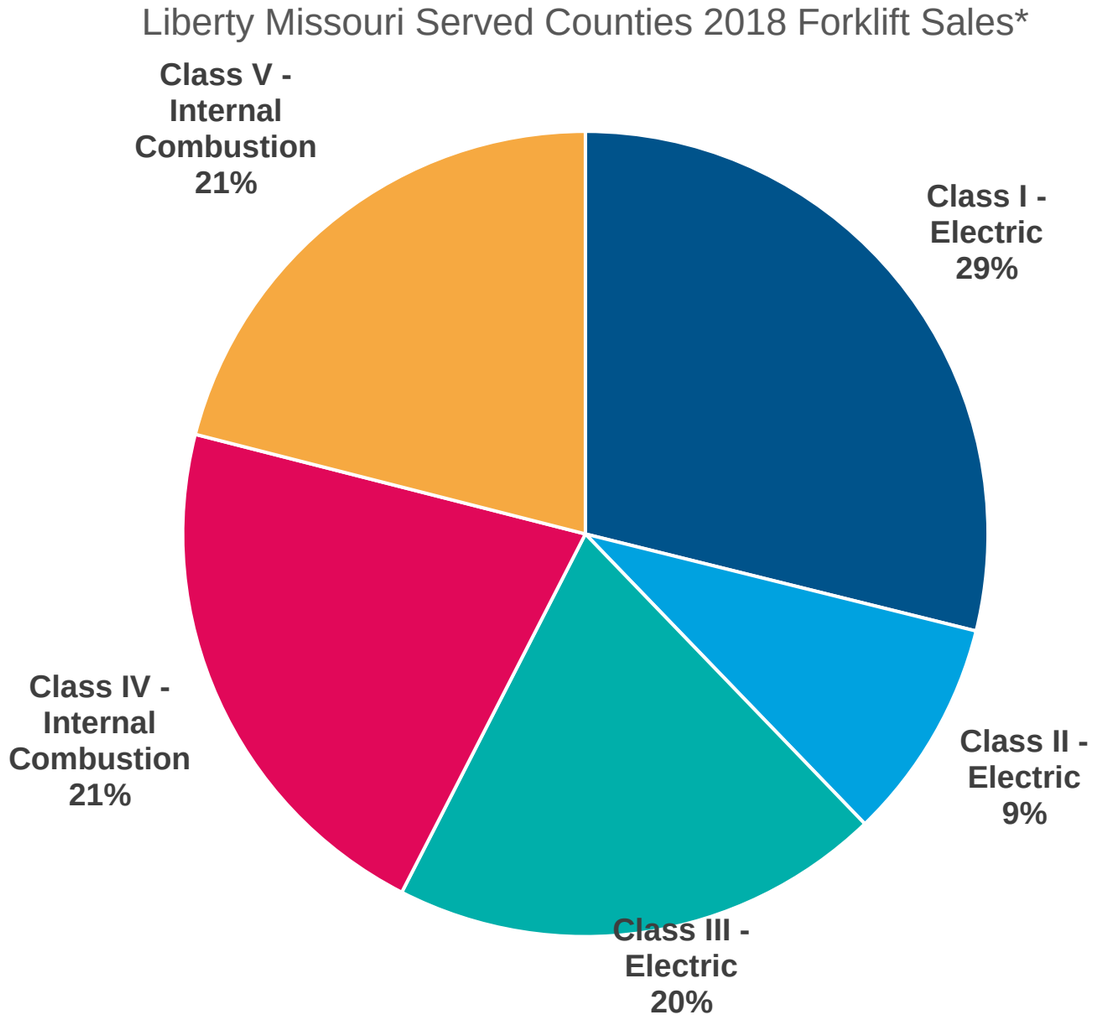


*Source: Industrial Truck Association (ITA)

NON-ROAD MARKET ASSESSMENT

Material Handling Potential: Forklifts





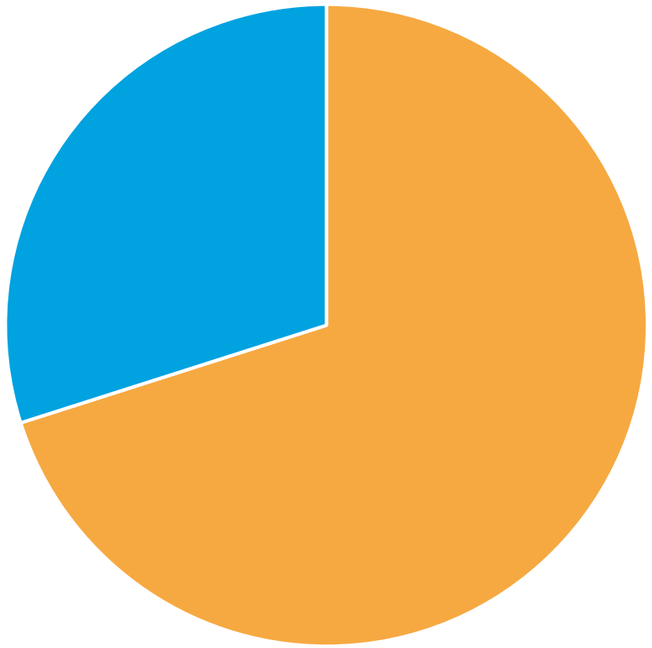
*Source: Industrial Truck Association (ITA)

NON-ROAD MARKET ASSESSMENT

Material Handling Potential: TRUs

	Existing Convertible Population		Baseline Electric Population	
	Units		Units	
TRU - Box	429	Confidential	143	Confidential
TRU - Trailer	277		31	

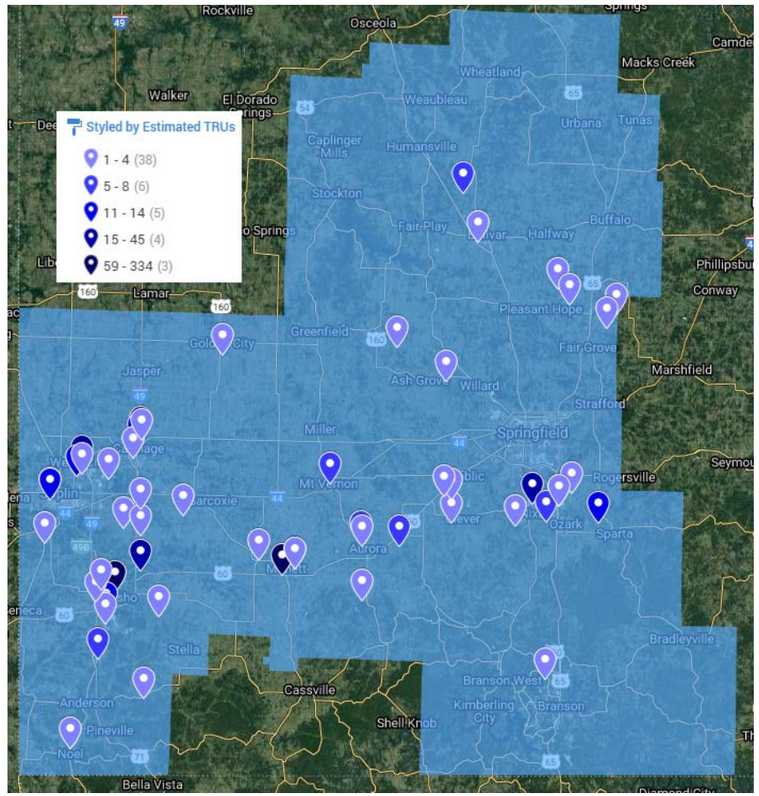
Liberty Utilities Estimated eTRU Population



Convertible IC Population Baseline Electric Population

Largest Fleets	TOTAL TRAILERS	Estimated TRUs
Confidential		

Local TRU Fleets*

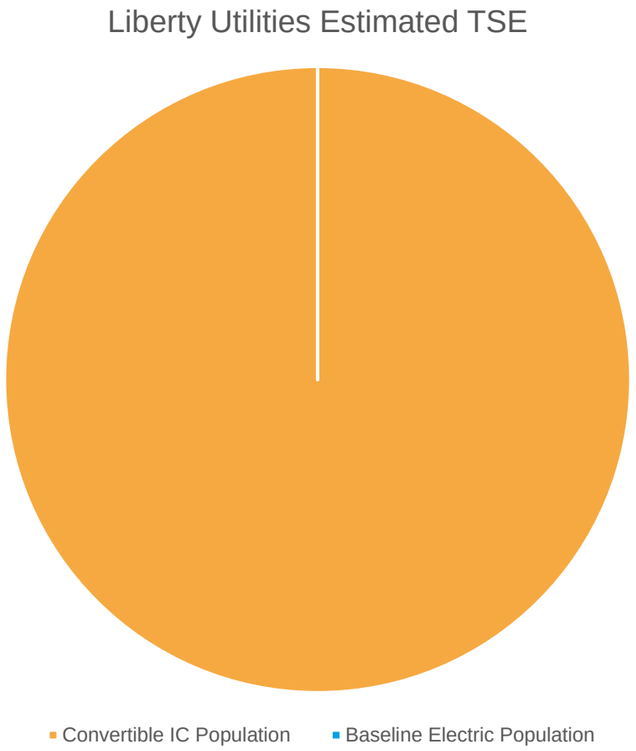


*Source: FleetSeek

NON-ROAD MARKET ASSESSMENT

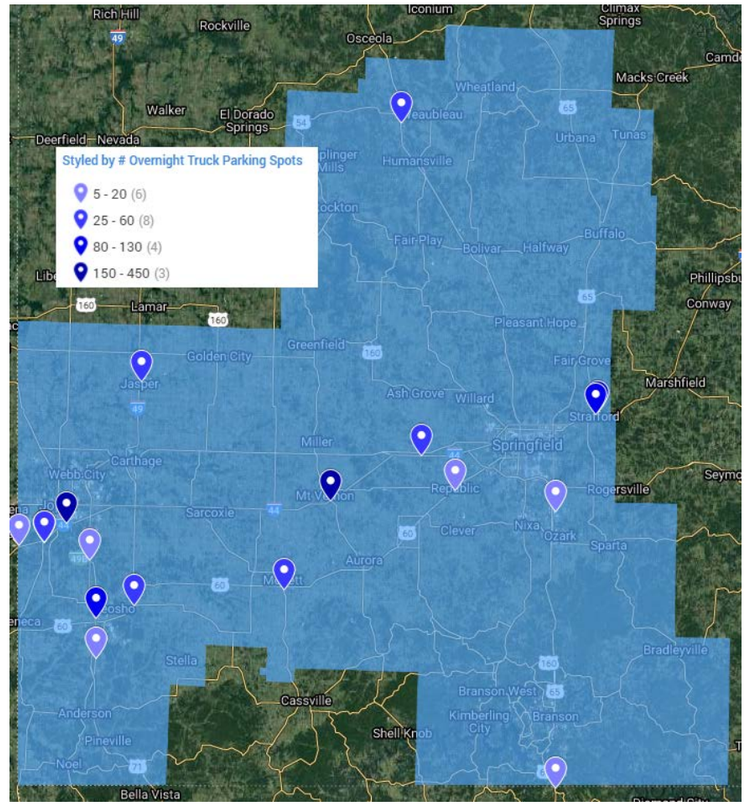
Material Handling Potential: TSE

	Existing Convertible Population		Baseline Electric Population	
	Units		Units	
TSE	517	Confidential	-	Confidential



Largest Truck Stops	Overnight Parking Spots
Joplin 44 Petro	450
Flying J Travel Center	160
Travel Centers of America	150
Springfield East Travel Center	130
Flying J Travel Center	100
Pilot Travel Center	90
Love's Travel Stop	80
Love's Travel Stop	80
Hood's Service Center	60
Pilot Travel Center	60

Local Truck Stops*



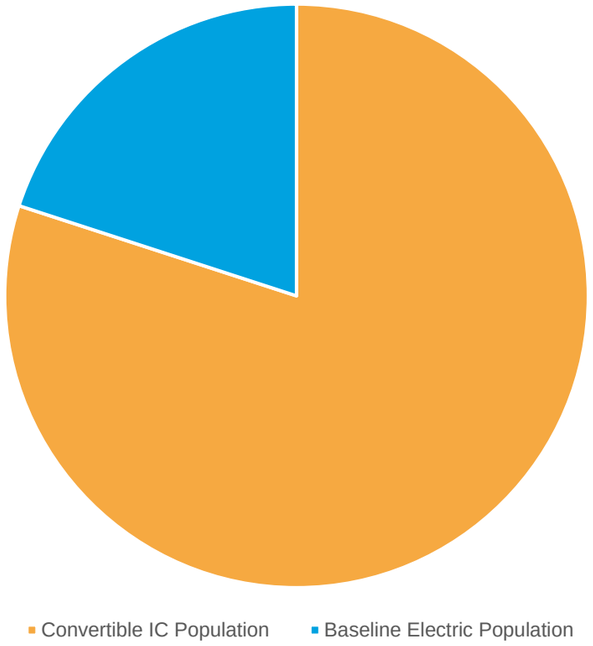
*Source: Truck Stop Info Plus

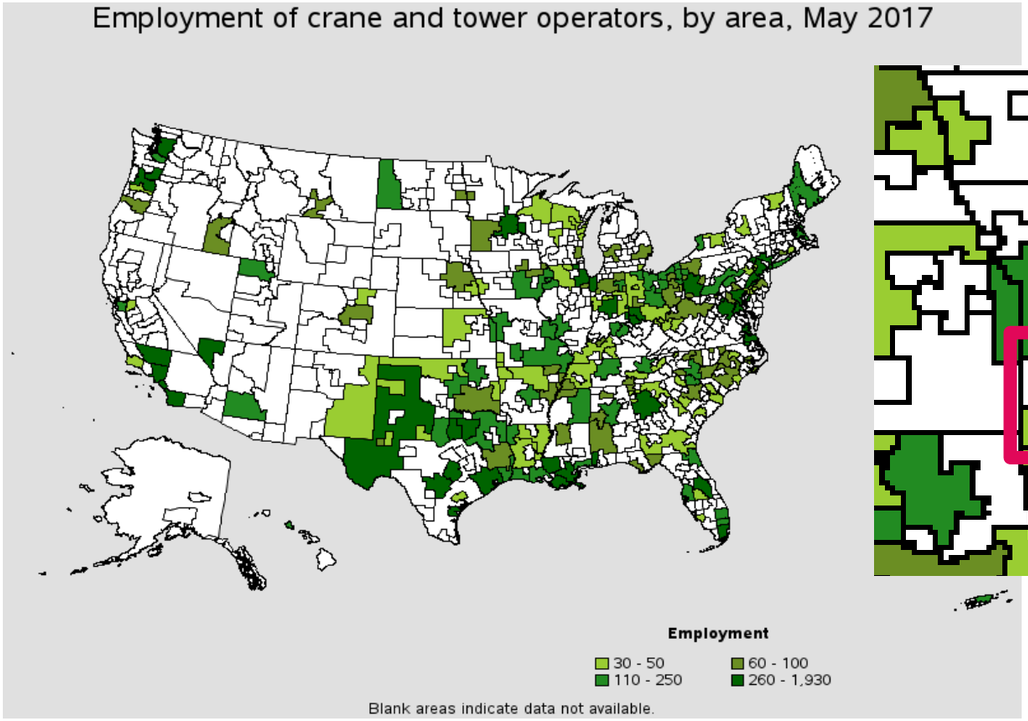
NON-ROAD MARKET ASSESSMENT

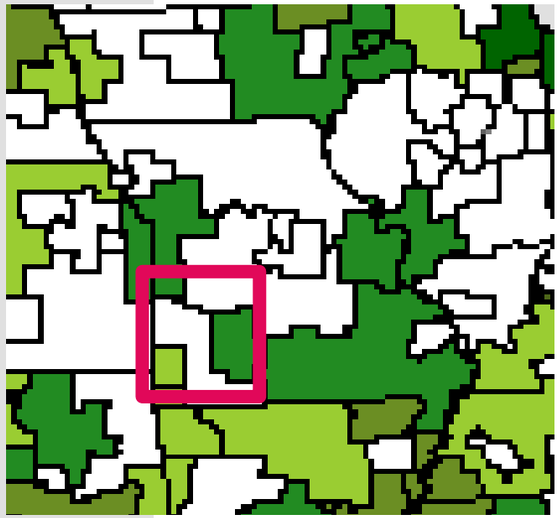
Intermodal Equipment Potential

	Existing Convertible Population		Baseline Electric Population	
	Units		Units	
Intermodal Equipment (Custom)	**135**	Confidential	**2**	Confidential
Cranes	8		2	
Drayage Trucks - Conven.	95		-	
Drayage Trucks - Rapid	32		-	

Liberty Utilities Estimated Crane Population





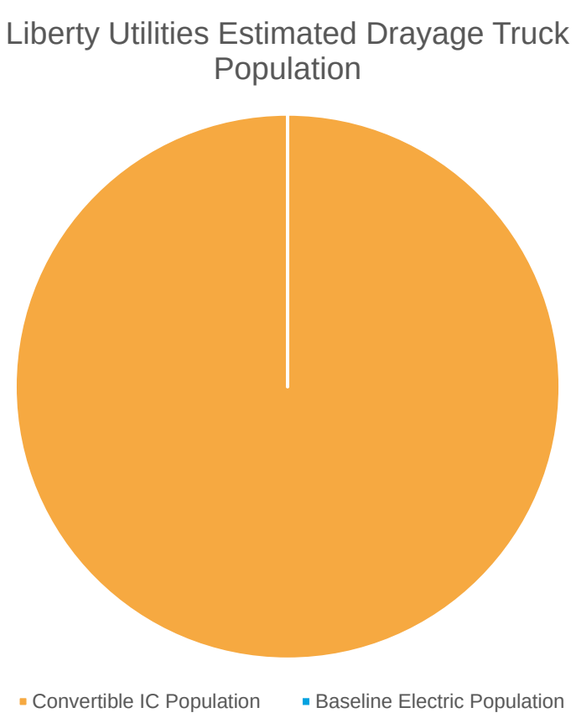


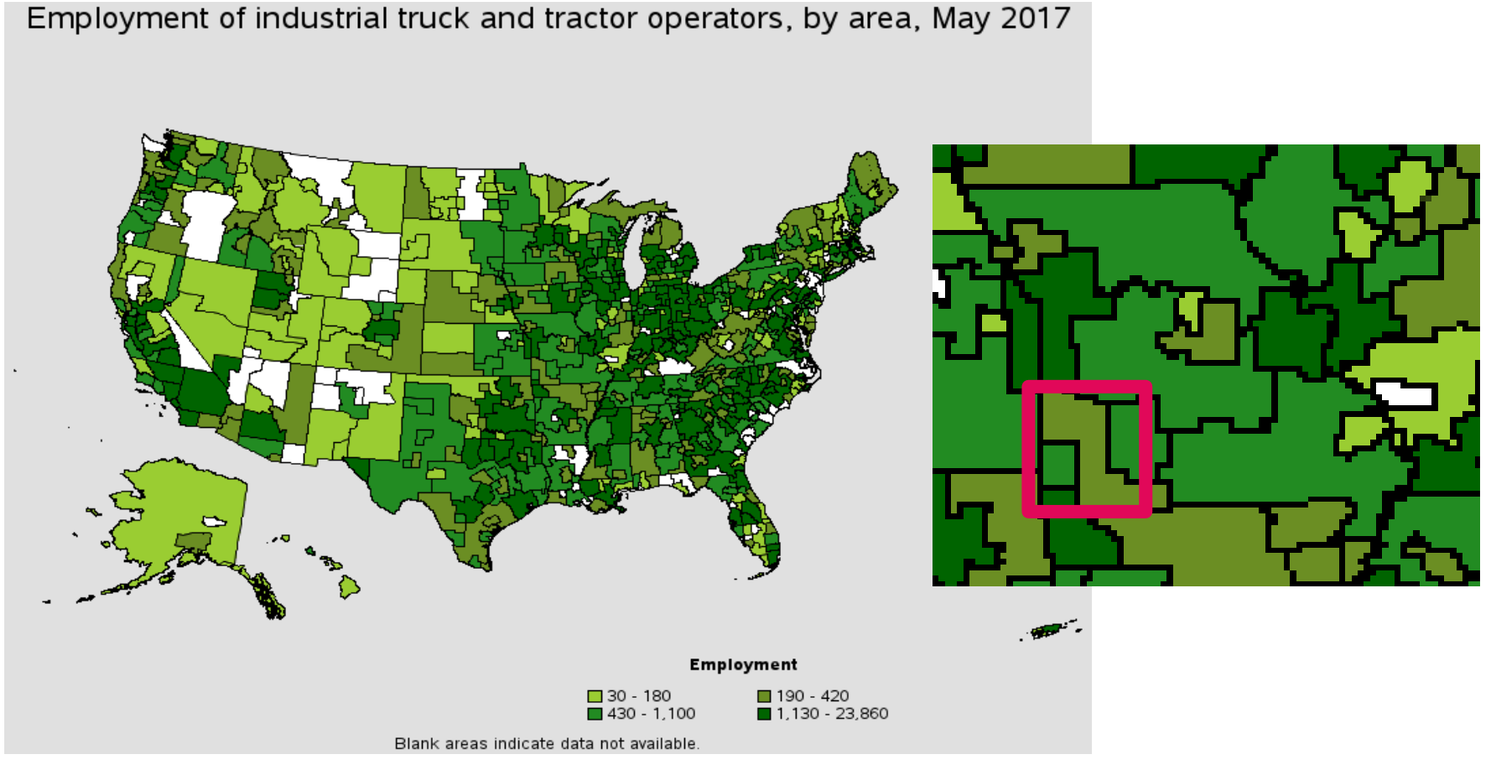
Source: Bureau of Labor Statistics

NON-ROAD MARKET ASSESSMENT

Intermodal Equipment Potential

	Existing Convertible Population		Baseline Electric Population	
	Units		Units	
Intermodal Equipment (Custom)	**135**	Confidential	**2**	Confidential
Cranes	8		2	
Drayage Trucks - Conven.	95		-	
Drayage Trucks - Rapid	32		-	





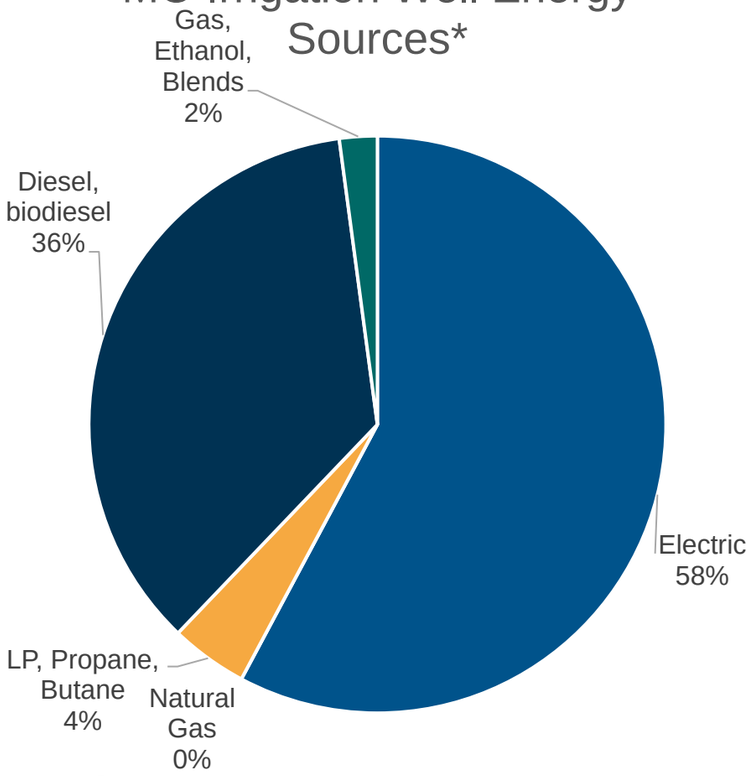
Source: Bureau of Labor Statistics

NON-ROAD MARKET ASSESSMENT

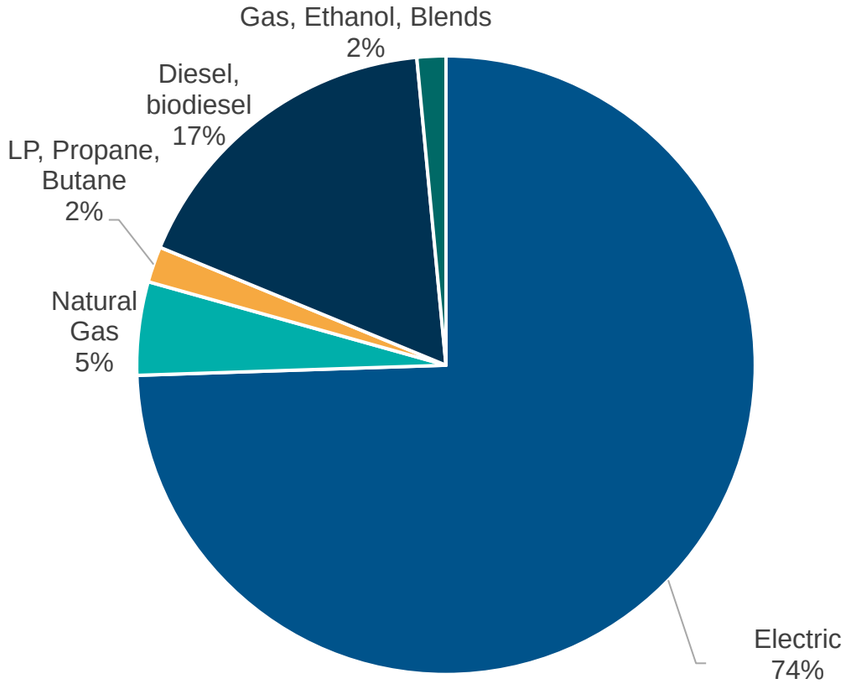
Agricultural Well Pumps Potential

	Existing Convertible Population		Baseline Electric Population	
	Units	Confidential	Units	Confidential
Ag. Well Pumps	704		965	

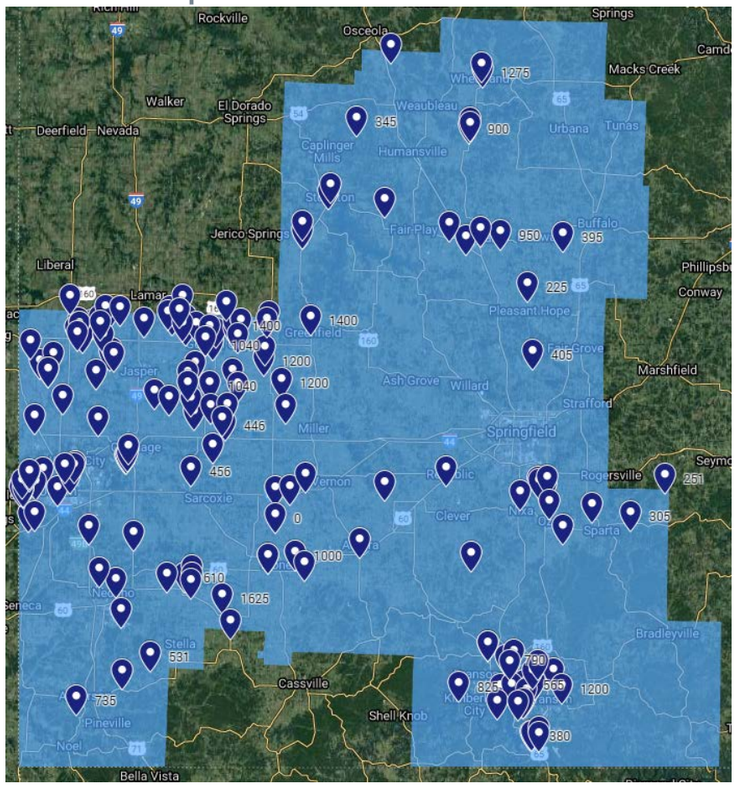
MO Irrigation Well Energy Sources*



US Irrigation Well Energy Sources*



Sample Well Distribution**



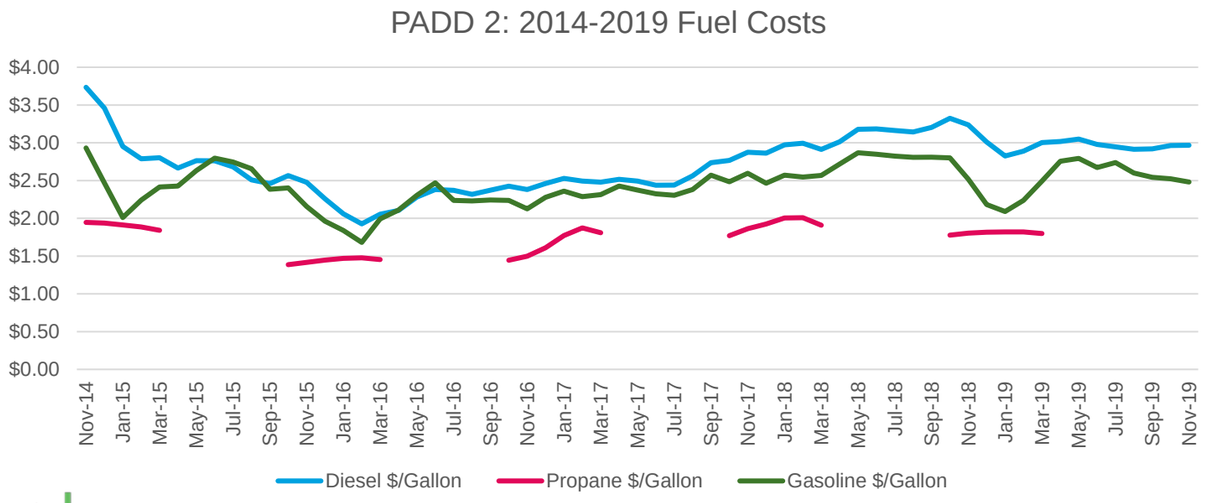
*Source: USDA Irrigation Pumping Survey Report, 2018
**Source: Missouri Department of Natural Resources https://dnr.mo.gov/geology/wrc/

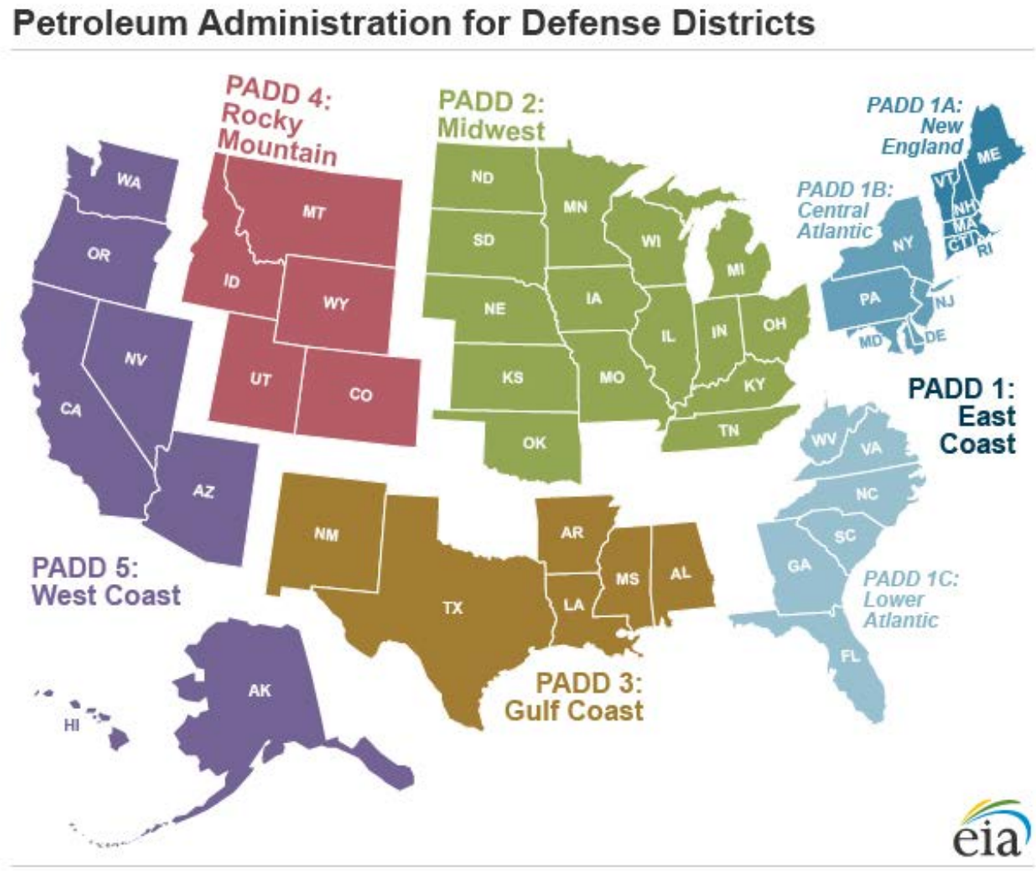
LOCAL MARKET ASSUMPTIONS

Propane, Diesel, and Gas Fuel Rates

IC Fuel Retail Rates ($/Gallon)			
	Diesel	**Propane**	**Gas**
Missouri (PADD 2: Midwest)	$2.73	$1.74	$2.44
Supply Costs (% of Fuel Rates)	40%	26%	91%
Escalation Rates	0.7%	1.5%	1.2%

Source: US EIA: Average Monthly Prices 2014-2019, Annual Energy Outlook 2019 - 2030
Supply costs based on crude oil (diesel) and wholesale (propane) prices





LOCAL MARKET ASSUMPTIONS

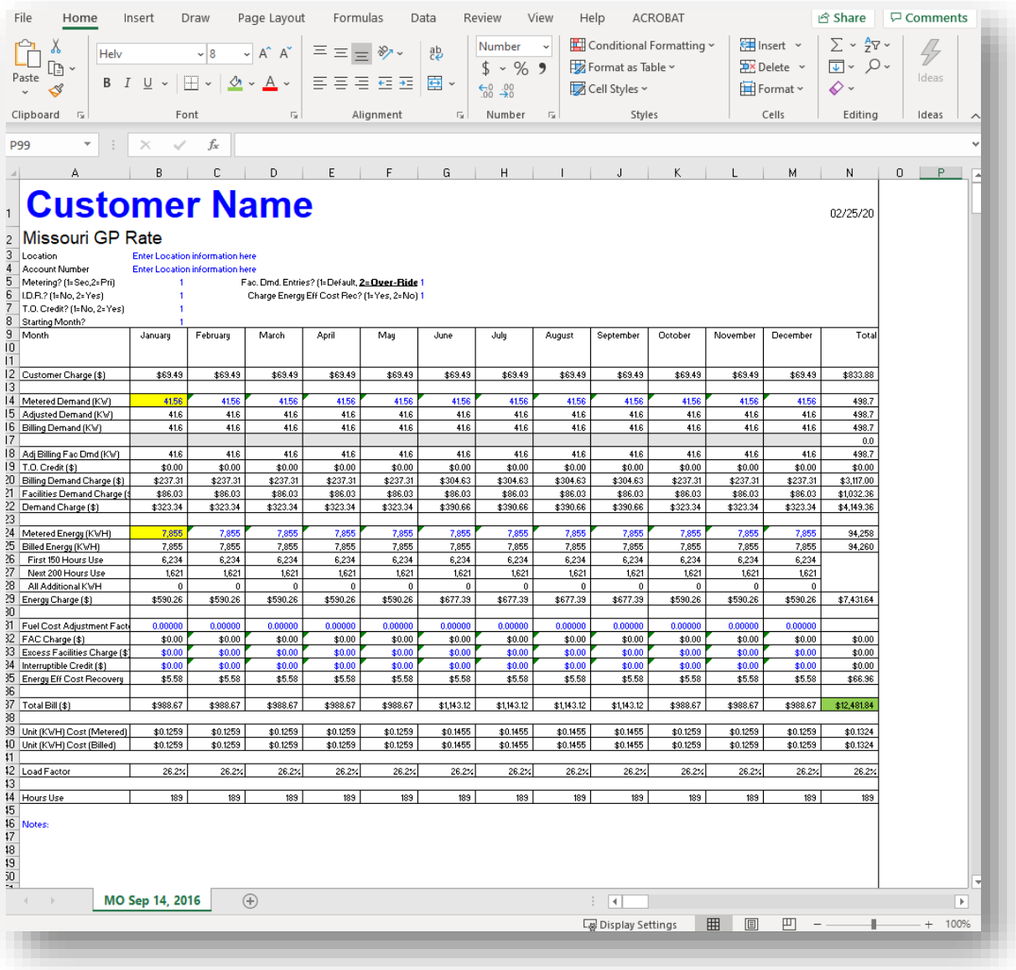
Liberty MO Electric Rates

Liberty MO provided rate calculator Excel File to estimate customer bills

Ran baseline load profiles through Commercial (GP) and Industrial (LP) rates

Ran load profiles through same rates with single unit of each technology added to calculated incremental revenue

Escalated rates across equipment lifetime in line with supply costs (see next slide)



Customer Name 02/25/20

Missouri GP Rate

Location	Enter Location information here												
Account Number	Enter Location information here												
Metering? (1=Sec,2=Pri)	1												
I.D.R.? (1=No, 2=Yes)	1												
T.O. Credit? (1=No, 2=Yes)	1												
Starting Month?	1												

Fac. Dmd. Entries? (1=Default, 2=Over-Ride) 1

Charge Energy Eff Cost Rec? (1=Yes, 2=No) 1

Month	January	February	March	April	May	June	July	August	September	October	November	December	Total
Customer Charge ($)	$69.49	$69.49	$69.49	$69.49	$69.49	$69.49	$69.49	$69.49	$69.49	$69.49	$69.49	$69.49	$833.88
Metered Demand (KW)	41.56	41.56	41.56	41.56	41.56	41.56	41.56	41.56	41.56	41.56	41.56	41.56	498.7
Adjusted Demand (KW)	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	498.7
Billing Demand (KW)	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	498.7
													0.0
Adj Billing Fac Dmd (KW)	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	41.6	498.7
T.O. Credit ($)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Billing Demand Charge ($)	$237.31	$237.31	$237.31	$237.31	$237.31	$304.63	$304.63	$304.63	$304.63	$237.31	$237.31	$237.31	$3,117.00
Facilities Demand Charge (	$86.03	$86.03	$86.03	$86.03	$86.03	$86.03	$86.03	$86.03	$86.03	$86.03	$86.03	$86.03	$1,032.36
Demand Charge ($)	$323.34	$323.34	$323.34	$323.34	$323.34	$390.66	$390.66	$390.66	$390.66	$323.34	$323.34	$323.34	$4,149.36
Metered Energy (KWH)	7,855	7,855	7,855	7,855	7,855	7,855	7,855	7,855	7,855	7,855	7,855	7,855	94,258
Billed Energy (KWH)	7,855	7,855	7,855	7,855	7,855	7,855	7,855	7,855	7,855	7,855	7,855	7,855	94,260
First 150 Hours Use	6,234	6,234	6,234	6,234	6,234	6,234	6,234	6,234	6,234	6,234	6,234	6,234	
Next 200 Hours Use	1,621	1,621	1,621	1,621	1,621	1,621	1,621	1,621	1,621	1,621	1,621	1,621	
All Additional KWH	0	0	0	0	0	0	0	0	0	0	0	0	
Energy Charge ($)	$590.26	$590.26	$590.26	$590.26	$590.26	$677.39	$677.39	$677.39	$677.39	$590.26	$590.26	$590.26	$7,431.64
Fuel Cost Adjustment Fact	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	
FAC Charge ($)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Excess Facilities Charge ($	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Interruptible Credit ($)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Energy Eff Cost Recovery	$5.58	$5.58	$5.58	$5.58	$5.58	$5.58	$5.58	$5.58	$5.58	$5.58	$5.58	$5.58	$66.96
Total Bill ($)	$988.67	$988.67	$988.67	$988.67	$988.67	$1,143.12	$1,143.12	$1,143.12	$1,143.12	$988.67	$988.67	$988.67	$12,481.84
Unit (KWH) Cost (Metered)	$0.1259	$0.1259	$0.1259	$0.1259	$0.1259	$0.1455	$0.1455	$0.1455	$0.1455	$0.1259	$0.1259	$0.1259	$0.1324
Unit (KWH) Cost (Billed)	$0.1259	$0.1259	$0.1259	$0.1259	$0.1259	$0.1455	$0.1455	$0.1455	$0.1455	$0.1259	$0.1259	$0.1259	$0.1324
Load Factor	26.2%	26.2%	26.2%	26.2%	26.2%	26.2%	26.2%	26.2%	26.2%	26.2%	26.2%	26.2%	26.2%
Hours Use	189	189	189	189	189	189	189	189	189	189	189	189	189

Notes:

MO Sep 14, 2016

LOCAL MARKET ASSUMPTIONS

Liberty MO Electric Supply Costs

System Peak

LOCAL MARKET ASSUMPTIONS

Load Profiles & System Peak

Demand

Confidential

LOCAL MARKET ASSUMPTIONS

Emission Impacts

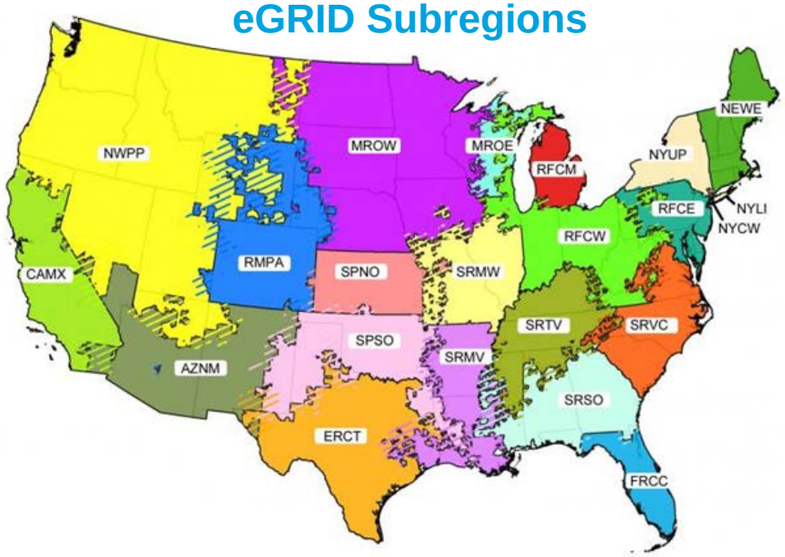
Site Emission Reductions - **Source Emission Increases** = **Net Emission Impacts**

- Technology emission reductions are determined using an energy economy ratio (EER) and NOx Emission Factor specific to each technology and fuel type
- This allows for an emission reduction estimate for an IC equivalent to electric version modeled

Sample Single Unit Calculation

Measure Name	Confidential
Annual kWh	
Propane Energy Economy Ratio	
Gallons Displaced/kWh	
NOx Emission Factor (g/bhp-hr)	
GHG Emissions (MT/kWh)	
NOx Emissions (MT/kWh)	
GHG Emissions (MT)	
NOx Emissions (MT)	

eGRID Subregions



GHG Emissions SRMW (MT/kWh)	0.000848
NOx Emissions SRMW (MT/kWh)	0.0000006
GHG Emissions (MT)	22.970
NOx Emissions (MT)	0.016

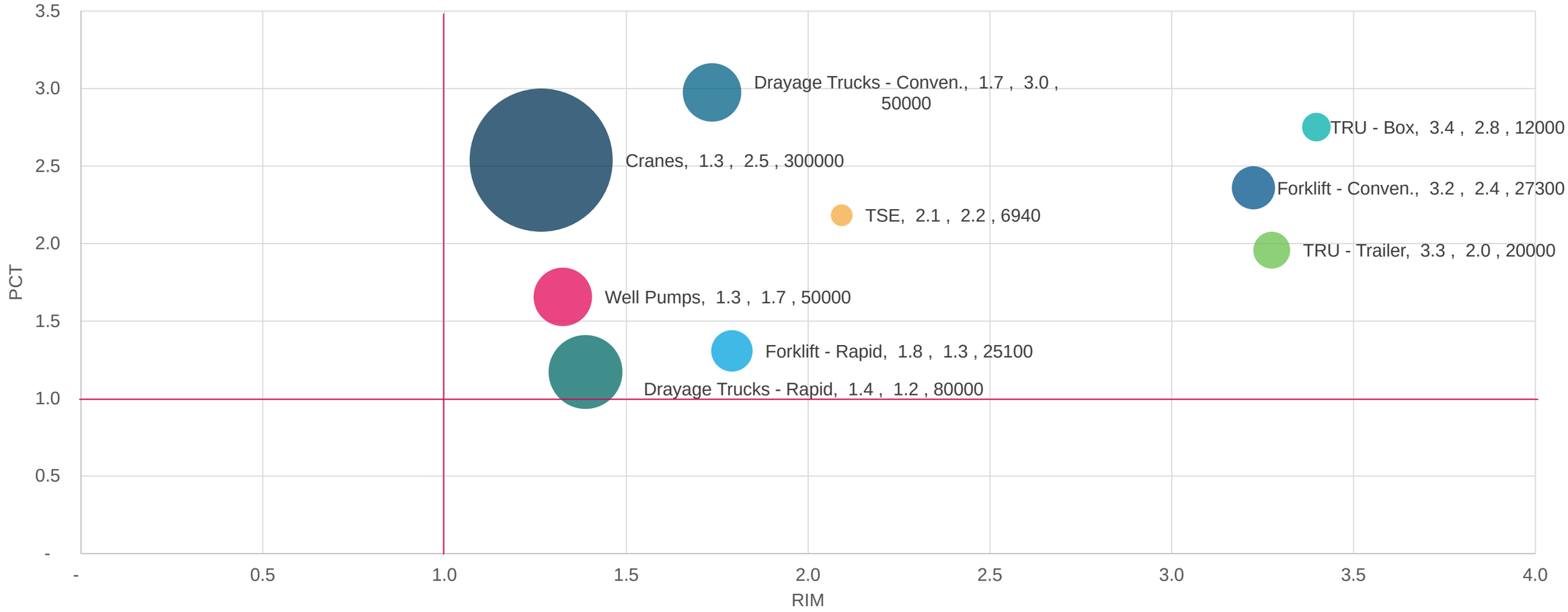
GHG Emissions (MT)	7.43
NOx Emissions (MT)	0.006

SITE EMISSION SOURCES: California Air Resource Board's Off-Road Model, EPRI
SOURCE EMISSION SOURCES: eGRID Generation Resource Mix by Subregion, Argonne GREET Model

INDIVIDUAL TECHNOLOGY RESULTS

Non-Road Technologies (Single Unit, No Incentives)

Technology, RIM Score (x-axis), PCT Score (y-axis), Annual kWh (bubble size)



Individual Technology CBA Results: Non-Road

NO INCENTIVES									
Benefit Cost Ratio	**Forklift - Conven.**	**Forklift - Rapid**	**TRU - Box**	**TRU - Trailer**	**TSE**	**Well Pumps**	**Cranes**	**Drayage Trucks - Conven.**	**Drayage Trucks - Rapid**
RIM	3.22	1.79	3.40	3.28	2.09	1.33	1.27	1.74	1.39
PCT	2.36	1.31	2.75	1.96	2.18	1.66	2.54	2.97	1.17
mTRC	1.60	0.67	2.62	1.37	1.73	1.46	1.98	2.78	0.87
Net Benefit									
RIM	$13,615	$14,942	$5,823	$9,208	$6,065	$13,767	$74,139	$12,640	$27,459
PCT	$32,030	$12,097	$16,510	$21,447	$18,063	$38,093	$805,361	$87,813	$24,215
mTRC	$7,053	($8,815)	$7,114	$5,356	$7,625	$21,123	$451,493	$59,339	($14,999)
INCENTIVE	$0	$0	$0	$0	$0	$0	$0	$0	$0

LOW INCENTIVES									
Benefit Cost Ratio	**Forklift - Conven.**	**Forklift - Rapid**	**TRU - Box**	**TRU - Trailer**	**TSE**	**Well Pumps**	**Cranes**	**Drayage Trucks - Conven.**	**Drayage Trucks - Rapid**
RIM	2.91	1.73	3.05	2.57	1.87	1.30	1.24	1.65	1.36
PCT	2.39	1.32	2.78	2.01	2.22	2.11	2.55	3.00	1.18
mTRC	1.60	0.67	2.62	1.37	1.73	1.81	1.98	2.78	0.87
Net Benefit									
RIM	$12,963	$14,290	$5,544	$8,090	$5,413	$14,147	$68,549	$11,708	$25,968
PCT	$32,666	$12,734	$16,782	$22,538	$18,699	$67,105	$810,815	$88,722	$25,669
mTRC	$7,053	($8,815)	$7,114	$5,356	$7,625	$38,077	$451,493	$59,339	($14,999)
INCENTIVE	$700	$700	$300	$1,200	$700	$1,000	$6,000	$1,000	$1,600

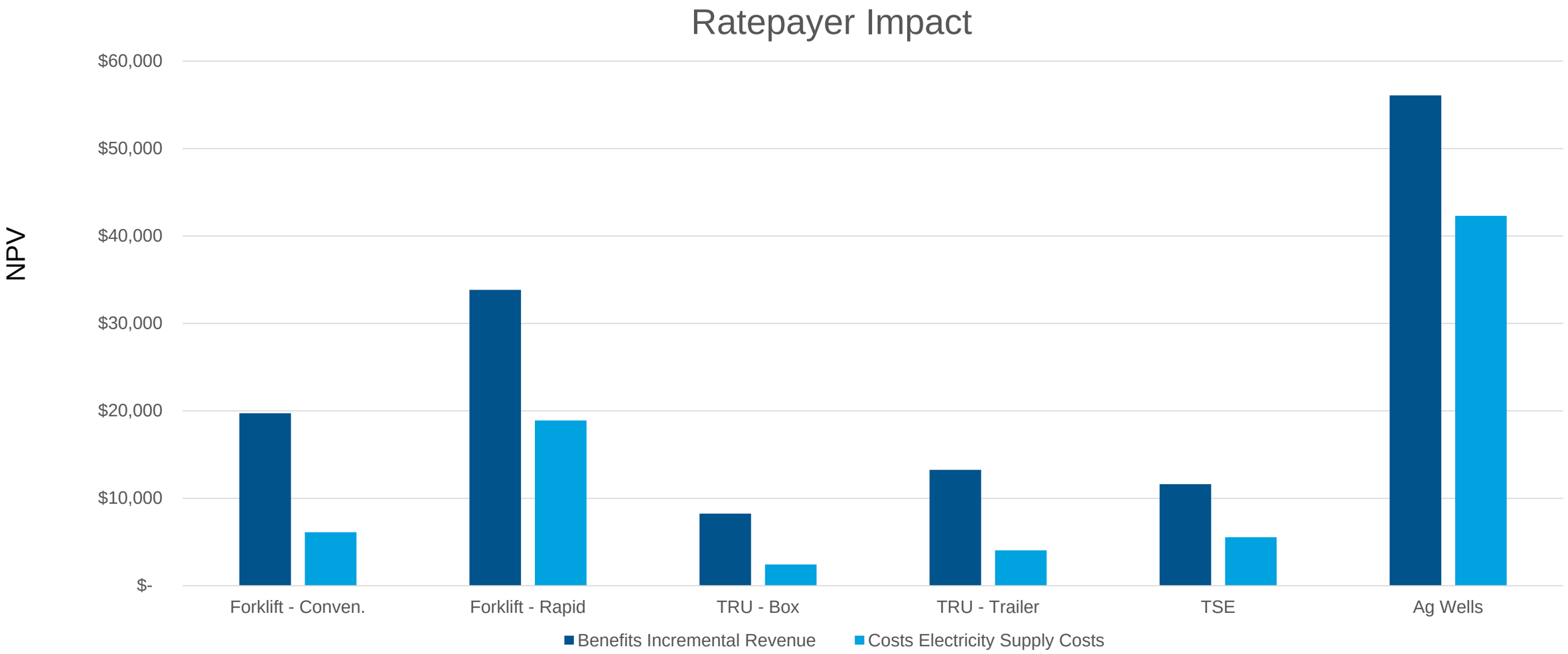
Individual Technology CBA Results: Non-Road

	MEDIUM INCENTIVES								
Benefit Cost Ratio	**Forklift - Conven.**	**Forklift - Rapid**	**TRU - Box**	**TRU - Trailer**	**TSE**	**Well Pumps**	**Cranes**	**Drayage Trucks - Conven.**	**Drayage Trucks - Rapid**
RIM	2.34	1.59	2.53	1.67	1.51	1.20	1.15	1.37	1.26
PCT	2.46	1.37	2.84	2.13	2.32	2.17	2.59	3.08	1.22
mTRC	1.60	0.67	2.62	1.37	1.73	1.81	1.98	2.78	0.87
Net Benefit									
RIM	$11,286	$12,613	$4,985	$5,295	$3,922	$10,420	$46,188	$7,982	$20,005
PCT	$34,302	$14,370	$17,328	$25,265	$20,154	$70,742	$832,633	$92,359	$31,488
mTRC	$7,053	($8,815)	$7,114	$5,356	$7,625	$38,077	$451,493	$59,339	($14,999)
INCENTIVE	$2,500	$2,500	$900	$4,200	$2,300	$5,000	$30,000	$5,000	$8,000

	HIGH INCENTIVES								
Benefit Cost Ratio	**Forklift - Conven.**	**Forklift - Rapid**	**TRU - Box**	**TRU - Trailer**	**TSE**	**Well Pumps**	**Cranes**	**Drayage Trucks - Conven.**	**Drayage Trucks - Rapid**
RIM	2.08	1.52	2.27	1.38	1.35	1.06	1.01	1.03	1.10
PCT	2.50	1.39	2.88	2.20	2.38	2.28	2.67	3.23	1.30
mTRC	1.60	0.67	2.62	1.37	1.73	1.81	1.98	2.78	0.87
Net Benefit									
RIM	$10,261	$11,588	$4,612	$3,618	$2,991	$3,432	$4,261	$994	$8,825
PCT	$35,302	$15,370	$17,692	$26,901	$21,063	$77,560	$873,542	$99,177	$42,397
mTRC	$7,053	($8,815)	$7,114	$5,356	$7,625	$38,077	$451,493	$59,339	($14,999)
INCENTIVE	$3,600	$3,600	$1,300	$6,000	$3,300	$12,500	$75,000	$12,500	$20,000

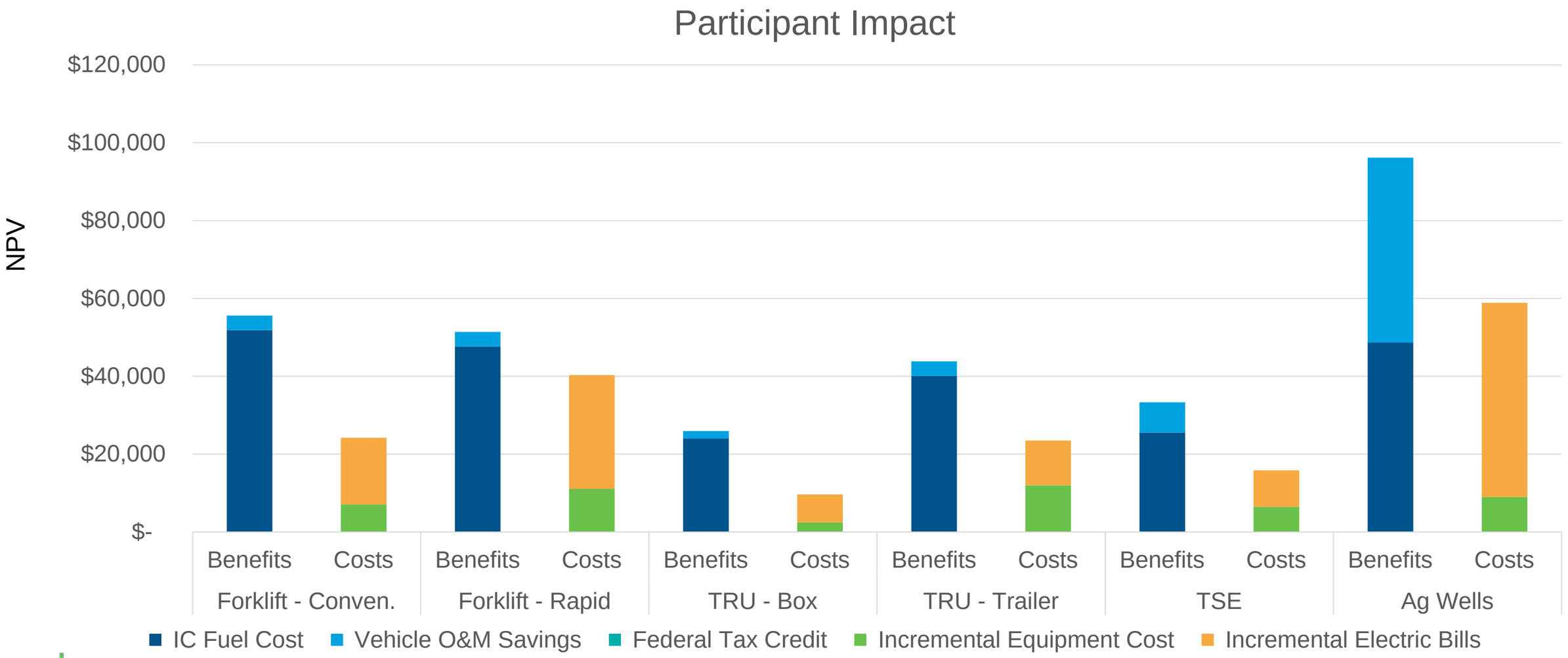
INDIVIDUAL TECHNOLOGY CBA RESULTS

Non-Road Technologies: No Incentives



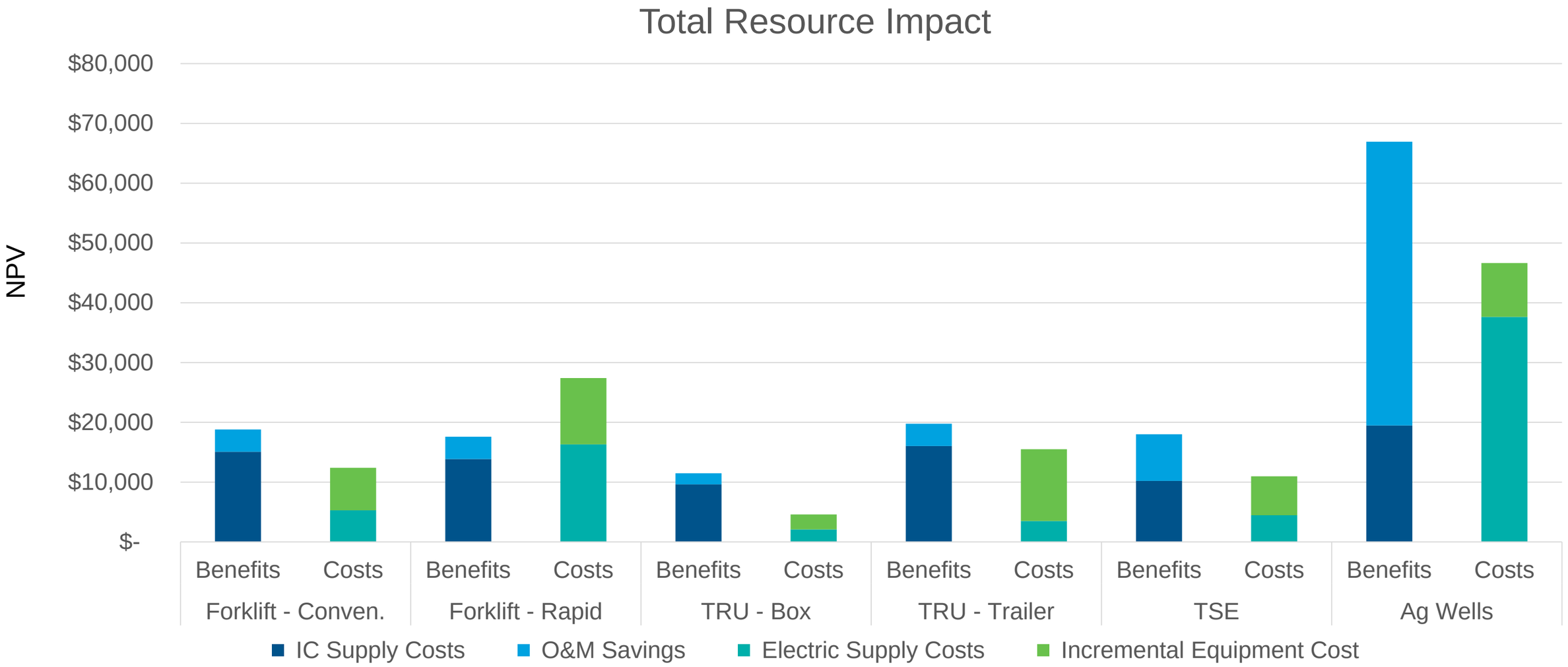
INDIVIDUAL TECHNOLOGY CBA RESULTS

Non-Road Technologies: No Incentives



INDIVIDUAL TECHNOLOGY CBA RESULTS

Non-Road Technologies: No Incentives



Key Assumptions

CATEGORY	DATA	SOURCE
General CBA Assumptions	RIM and TRC Discount Rate	Liberty Provided
	Line Loss Factor	Liberty Provided
	Reserve Margin Factor	Liberty Provided
	Participant Discount Rate	ICF Planning Assumption (10%)
	Fossil Fuel Escalation Rates (Diesel, Propane)	US EIA Annual Energy Outlook 2018 - 2030
	O&M Savings Escalation rate	ICF Planning Assumption (2%)
	Net-to-Gross Ratio	ICF Planning Assumption (80%)
	Program Implementation Cost Estimates	ICF Planning Assumption
	Customer Payback Acceptance Curve	ICF Planning Assumption
	Program Ramp Up Penetration	ICF Planning Assumption
Emissions	Technology Emission Reductions	ICF Technology Library, CA Air Resource Board
	Source Emissions Increases	Argonne GREET Model, eGRID Generation Resource Mix by Subregion
IC Fuel Costs	Fossil Fuel Prices	US EIA Petroleum & Other Liquid Fuel Prices
	Fossil Gross Margins	US EIA Petroleum & Other Liquid Fuel Prices
Load Shapes	Technology Weekday Load Shapes	ICF Technology Library (metering studies, manufacturer interviews, program implementation data)
	Electric Rates	Liberty Provided
	System Load Shape	Liberty Provided
Supply Costs	Electric Supply Costs ($/kWh)	Liberty Provided
	Electric Capacity Cost ($/kW)	Liberty Provided
	Electric T&D Cost ($/kW)	Liberty Provided
	Inflation Rates	Liberty Provided

*ICF Technology Library Sources: Metering Studies, Manufacturer Interviews, Vendor Spec Sheets, Technical Papers, Internal Expert Interviews

Benefit Costs Analysis Tests

Benefit Cost Tests	Key Question Asked	Benefits	Costs
Ratepayer Impact Measure (RIM)	Will utility rates increase?	▪ Incremental Revenue	▪ Program Incentives ▪ Program Overhead ▪ Incremental Electricity Supply Costs
Participant (PCT)	Will participants benefit over the measure life?	▪ Incentives ▪ Fuel Savings ▪ O&M Savings	▪ Incremental Equipment Costs ▪ Incremental Electric Bills
Modified Total Resource Cost (mTRC)	Will the total cost of energy in the utility service territory decrease?	▪ Net Participants O&M Savings ▪ Net Participants IC (Propane, Diesel, and Natural Gas) Energy Supply Costs	▪ Net Participants Electric Supply Costs ▪ Net Participants Incremental Capital Costs ▪ Program Overhead ▪ Program Incentives Paid to “Free Riders”

NON-ROAD PROGRAM ASSUMPTIONS

Incentives & Penetration Rates

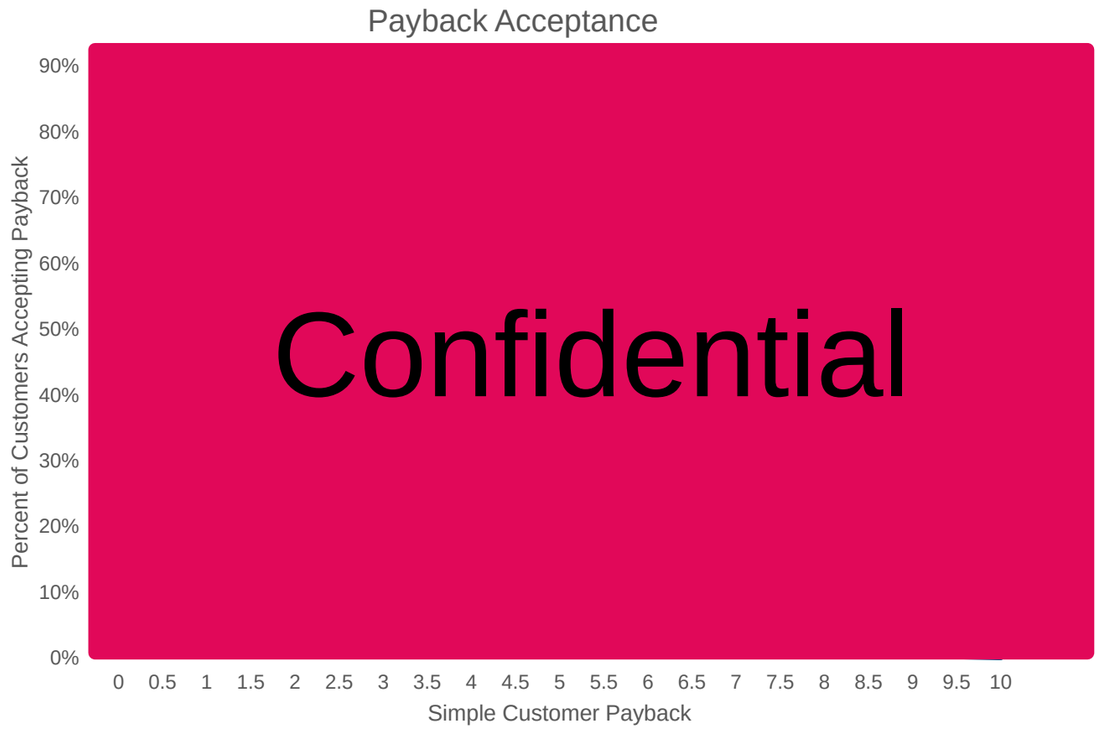
Incentives are based on:

- Market assessment feedback
- Implementation experience
- Incremental capital cost

Penetration rates factor in:

- Implementation experience
- Incremental cost of annual sales
- Payback acceptance
- 3-year program ramp up

$$\text{Simple Customer Payback} = \frac{\text{Incremental Capital Cost (- Incentives)}}{\text{Annual Maintenance Savings + Annual Fuel Savings}}$$



NON-ROAD PROGRAM ASSUMPTIONS

Incentives & Penetration Rates

Impact of Incentive on Customer Simple Payback

Simple Payback (% of Customer Adopting at Program Maturity)

Technology	Incentive Type	Incentive Levels			Updated Customer Payback			
		Low Incentive	Medium Incentive	High Incentive	No Incentive	Low Incentive	Medium Incentive	High Incentive
Forklift - Conven.	Prescriptive	$700	$2,500	$3,600	1.27	1.15	0.82	0.63
Forklift - Rapid	Prescriptive	$700	$2,500	$3,600	3.13	2.94	2.43	2.12
TRU - Box Infrastructure	Prescriptive	$300	$900	$1,300	0.90	0.79	0.57	0.43
TRU - Trailer Infrastructure	Prescriptive	$1,200	$4,200	$6,000	2.51	2.26	1.63	1.25
TSE	Prescriptive	$700	$2,300	$3,300	2.32	2.07	1.50	1.14
Well Pumps	Custom	$1,000	$5,000	$12,500	0.63	0.54	0.18	0.00
Cranes	Custom	$6,000	$30,000	$75,000	1.90	1.86	1.67	1.33
Drayage Trucks - Conven.	Custom	$1,000	$5,000	$12,500	1.19	1.13	0.89	0.45
Drayage Trucks - Rapid	Custom	$1,600	$8,000	$20,000	4.37	4.26	3.79	2.91

Custom ($/Annual kWh): Low $0.02, Medium **$0.10, High $0.25**
Prescriptive (% of Incremental Cost): Low 10%, Medium 35%, High 50%

NON-ROAD PROGRAM ASSUMPTIONS

Program Delivery

Base Program Delivery Costs

- Program Design/Startup
- Program Management
- Account Management
- IT/Analytics & Reporting
- Marketing
- Travel
- ODCs

Program Cost Scaling

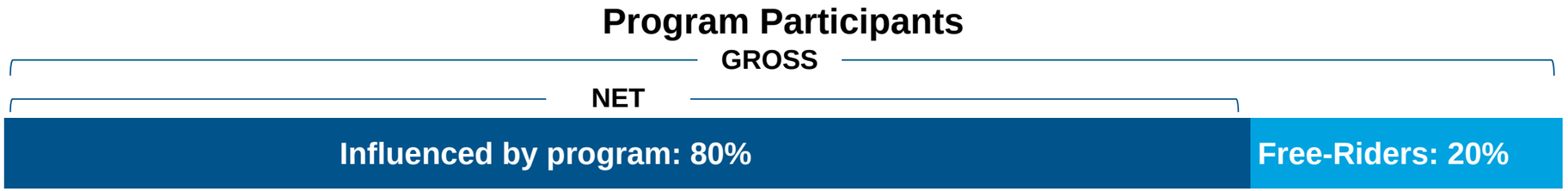
- Accounts for start up costs in year 1
- Low, medium, high program scenarios for non-road portfolio scale costs based on load (kwh) impacts

5 Year Base Program Delivery Costs

Confidential

NON-ROAD PROGRAM ASSUMPTIONS

Net-To-Gross Ratios



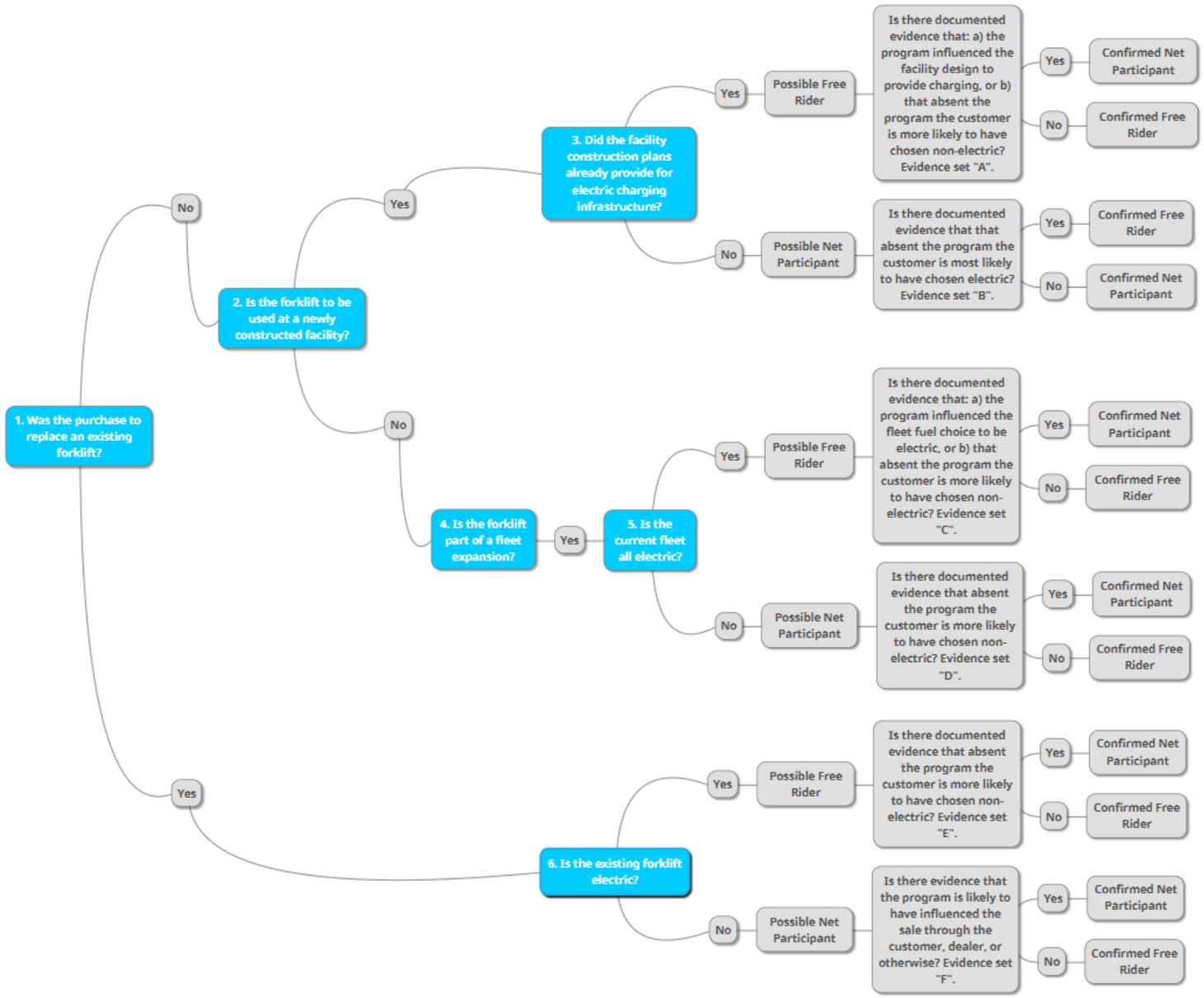
Net to Gross Ratio

- 80% default rate based on implementation experience, current market mix, and reduced free-ridership tactics

Reduced Free-Ridership Tactic Recommendations

- Electric-to-electric conversions not allowed to participate
- Applications must be submitted within certain window of invoice date
- Higher incentives for conversions (over fleet expansions/new equipment)

Sample Free Ridership Matrix



$$\frac{\text{Net (Sum of All Confirmed Net Participants)}}{\text{Gross (Sum of All Confirmed Net Participants \& Confirmed Free Riders)}} = \text{(NTG with incentives)}$$

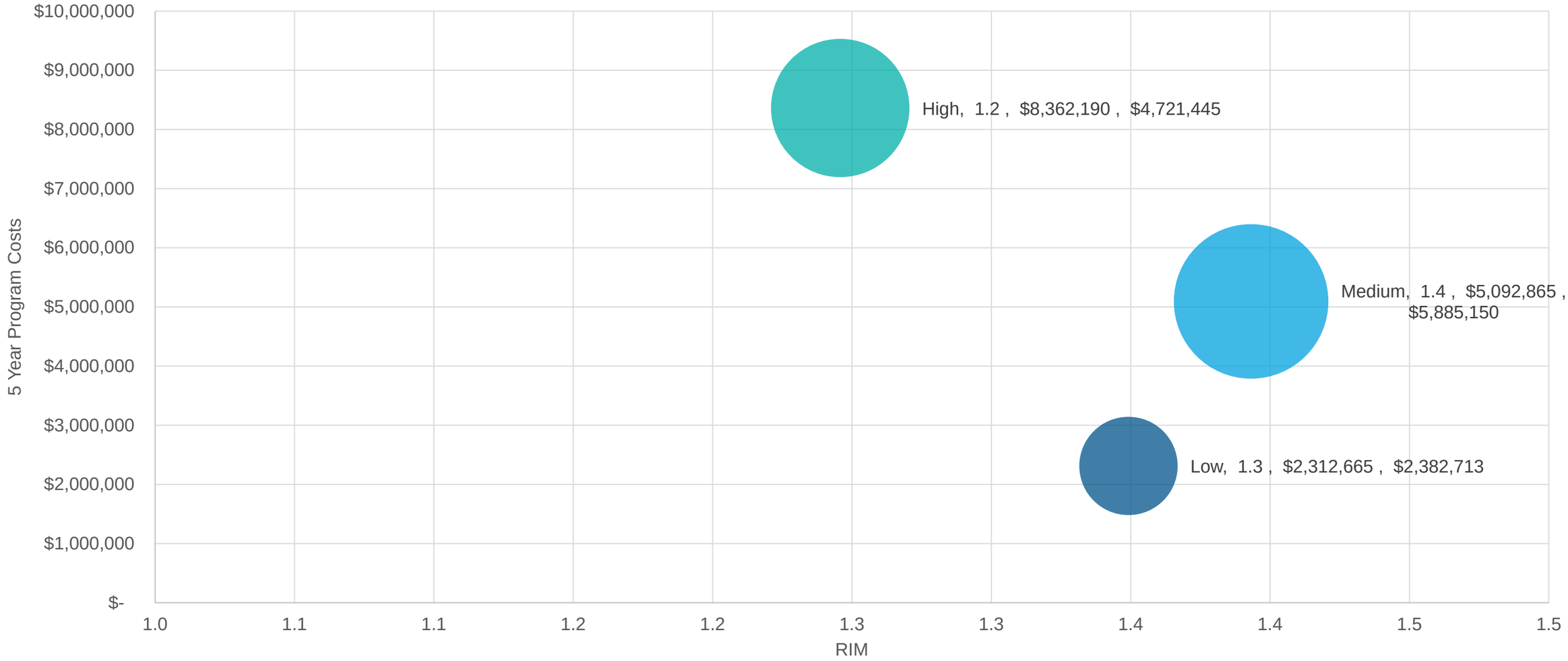
Triangulating Data

- ITA Electric share (market)
- Electric share (by dealer)
- Dealer self reports/information

NON-ROAD PROGRAM POTENTIAL

Financial Comparison of Scenarios – 5 Year Program

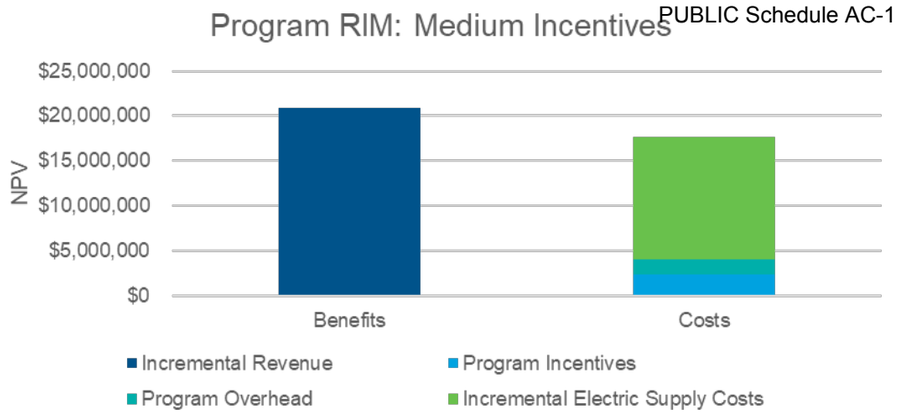
Scenario, RIM Score (x-axis), 5-Year Program Costs (y-axis), NPV RIM Net Benefit (bubble size)

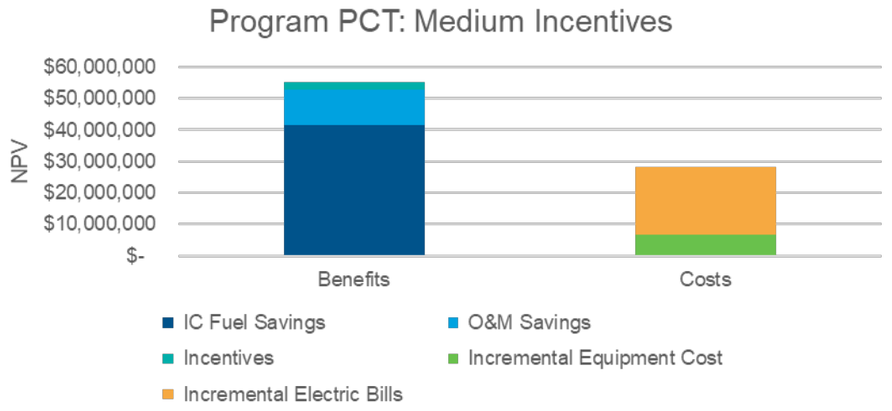


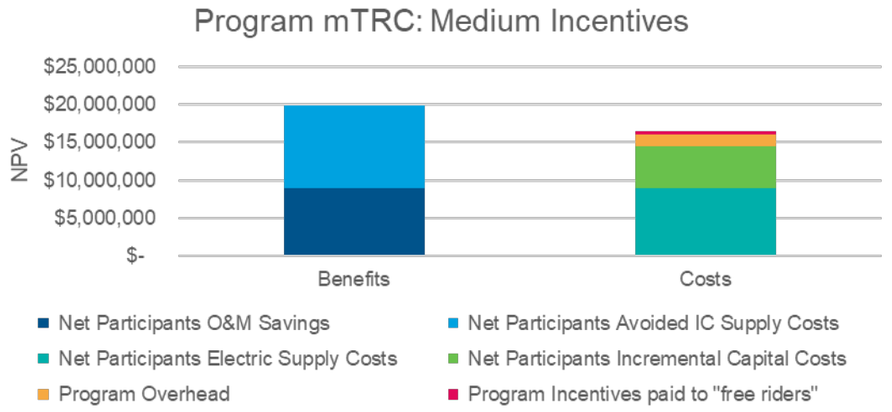
Non-Road Program Potential

Recommended Scenario: **Medium Incentives**
(highest RIM with highest RIM net benefit $)

PROGRAM ANALYSIS RESULTS	Non-Road (Material Handling, Well Pumps, & Custom)		
	LOW INCENTIVES	MEDIUM INCENTIVES	HIGH INCENTIVES
Benefit Cost Ratio			
RIM	1.35	1.39	1.25
PCT	1.91	1.95	2.01
mTRC	1.14	1.21	1.20
Net Benefit			
RIM	$2,382,713	$5,885,150	$4,721,445
PCT	$11,588,125	$26,811,786	$32,559,743
mTRC	$1,130,899	$3,469,685	$3,738,169
5 Year Program Expenditure			
Incentives	$341,800	$3,077,000	$6,213,700
Program Delivery	$1,970,865	$2,015,865	$2,148,490
TOTAL	$2,312,665	$5,092,865	$8,362,190
Load Growth			
Gross Coincident On-Peak Demand (MW)	4	10	11
Gross Combined Non-Coincident Demand (MW)	7	17	19
Gross Electricity over 25 Years (MWh)	158,172	356,163	406,229
Net Coincident On-Peak Demand (MW)	4	8	9
Net Combined Non-Coincident Demand (MW)	6	13	16
Net Electricity over 25 Years (MWh)	126,538	284,930	324,983
Emission Reductions			
GHG Emissions Reduced (MT Lifetime)	39,103	81,780	92,345
NOx Emission Reduced (MT Lifetime)	203	427	489







Non-Road Program Potential

It is more cost effective overall to implement non-road beneficial electrification program as a portfolio rather than stand-alone programs (with base program overhead costs assumed) for each technology.

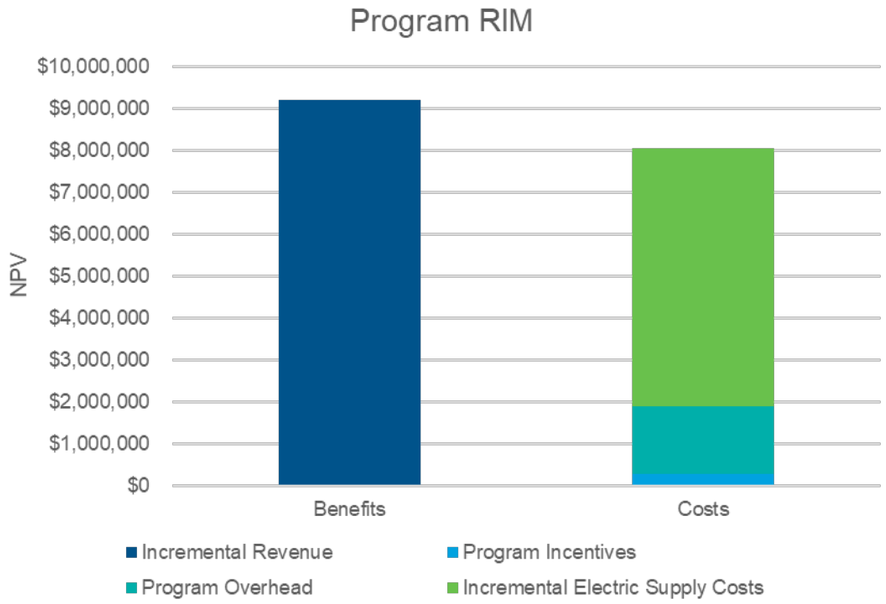
PROGRAM ANALYSIS RESULTS	Non-Road (Material Handling, Well Pumps, & Custom)			STAND ALONE PROGRAMS (MEDIUM INCENTIVES)					
	LOW INCENTIVES	MEDIUM INCENTIVES	HIGH INCENTIVES	Forklifts	TRUs	TSE	Ag Well Pumps	Cranes	Drayage Trucks
Benefit Cost Ratio									
RIM	1.35	1.39	1.25	1.55	0.48	0.24	0.90	0.38	0.41
PCT	1.91	1.95	2.01	1.86	2.29	2.08	1.91	2.49	2.28
mTRC	1.14	1.21	1.20	0.88	0.56	0.30	1.15	0.79	0.77
Net Benefit									
RIM	$2,382,713	$5,885,150	$4,721,445	$4,185,804	-$1,048,373	-$1,383,139	-$612,434	-$2,754,196	-$1,305,740
PCT	$11,588,125	$26,811,786	$32,559,743	$13,947,772	$2,012,970	$699,500	$5,907,935	$4,193,084	$1,972,849
mTRC	$1,130,899	$3,469,685	$3,738,169	-$1,038,357	-$943,849	-$1,244,474	$813,255	-$1,001,789	-$542,462
5 Year Program Expenditure									
Incentives	$341,800	$3,077,000	$6,213,700	$1,765,000	$272,700	$117,300	$625,000	$265,000	$177,000
Program Delivery	$1,970,865	$2,015,865	$2,148,490	$1,852,365	$1,852,365	$1,852,365	$1,852,365	$3,704,731	$1,852,365
TOTAL	$2,312,665	$5,092,865	$8,362,190	$3,617,365	$2,125,065	$1,969,665	$2,477,365	$3,969,731	$2,029,365
Load Growth									
Gross Coincident On-Peak Demand (MW)	4	10	11	3	0	0	6	1	1
Gross Combined Non-Coincident Demand (MW)	7	17	19	7	1	0	6	1	1
Gross Electricity over 25 Years (MWh)	158,172	356,163	406,229	226,692	24,192	7,079	62,500	32,500	17,700
Net Coincident On-Peak Demand (MW)	4	8	9	2	0	0	5	1	0
Net Combined Non-Coincident Demand (MW)	6	13	16	6	1	0	5	1	1
Net Electricity over 25 Years (MWh)	126,538	284,930	324,983	181,354	19,354	5,663	50,000	26,000	14,160
Emission Reductions									
GHG Emissions Reduced (MT Lifetime)	39,103	81,780	92,345	41,641	11,369	7,489	10,116	10,786	2,098
NOx Emission Reduced (MT Lifetime)	203	427	489	49	80	33	168	88	48

Non-Road Program Potential: Low Scenario

	MATERIAL HANDLING					INTERMODAL			AGRICULTURE
	Forklift - Conven.	Forklift - Rapid	TRU - Box	TRU - Trailer	TSE	Cranes	Drayage Trucks - Conven.	Drayage Trucks - Rapid	Well Pumps
Incentive per unit	$ 700	$ 700	$ 300	$ 1,200	$ 700	$ 6,000	$ 1,000	$ 1,600	$ 1,000
Year 1									
Year 2									
Year 3									
Year 4									
Year 5									
Gross Program Participants									
Gross Coincident On-Peak Demand (kW)									
Gross Combined Non-Coincident Demand (kW)									
Total kWh (at end of Year 5)	**6,060,600**	**1,857,400**	**492,000**	**280,000**	**159,620**	**1,200,000**	**700,000**	**320,000**	**2,250,000**
GHG Emissions Reduced (MT Lifetime)	**13,359**	**4,094**	**2,775**	**1,579**	**3,377**	**9,067**	**830**	**379**	**3,642**
Nox Emissions Reduced (MT Lifetime)	**16**	**5**	**19**	**11**	**15**	**49**	**19**	**9**	**61**

	Annual kWh	Incentives	Program Delivery	TOTAL Program Expenditure
Year 1	961,880	$ 25,300	$ 483,522	**$ 508,822**
Year 2	2,265,760	$ 57,500	$ 355,407	**$ 412,907**
Year 3	2,944,700	$ 75,200	$ 364,960	**$ 440,160**
Year 4	3,573,640	$ 91,900	$ 377,075	**$ 468,975**
Year 5	3,573,640	$ 91,900	$ 389,901	**$ 481,801**
TOTAL	**13,319,620**	**$ 341,800**	**$ 1,970,865**	**$ 2,312,665**

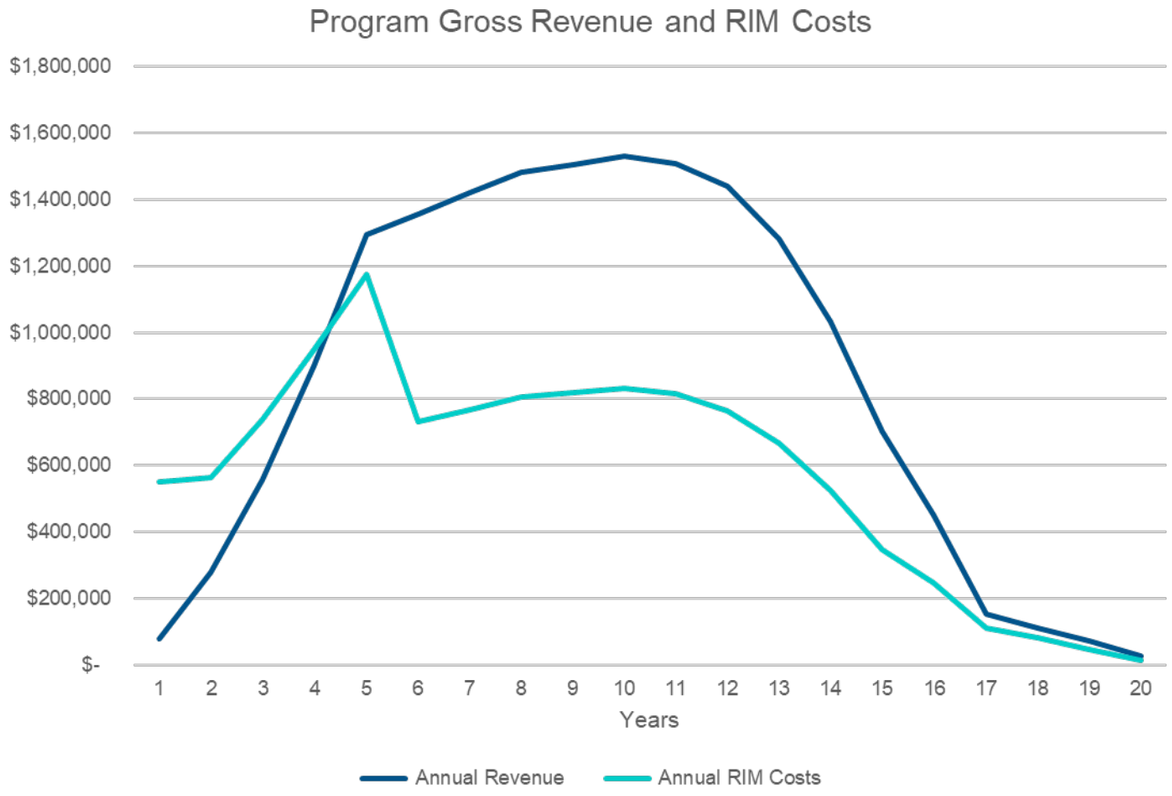
	Annual		Lifetime	
	GHG	NOx	GHG	NOx
Site Emissions Reductions (MT)	14,369	25	173,213	296
Source Emissions Increases (MT)	11,293	5	134,110	93
Net Emissions Reductions (MT)	**3,076**	**19**	**39,103**	**203**



Non-Road Program Potential: Low Scenario

NTG Ratio	80%
Discount Rate	7.3%
NPV RIM Benefits	$9,206,314
NPV RIM Costs	$6,823,601
RIM Benefit Cost Ratio	1.35
NPV RIM Net Benefits	$2,382,713

Year	Cumulative Units	Cumulative kWh	Incremental Electricity Supply Costs	Gross Incremental Revenue (AC Escalation)	Incentives	Program Overhead	Gross RIM Costs	Gross RIM Benefits	Gross Incremental Margin
1	35	Confidential			$25,300	$483,522	$549,292	$79,166	($470,126)
2	107				$57,500	$355,407	$562,512	$279,271	($283,241)
3	203				$75,200	$364,960	$737,977	$556,369	($181,608)
4	322				$91,900	$377,075	$947,221	$898,441	($48,780)
5	441				$91,900	$389,901	$1,174,710	$1,295,791	$121,081
6	441						$730,650	$1,357,282	$626,632
7	441						$768,690	$1,420,277	$651,587
8	441						$805,822	$1,481,849	$676,027
9	441						$818,513	$1,503,620	$685,107
10	441						$832,871	$1,529,253	$696,381
11	436						$815,661	$1,509,124	$693,463
12	426						$763,060	$1,438,639	$675,579
13	384						$667,612	$1,282,654	$615,042
14	310						$523,421	$1,031,185	$507,764
15	217						$346,912	$703,015	$356,103
16	122						$247,116	$450,867	$203,751
17	26						$112,287	$152,377	$40,091
18	25						$80,863	$112,840	$31,977
19	24						$47,607	$70,919	$23,313
20	23						$13,192	$27,602	$14,410
21	21						$12,320	$25,778	$13,458
22	17						$10,202	$21,346	$11,144
23	12						$7,262	$15,194	$7,932
24	6						$3,662	$7,662	$4,000

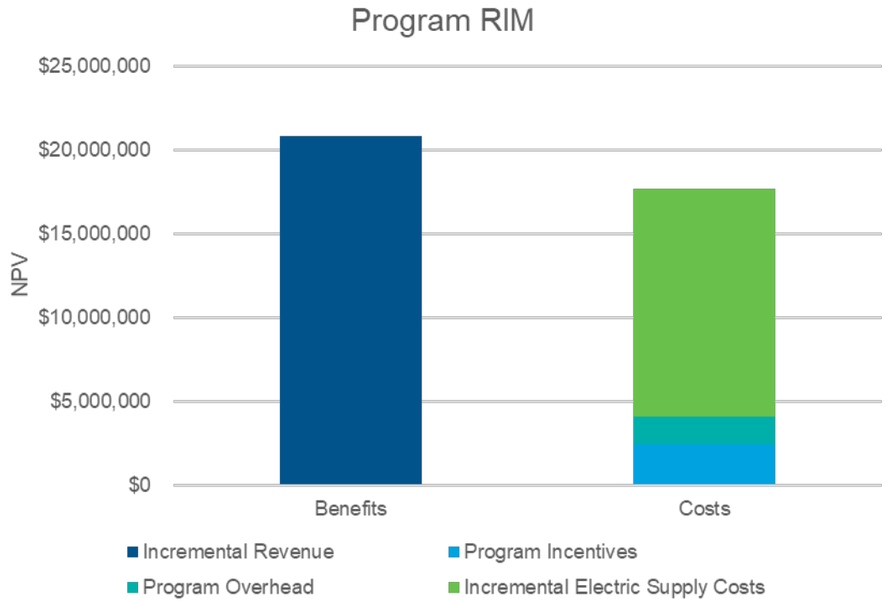


Non-Road Program Potential: Medium Scenario

	MATERIAL HANDLING					INTERMODAL			AGRICULTURE
	Forklift - Conven.	Forklift - Rapid	TRU - Box	TRU - Trailer	TSE	Cranes	Drayage Trucks - Conven.	Drayage Trucks - Rapid	Well Pumps
Incentive per unit	$ 2,500	$ 2,500	$ 900	$ 4,200	$ 2,300	$ 30,000	$ 5,000	$ 8,000	$ 5,000
Year 1									
Year 2									
Year 3									
Year 4									
Year 5									
Gross Program Participants									
Gross Coincident On-Peak Demand (kW)									
Gross Combined Non-Coincident Demand (kW)									
Total kWh (at end of Year 5)	**14,523,600**	**4,367,400**	**1,116,000**	**900,000**	**353,940**	**1,200,000**	**1,450,000**	**320,000**	**6,250,000**
GHG Emissions Reduced (MT Lifetime)	**32,014**	**9,627**	**6,294**	**5,076**	**7,489**	**9,067**	**1,719**	**379**	**10,116**
Nox Emissions Reduced (MT Lifetime)	**37**	**11**	**44**	**36**	**33**	**49**	**39**	**9**	**168**

	Annual kWh	Incentives	Program Delivery	TOTAL Program Expenditure
Year 1	2,329,060	$ 235,700	$ 494,322	**$ 730,022**
Year 2	5,056,120	$ 509,300	$ 363,957	**$ 873,257**
Year 3	6,639,640	$ 670,800	$ 373,510	**$ 1,044,310**
Year 4	8,228,060	$ 830,600	$ 385,625	**$ 1,216,225**
Year 5	8,228,060	$ 830,600	$ 398,451	**$ 1,229,051**
TOTAL	**30,480,940**	**$ 3,077,000**	**$ 2,015,865**	**$ 5,092,865**

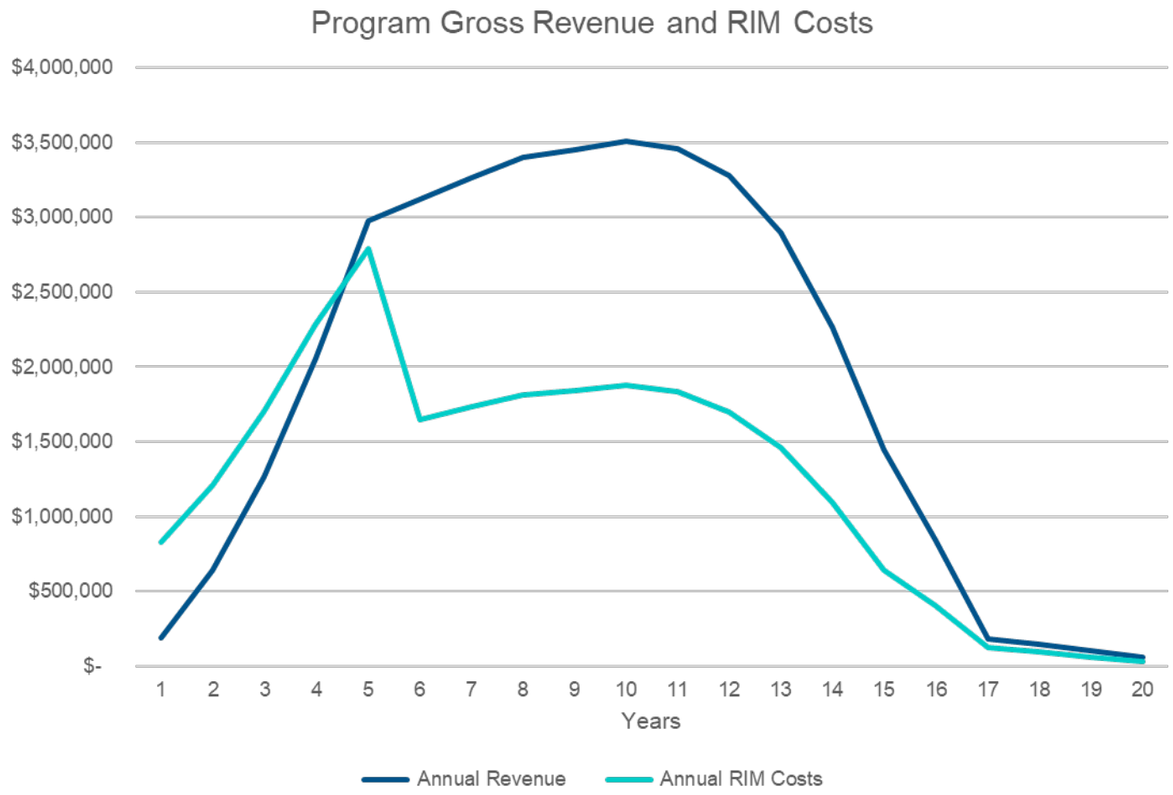
	Annual		Lifetime	
	GHG	NOx	GHG	NOx
Site Emissions Reductions (MT)	32,462	55	383,761	637
Source Emissions Increases (MT)	25,844	13	301,981	210
Net Emissions Reductions (MT)	**6,618**	**42**	**81,780**	**427**



Non-Road Program Potential: Medium Scenario

NTG Ratio	80%
Discount Rate	7.3%
NPV RIM Benefits	$20,852,476
NPV RIM Costs	$14,967,325
RIM Benefit Cost Ratio	1.39
NPV RIM Net Benefits	$5,885,150

Year	Cumulative Units	Cumulative kWh	Incremental Electricity Supply Costs	Gross Incremental Revenue (AC Escalation)	Incentives	Program Overhead	Gross RIM Costs	Gross RIM Benefits	Gross Incremental Margin
1	85	Confidential			$235,700	$494,322	$828,007	$191,589	($636,419)
2	256				$509,300	$363,957	$1,208,086	$639,203	($568,883)
3	485				$670,800	$373,510	$1,705,961	$1,266,821	($439,140)
4	771				$830,600	$385,625	$2,290,142	$2,060,532	($229,610)
5	1,057				$830,600	$398,451	$2,792,139	$2,979,861	$187,723
6	1,057						$1,647,665	$3,119,438	$1,471,773
7	1,057						$1,732,975	$3,262,664	$1,529,689
8	1,057						$1,816,253	$3,402,673	$1,586,420
9	1,057						$1,844,762	$3,452,345	$1,607,583
10	1,057						$1,877,076	$3,511,044	$1,633,967
11	1,045						$1,832,192	$3,458,366	$1,626,174
12	1,019						$1,696,547	$3,277,410	$1,580,864
13	916						$1,460,477	$2,894,745	$1,434,267
14	737						$1,093,457	$2,266,739	$1,173,282
15	511						$645,108	$1,448,350	$803,242
16	283						$405,099	$842,410	$437,311
17	54						$127,379	$183,956	$56,576
18	53						$96,307	$145,153	$48,846
19	52						$63,307	$103,770	$40,462
20	51						$29,252	$61,203	$31,952
21	47						$27,574	$57,694	$30,119
22	39						$23,405	$48,969	$25,565
23	28						$16,945	$35,454	$18,509
24	14						$8,545	$17,878	$9,333

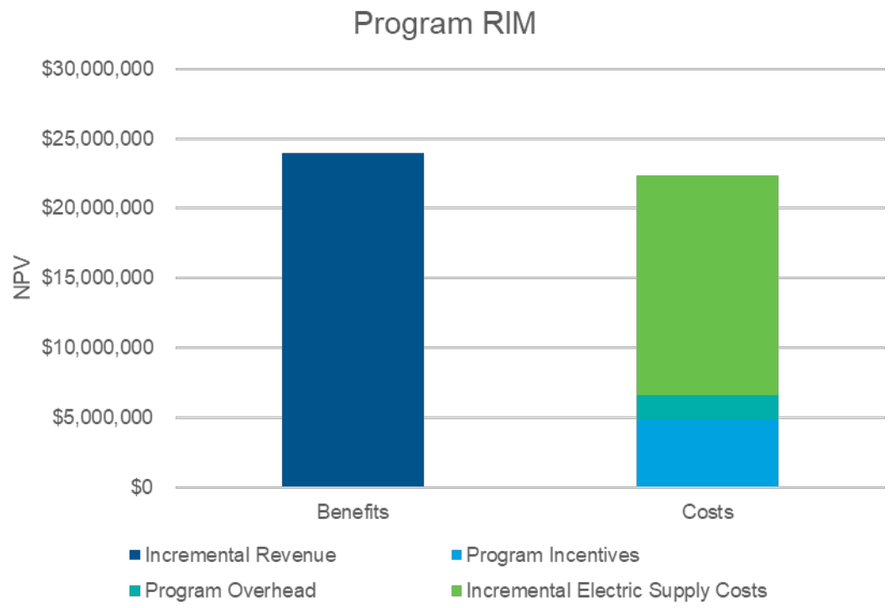


Non-Road Program Potential: High Scenario

	MATERIAL HANDLING					INTERMODAL			AGRICULTURE
	Forklift - Conven.	Forklift - Rapid	TRU - Box	TRU - Trailer	TSE	Cranes	Drayage Trucks - Conven.	Drayage Trucks - Rapid	Well Pumps
Incentive per unit	$ 3,600	$ 3,600	$ 1,300	$ 6,000	$ 3,300	$ 75,000	$ 12,500	$ 20,000	$ 12,500
Year 1									
Year 2									
Year 3									
Year 4									
Year 5									
Gross Program Participants									
Gross Coincident On-Peak Demand (kW)									
Gross Combined Non-Coincident Demand (kW)									
Total kWh (at end of Year 5)	16,543,800	4,919,600	1,200,000	1,020,000	416,400	1,200,000	1,650,000	320,000	7,600,000
GHG Emissions Reduced (MT Lifetime)	36,467	10,844	6,767	5,752	8,810	9,067	1,956	379	12,301
Nox Emissions Reduced (MT Lifetime)	43	13	48	40	39	49	44	9	205

	Annual kWh	Incentives	Program Delivery	TOTAL Program Expenditure
Year 1	2,700,000	$ 472,400	$ 515,638	**$ 988,038**
Year 2	5,780,000	$ 1,039,800	$ 408,213	**$ 1,448,013**
Year 3	7,584,720	$ 1,355,300	$ 408,213	**$ 1,763,513**
Year 4	9,402,540	$ 1,673,100	$ 408,213	**$ 2,081,313**
Year 5	9,402,540	$ 1,673,100	$ 408,213	**$ 2,081,313**
TOTAL	**34,869,800**	**$ 6,213,700**	**$ 2,148,490**	**$ 8,362,190**

	Annual		Lifetime	
	GHG	NOx	GHG	NOx
Site Emissions Reductions (MT)	37,060	64	436,775	729
Source Emissions Increases (MT)	29,565	15	344,430	240
Net Emissions Reductions (MT)	**7,495**	**49**	**92,345**	**489**



Non-Road Program Potential: High Scenario

NTG Ratio	80%
Discount Rate	7.3%
NPV RIM Benefits	$23,931,701
NPV RIM Costs	$19,210,257
RIM Benefit Cost Ratio	1.25
NPV RIM Net Benefits	$4,721,445

Year	Cumulative Units	Cumulative kWh	Incremental Electricity Supply Costs	Gross Incremental Revenue (AC Escalation)	Incentives	Program Overhead	Gross RIM Costs	Gross RIM Benefits	Gross Incremental Margin
1	97	Confidential			$472,400	$515,638	$1,103,445	$223,076	($880,369)
2	293				$1,039,800	$408,213	$1,838,863	$739,886	($1,098,976)
3	554				$1,355,300	$408,213	$2,531,618	$1,459,993	($1,071,625)
4	880				$1,673,100	$408,213	$3,325,024	$2,371,075	($953,949)
5	1,206				$1,673,100	$408,213	$3,890,071	$3,427,596	($462,474)
6	1,206						$1,907,146	$3,589,183	$1,682,037
7	1,206						$2,006,329	$3,754,861	$1,748,532
8	1,206						$2,103,145	$3,916,806	$1,813,661
9	1,206						$2,136,246	$3,974,164	$1,837,918
10	1,206						$2,173,709	$4,041,823	$1,868,113
11	1,191						$2,117,453	$3,974,281	$1,856,828
12	1,160						$1,951,597	$3,753,871	$1,802,274
13	1,042						$1,669,218	$3,301,027	$1,631,809
14	837						$1,236,776	$2,567,143	$1,330,367
15	580						$714,413	$1,622,022	$907,610
16	322						$442,478	$935,021	$492,543
17	63						$132,231	$194,106	$61,875
18	62						$101,271	$155,539	$54,268
19	61						$68,354	$114,329	$45,975
20	60						$34,414	$72,004	$37,590
21	55						$32,268	$67,514	$35,246
22	45						$27,005	$56,503	$29,498
23	32						$19,366	$40,519	$21,153
24	16						$9,765	$20,432	$10,667