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Sent: Monday, April 29, 2019 7:56 PM
To: Sarah Brody
Subject: ICF Electrification Study

Sarah,

Please review and let me know if there are questions.

Thanks,

Julio



Beneficial Electrification

Strategy Development & Comparison of Program Options

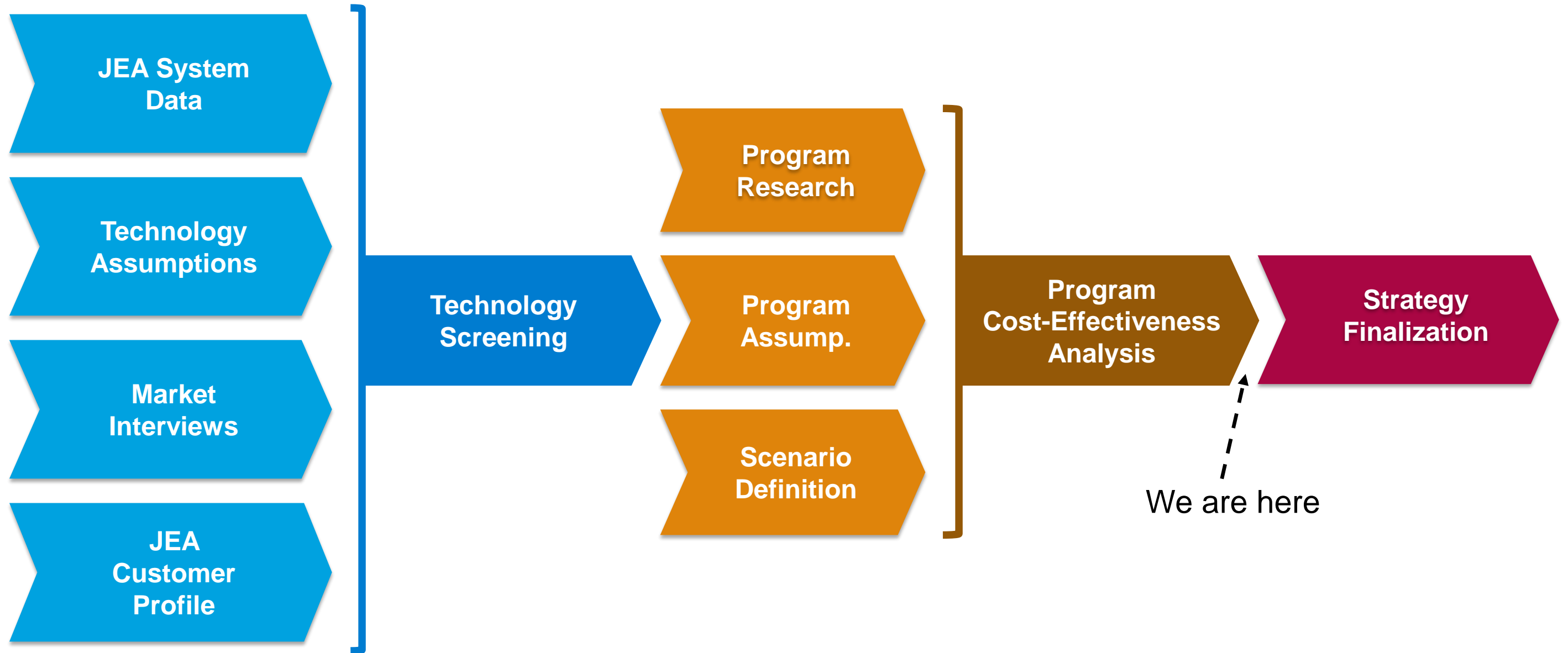
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29 April 2019

Agenda

- **Process Recap**
- **Description of Program Scenarios**
- **Comparison of Impacts**
- **Appendix**

Process Recap



Program Scenarios: Technologies Promoted

Current



- Forklifts
- TRUs
- Golf Carts
- TSE
- Welders
- Airport GSE



- Illustrative Custom:
 - Cranes
 - Conveyor Systems
 - Injection Molding
 - Scissor/Boom lifts
 - Scrubbers



- On-Road:
 - Vehicle Incentives

Low

- Forklifts
- TRUs
- Golf Carts
- TSE
- Welders
- Airport GSE
- Scissor/Boom lifts
- Scrubbers
- Beverage Carts

- Illustrative Custom:
 - Cranes
 - Conveyor Systems
 - Injection Molding
 - Drayage Trucks
 - Electric Arc Furnaces
 - Induction Heating
 - Induction Melting
 - Microwave Processing
 - RF Processing
 - UV Curing

- On-Road Charging:
 - SF Residential
 - MF Residential
 - Workplace
 - Public
 - DCFC
 - School Bus
 - Transit Bus

Medium

- Forklifts
- TRUs
- Golf Carts
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- Illustrative Custom:
 - Cranes
 - Conveyor Systems
 - Injection Molding
 - Drayage Trucks
 - Electric Arc Furnaces
 - Induction Heating
 - Induction Melting
 - Microwave Processing
 - RF Processing
 - UV Curing
 - Monorail
 - Shorepower
 - Tug Boats

- On-Road Charging:
 - SF Residential
 - MF Residential
 - Workplace
 - Public
 - DCFC
 - School Bus
 - Transit Bus

Program Scenarios: Incentives and Infrastructure

Current

Low

Medium

High

AVERAGE CASH INCENTIVES

- \$0.01/kWh

- \$0.02/kWh

- \$0.05/kWh

- \$0.10/kWh

NON-CASH INCENTIVES

- Dealer Education/Sales Training
- Local Dealer Networks

- Dealer Education/Sales Training
- Local Dealer Networks
- Subsidized Engineering Studies
- Manufacturing Process Equipment Trade Ally Network and Demos

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- Manufacturing Process Equipment Trade Ally Network and Demos

ON-ROAD INFRASTRUCTURE INVESTMENT

- Targeting residential charging market
- Some support for workplace and opportunity
- Minimal focus on multi-family
- Limited DCFC intervention
- School buses: 5 buses
- Transit buses: 3-5 buses

- Targeting residential charging market: higher incentives
- Some support for workplace and opportunity
- Focus on L2 for multi-family charging
- DCFC support for opportunity charging
- School buses: 5 buses
- Transit buses: 3-5 buses

- Targeting all Level 2 charging markets: residential, workplace, opportunity
- Focus on multi-family for Level 2 and DC fast charging
- School buses: 10+ buses
- Transit buses: 5-10 buses

Program Scenarios: Delivery Channels

Current

MARKETING ACTIVITIES

- Program Flyers
- Case Studies
- Website Content

CHANNELS AND PARTNERSHIPS

- Local Equipment Dealers
- Local Trade Associations
- JEA Account Manager Involvement
- Strategic meetings with City and Ports

Low

- Program Flyers
- Case Studies
- Website Content
- Collateral Refresh
- End-User:
 - Email Communications (8/Year)
 - Direct Mail (4/Year)
- Dealer Co-Branded:
 - Materials
- Tradeshow Support
- Marketing Support (75 hrs/year)
- Ride and Drive Events (1/year)

- Local Equipment Dealers
- Local Trade Associations
- JEA Account Manager Involvement
- Strategic meetings with City and Ports
- National Manufacturers

Medium

- Program Flyers
- Case Studies
- Website Content
- Collateral Refresh
- End-User:
 - Email Communications (Monthly)
 - Direct Mail (6/Year)
 - Search
- Dealer Co-Branded:
 - Materials
- Tradeshow Support
- Marketing Support (100 hrs/year)
- Ride and Drive Events (2/year)

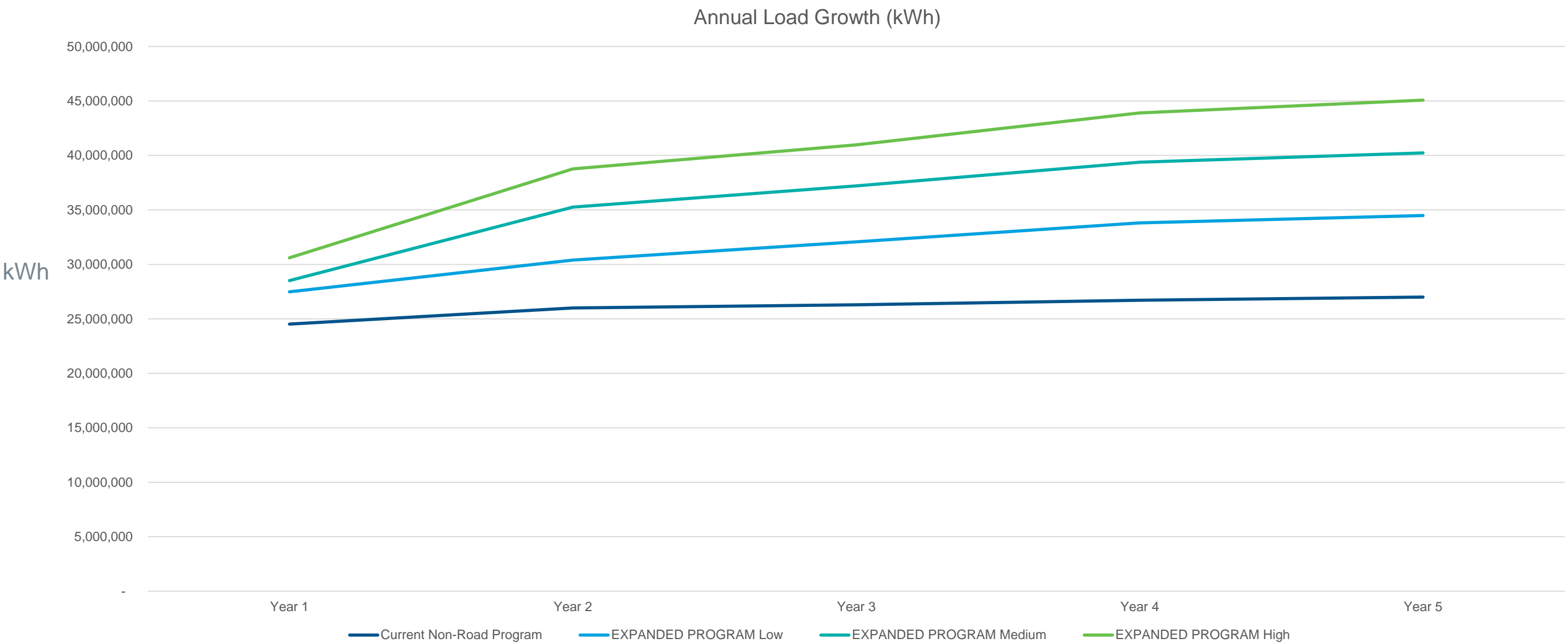
- Local Equipment Dealers
- Local Trade Associations
- JEA Account Manager Involvement (Medium)
- Strategic meetings with City and Ports (Medium)
- National Manufacturers
- Global Manufacturers

High

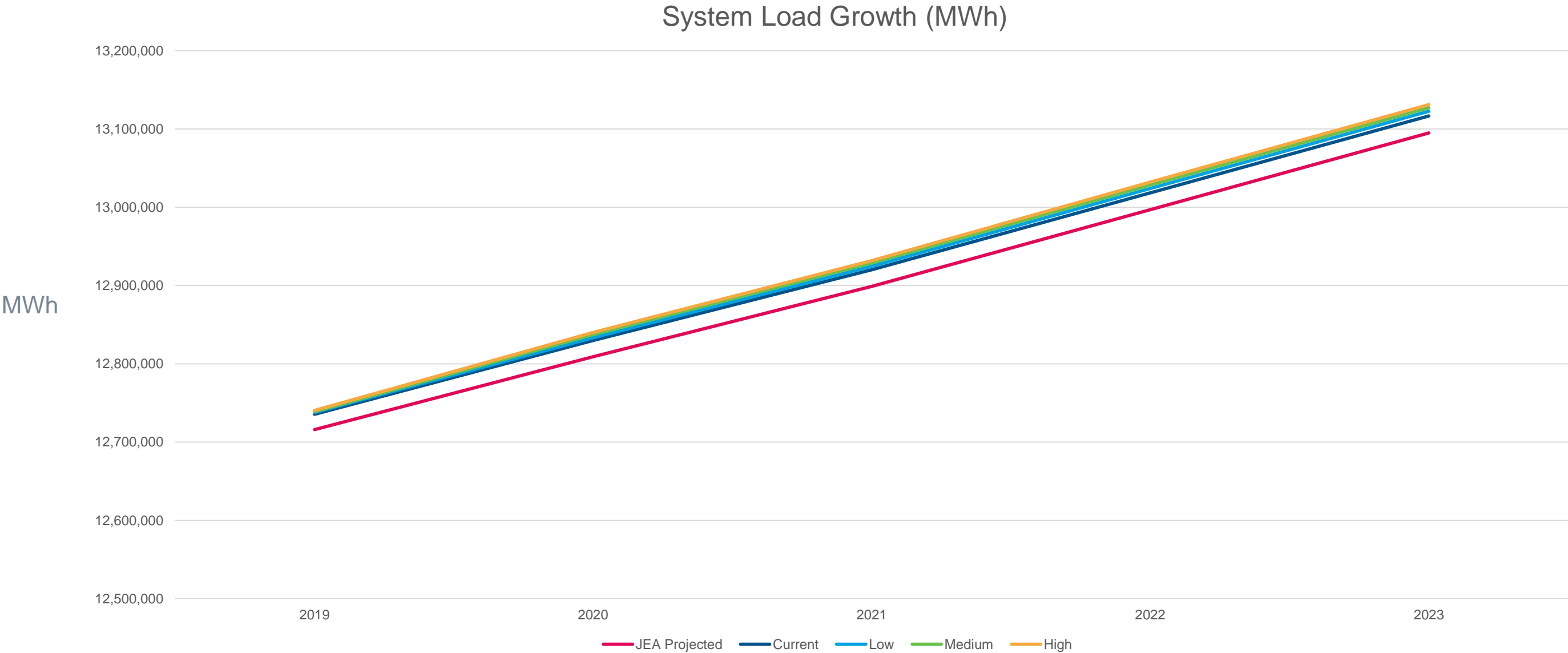
- Program Flyers
- Case Studies
- Website Content
- Collateral Refresh
- End-User:
 - Email Communications (Monthly)
 - Direct Mail (8/Year)
 - Search
 - Trade Publication Media
- Dealer Co-Branded:
 - Materials
 - Case Studies
- Tradeshow Support
- Marketing Support (150 hrs/year)
- Ride and Drive Events (3/year)

- Local Equipment Dealers
- Local Trade Associations
- JEA Account Manager Involvement (High)
- Strategic meetings with City and Ports (High)
- National Manufacturers
- Global Manufacturers

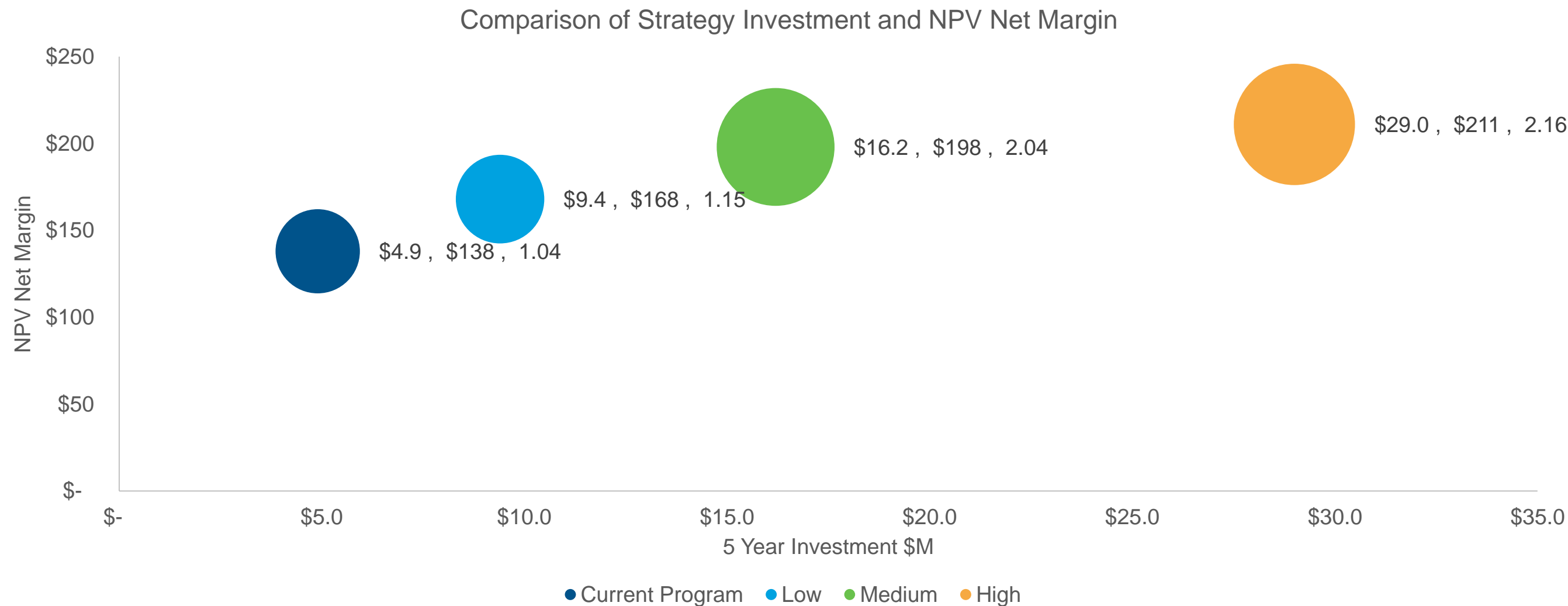
Comparison of Program Energy Sales Impact



Impact on JEA System Sales

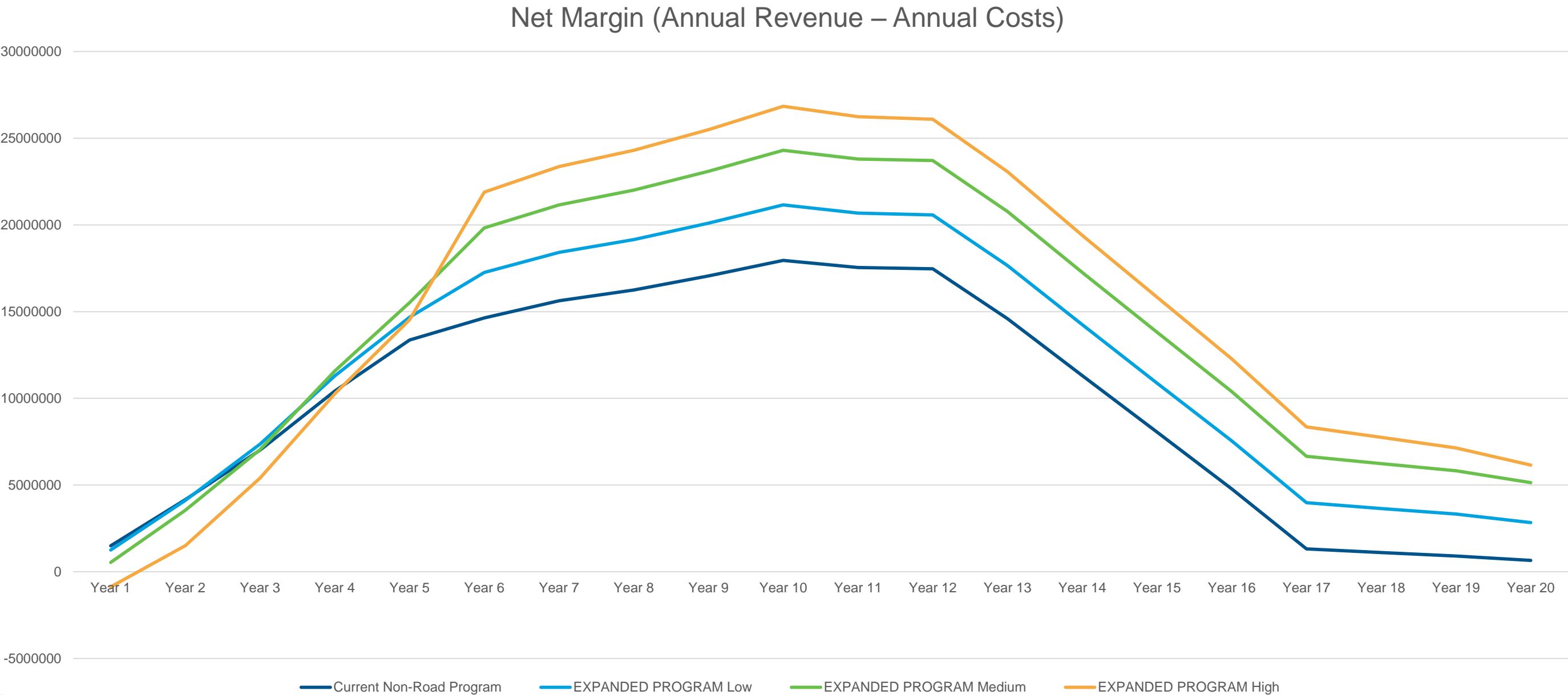


Financial Comparison of Scenarios – 5 Year Program



5 Year Investment (\$ Millions), NPV Net Margin (\$ Millions), GHG Emission Reductions (Millions of Metric Tons)

Net Annual Margin by Scenario



Detailed Impacts by Scenario

	Current	Low	Medium	High
5-Year Investment Totals				
Cash Incentives	\$1,454,200	\$3,328,203	\$9,720,220	\$22,020,420
Non-Cash Incentives	\$1,644,830	\$2,940,772	\$3,154,873	\$3,388,293
Delivery	\$1,839,784	\$3,147,740	\$3,370,084	\$3,621,138
TOTAL	\$4,938,814	\$9,416,715	\$16,245,177	\$29,029,851
Results				
FTEs (Year 5)	2	3.7	3.9	4.1
# Equipment Participants	5,034	6,180	6,529	7,337
Incremental annual MWh (Year 5)	104,413	126,583	144,477	159,469
Incremental off-peak MWh (Year 5)	93,730	113,091	127,860	141,119
Incremental on-peak MW (Year 5)	27.8	29.1	32.6	38.9
Annual Program Costs (Year 5)	\$1,047,942	\$2,422,354	\$4,095,699	\$7,130,174
Incremental Annual Revenue (Year 6)	\$19,496,479	\$23,153,800	\$26,582,731	\$29,353,880
Incremental Annual Margin (Year 6)	\$14,638,981	\$17,253,871	\$19,824,262	\$21,894,266
NPV Incremental Revenue	\$190,351,006	\$237,072,489	\$284,655,050	\$317,574,035
NPV Incremental Margin (net benefits)	\$138,539,164	\$168,362,443	\$197,974,750	\$211,282,537
Delta from Next Less Aggressive Scenario		\$29,823,279	\$29,612,307	\$13,307,787
GHG Emissions Reduced (Metric Tons, Lifetime)	1,036,864	1,157,042	2,039,528	2,161,962

Next Steps

1) Determine Program Scenario

2) Finalize Strategic Plan

Appendix

Program Results: Medium Scenario

JEA Beneficial Electrification

Medium Incentive Program

Discount Rate	4.0%
NPV RIM Benefits	\$284,655,050
NPV RIM Costs	\$86,680,300
RIM Benefit Cost Ratio	3.28
NPV RIM Net Benefits	\$197,974,750

Year	Cumulative Units	Incremental kWh On-Peak	Incremental kWh Off-Peak	Incremental System kW	Incremental Electricity Supply Costs	Selected Gross Incremental Revenue	Incentives	Program Overhead	Gross RIM Costs	Gross RIM Benefits	Gross Incremental Margin
1	1,129	2,981,017	25,533,142	6,742	\$934,714	\$3,676,463	\$1,220,860	\$1,076,054	\$3,231,627	\$3,676,463	\$444,835
2	2,359	7,115,594	56,659,479	15,755	\$2,152,386	\$8,465,869	\$1,711,485	\$1,130,593	\$4,994,465	\$8,465,869	\$3,471,404
3	3,668	11,464,992	89,514,401	25,076	\$3,505,863	\$13,789,428	\$1,940,811	\$1,381,720	\$6,828,394	\$13,789,428	\$6,961,034
4	5,071	16,056,888	124,304,223	34,808	\$5,170,189	\$20,335,633	\$2,242,336	\$1,445,619	\$8,858,144	\$20,335,633	\$11,477,489
5	6,529	20,771,360	159,825,454	44,749	\$6,652,191	\$26,164,715	\$2,604,728	\$1,490,971	\$10,747,891	\$26,164,715	\$15,416,824
6	6,529	20,771,360	159,825,454	44,749	\$6,758,469	\$26,582,731			\$6,758,469	\$26,582,731	\$19,824,262
7	6,529	20,771,360	159,825,454	44,749	\$7,213,840	\$28,373,819			\$7,213,840	\$28,373,819	\$21,159,979
8	6,529	20,771,360	159,825,454	44,749	\$7,503,941	\$29,514,858			\$7,503,941	\$29,514,858	\$22,010,917
9	6,529	20,771,360	159,825,454	44,749	\$7,871,189	\$30,959,334			\$7,871,189	\$30,959,334	\$23,088,145
10	6,529	20,771,360	159,825,454	44,749	\$8,287,483	\$32,596,724			\$8,287,483	\$32,596,724	\$24,309,241
11	6,442	20,304,040	157,706,308	44,188	\$8,114,093	\$31,914,736			\$8,114,093	\$31,914,736	\$23,800,643
12	6,343	19,801,301	155,153,195	43,496	\$8,084,246	\$31,797,341			\$8,084,246	\$31,797,341	\$23,713,095
13	5,315	17,531,341	132,074,226	37,699	\$7,083,555	\$27,861,375			\$7,083,555	\$27,861,375	\$20,777,820
14	4,236	15,213,619	108,161,050	31,722	\$5,882,683	\$23,138,051			\$5,882,683	\$23,138,051	\$17,255,367
15	3,114	12,859,605	83,729,714	25,686	\$4,710,162	\$18,526,232			\$4,710,162	\$18,526,232	\$13,816,070
16	1,946	10,505,345	60,084,620	19,576	\$3,542,912	\$13,935,150			\$3,542,912	\$13,935,150	\$10,392,238
17	728	8,055,392	35,550,502	13,294	\$2,269,473	\$8,926,398			\$2,269,473	\$8,926,398	\$6,656,925
18	545	7,395,676	32,636,862	12,203	\$2,124,171	\$8,354,892			\$2,124,171	\$8,354,892	\$6,230,720
19	324	6,663,099	29,313,638	11,006	\$1,983,513	\$7,801,648			\$1,983,513	\$7,801,648	\$5,818,135
20	60	5,845,711	25,539,066	9,669	\$1,752,121	\$6,891,525			\$1,752,121	\$6,891,525	\$5,139,404
21	56	5,616,706	24,315,096	9,432	\$1,701,056	\$6,690,675			\$1,701,056	\$6,690,675	\$4,989,619
22	46	5,020,761	21,333,487	8,775	\$1,536,740	\$6,044,377			\$1,536,740	\$6,044,377	\$4,507,638
23	35	4,307,838	17,726,281	7,998	\$1,316,829	\$5,179,414			\$1,316,829	\$5,179,414	\$3,862,585
24	22	3,477,939	13,493,478	7,100	\$1,030,552	\$4,053,415			\$1,030,552	\$4,053,415	\$3,022,864
25	9	2,643,091	9,233,450	6,198	\$744,575	\$2,928,599			\$744,575	\$2,928,599	\$2,184,024

Medium Incentive Program

	Incentives	Non-Cash Incentives	Program Delivery	TOTAL Program Expenditure
Year 1	\$1,220,860	\$430,421	\$645,632	\$2,296,913
Year 2	\$1,711,485	\$565,297	\$565,297	\$2,842,078
Year 3	\$1,940,811	\$690,860	\$690,860	\$3,322,531
Year 4	\$2,242,336	\$722,809	\$722,809	\$3,687,955
Year 5	\$2,604,728	\$745,486	\$745,486	\$4,095,699
TOTAL	\$9,720,220	\$3,154,873	\$3,370,084	\$16,245,177

	Total Annual kWh	On-Peak	Off Peak	% Off Peak
Year 1	28,514,159.17	2,981,016.8	25,533,142.3	90%
Year 2	35,260,913.45	4,134,576.8	31,126,336.7	88%
Year 3	37,204,320.45	4,349,398.5	32,854,922.0	88%
Year 4	39,381,718.23	4,591,895.9	34,789,822.3	88%
Year 5	40,235,702.65	4,714,472.0	35,521,230.6	88%
TOTAL	180,596,813.95	20,771,360.1	159,825,453.9	88%

	Annual Gross Revenue	Annual Gross Costs	Net Margin
Year 1	\$3,676,463	\$3,231,627	\$ 444,835
Year 2	\$8,465,869	\$4,994,465	\$ 3,471,404
Year 3	\$13,789,428	\$6,828,394	\$ 6,961,034
Year 4	\$20,335,633	\$8,858,144	\$ 11,477,489
Year 5	\$26,164,715	\$10,747,891	\$ 15,416,824
Year 6	\$26,582,731	\$6,758,469	\$ 19,824,262
Year 7	\$28,373,819	\$7,213,840	\$ 21,159,979
Year 8	\$29,514,858	\$7,503,941	\$ 22,010,917
Year 9	\$30,959,334	\$7,871,189	\$ 23,088,145
Year 10	\$32,596,724	\$8,287,483	\$ 24,309,241
Year 11	\$31,914,736	\$8,114,093	\$ 23,800,643
Year 12	\$31,797,341	\$8,084,246	\$ 23,713,095
Year 13	\$27,861,375	\$7,083,555	\$ 20,777,820
Year 14	\$23,138,051	\$5,882,683	\$ 17,255,367
Year 15	\$18,526,232	\$4,710,162	\$ 13,816,070
Year 16	\$13,935,150	\$3,542,912	\$ 10,392,238
Year 17	\$8,926,398	\$2,269,473	\$ 6,656,925
Year 18	\$8,354,892	\$2,124,171	\$ 6,230,720
Year 19	\$7,801,648	\$1,983,513	\$ 5,818,135
Year 20	\$6,891,525	\$1,752,121	\$ 5,139,404

Medium Incentive Program

	Forklift - Conven.	Forklift - Rapid	Scissor/Boom Lifts	Scrubbers - Ride on top	Scrubbers - Stand behind	TRU - Box	TRU - Trailer	TSE	Golf Carts	Beverage Carts	Welders	Overhead Cranes	Monorail (per Mile)	Conveyor Systems
Incentive per unit	\$800	\$800	\$1,000	\$400	\$400	\$400	\$1,000	\$1,300	\$200	\$600	\$500	\$2,300	\$113,900	\$3,000
Year 1	419	281	29	29	11	48	100	2	43	-	31	35	-	2
Year 2	423	284	43	43	16	49	101	2	44	1	32	36	1	4
Year 3	427	286	58	58	22	49	102	3	44	1	32	36	1	5
Year 4	432	289	73	73	27	50	103	4	45	1	32	36	1	6
Year 5	436	292	74	74	27	50	104	4	45	1	33	37	1	6
Gross Program Participants	2,137	1,432	277	277	103	246	510	15	221	4	160	180	4	23
Annual Load Growth Added Over 5-Year Program (kWh)	58,340,100	35,943,200	3,462,500	2,077,500	257,500	2,952,000	10,200,000	104,100	1,209,975	43,800	9,072,000	8,151,498	9,109,851	1,380,000
Gross Coincident On-Peak Demand (kW)	1,311	20,406	94	57	7	787	2,856	38	-	-	2,080	3,600	2,336	690
Gross Combined Non-Coincident Demand (kW)	19,233	21,480	1,385	831	103	1,968	7,140	45	884	32	2,080	3,600	2,336	690
GHG Emissions Reduced (MT Lifetime)	351,506	216,562	20,862	12,517	1,551	26,964	93,170	2,809	11,663	422	10,811	34,816	771,351	76,799
Nox Emissions Reduced (MT Lifetime)	373	230	22	13	2	128	443	11	36	1	48	65	90	59

	Cranes - Ship-to-shore	Cranes - RTG	Drayage Trucks - Conven.	Drayage Trucks - Rapid	Shorepower	Tug Boats	Pushbacks	Tug/Tow Tractors	Belt Loaders	GPUs	PCAs
Incentive per unit	\$29,200	\$18,700	\$2,500	\$4,000	\$51,200	\$12,800	\$1,600	\$400	\$800	\$13,100	\$34,700
Year 1	-	-	9	1	-	-	-	2	1	-	-
Year 2	1	1	14	2	-	1	1	3	2	1	1
Year 3	1	1	19	2	-	1	1	4	2	1	1
Year 4	1	1	24	3	-	1	1	5	3	1	1
Year 5	1	1	24	3	-	1	1	5	3	1	1
Gross Program Participants	4	4	90	11	-	4	4	19	11	4	4
Annual Load Growth Added Over 5-Year Program (kWh)	2,332,000	1,492,120	4,500,000	880,000	-	1,022,000	128,480	554,800	54,351	1,051,200	2,772,452
Gross Coincident On-Peak Demand (kW)	3,800	536	900	748	-	-	-	-	-	152	399
Gross Combined Non-Coincident Demand (kW)	3,800	536	1,800	880	-	1,400	40	190	77	160	420
GHG Emissions Reduced (MT Lifetime)	263,045	23,724	18,440	3,606	-	7,007	435	2,846	279	7,123	18,787
Nox Emissions Reduced (MT Lifetime)	176	90	136	27	-	157	(0)	9	1	(6)	(15)

Medium Incentive Program

	Electric arc furnace	Electric boiler (Small)	Electric boiler (Large)	Electric IR	Induction Heating (Small)	Induction Heating (Large)	Induction Melting (Small)	Induction Melting (Large)	Microwave	Radio frequency processing	UV curing	Injection Molding	Resistance Heating	Electric Drives
Incentive per unit	\$11,280,000	\$0	\$0	\$28,400	\$1,000	\$343,900	\$103,200	\$6,878,000	\$51,600	\$34,400	\$80,600	\$3,000	\$952,000	\$1,937,500
Year 1	-	-	-	0	0	0	-	-	0	0	0	6	0	0
Year 2	-	-	-	0	0	0	-	-	0	0	0	6	0	0
Year 3	-	-	-	1	0	0	-	-	0	0	0	6	0	0
Year 4	-	-	-	1	0	0	-	-	0	0	0	6	0	0
Year 5	-	-	-	1	0	0	-	-	0	0	0	6	0	0
Gross Program Participants	-	-	-	2	1	0	-	-	1	1	1	28	0	0
Annual Load Growth Added Over 5-Year Program (kWh)	-	-	-	1,405,989	13,041	310,494	-	-	570,530	434,690	891,348	1,726,409	752,080	11,632,750
Gross Coincident On-Peak Demand (kW)	-	-	-	202	2	45	-	-	82	62	126	322	124	1,485
Gross Combined Non-Coincident Demand (kW)	-	-	-	495	2	45	-	-	83	63	127	326	125	1,501
GHG Emissions Reduced (MT Lifetime)	-	-	-	16,621	329	7,843	-	-	8,473	14,912	21,996	(11,532)	3,342	1,736
Nox Emissions Reduced (MT Lifetime)	-	-	-	-	-	-	-	-	-	-	-	-	-	-








	SF Residential	MF Residential	Workplace	Public	DCFC	School Bus	Transit Bus
Incentive per unit	\$1,000	\$5,200	\$5,200	\$5,200	\$75,000	\$175,000	\$450,000
Year 1	50	10	10	8	2	-	-
Year 2	84	10	10	8	2	1	1
Year 3	106	11	13	10	1	2	1
Year 4	131	15	16	12	1	4	2
Year 5	159	18	18	14	1	7	3
Gross Program Participants	530	64	67	52	7	14	7
Annual Load Growth Added Over 5-Year Program (kWh)	3,332,996	389,839	709,613	420,744	153,300	350,000	560,000
Gross Coincident On-Peak Demand (kW)	849	99	176	90	66	1	240
Gross Combined Non-Coincident Demand (kW)	3,180	384	134	104	525	350	1,400

Market Assessment






JEA Beneficial Electrification

Expanded Approach to Beneficial Electrification









Technologies

	Non-Road & Material Handling		Manufacturing
	On-Road, Light-Duty		Infrastructure (Ports/Airports)
	On-Road, MD & HD		Recreational
	On-Road, Buses		
	Custom		

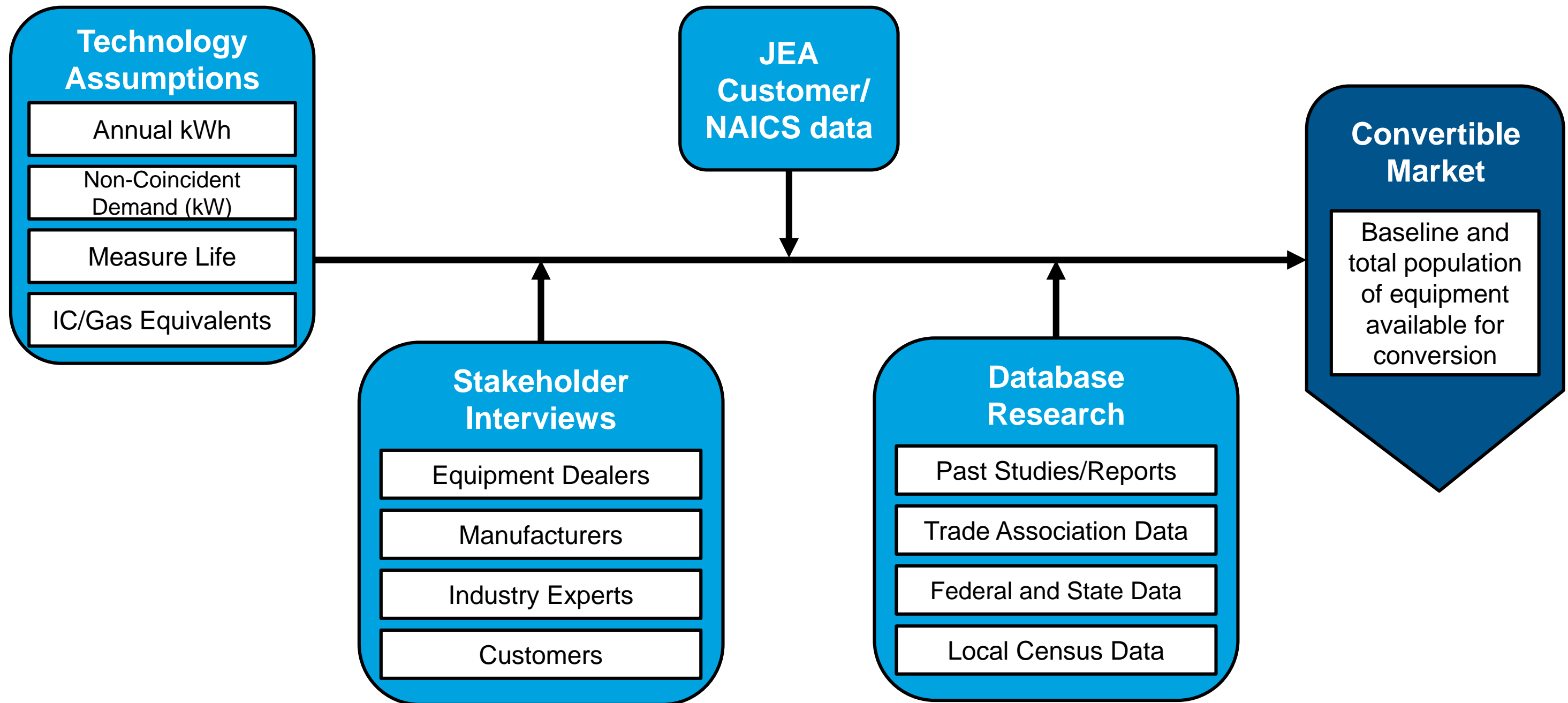
Locations

	Home
	Multi-family
	Workplace or Destination
	In-route
	Fleets

Strategies

	Infrastructure Deployment
	Rate Design
	Education & Outreach
	Incentives
	Financing
	Partnership Planning
	Managed Charging
	Active Load Management (DR, V2G)

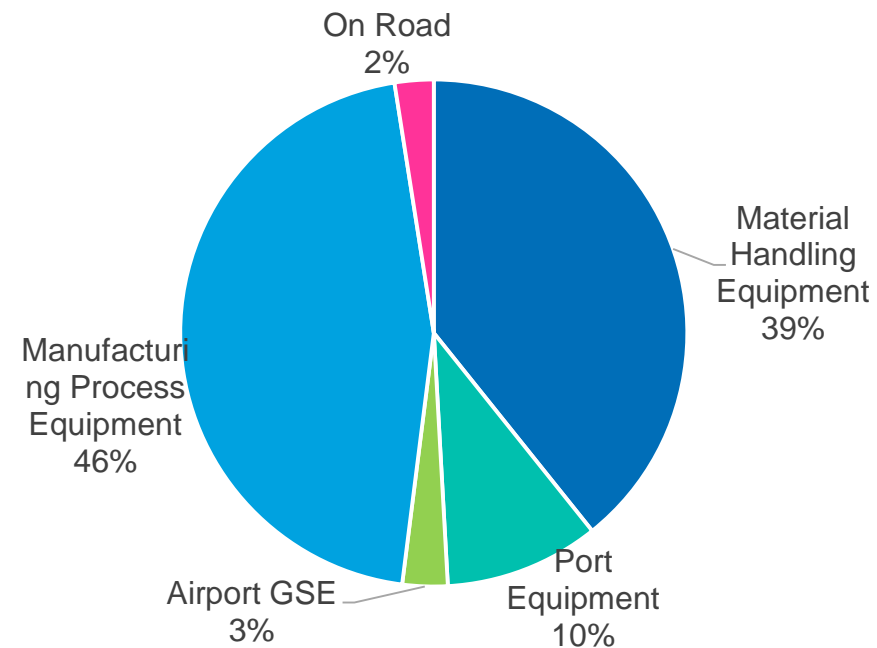
Market Assessment Process



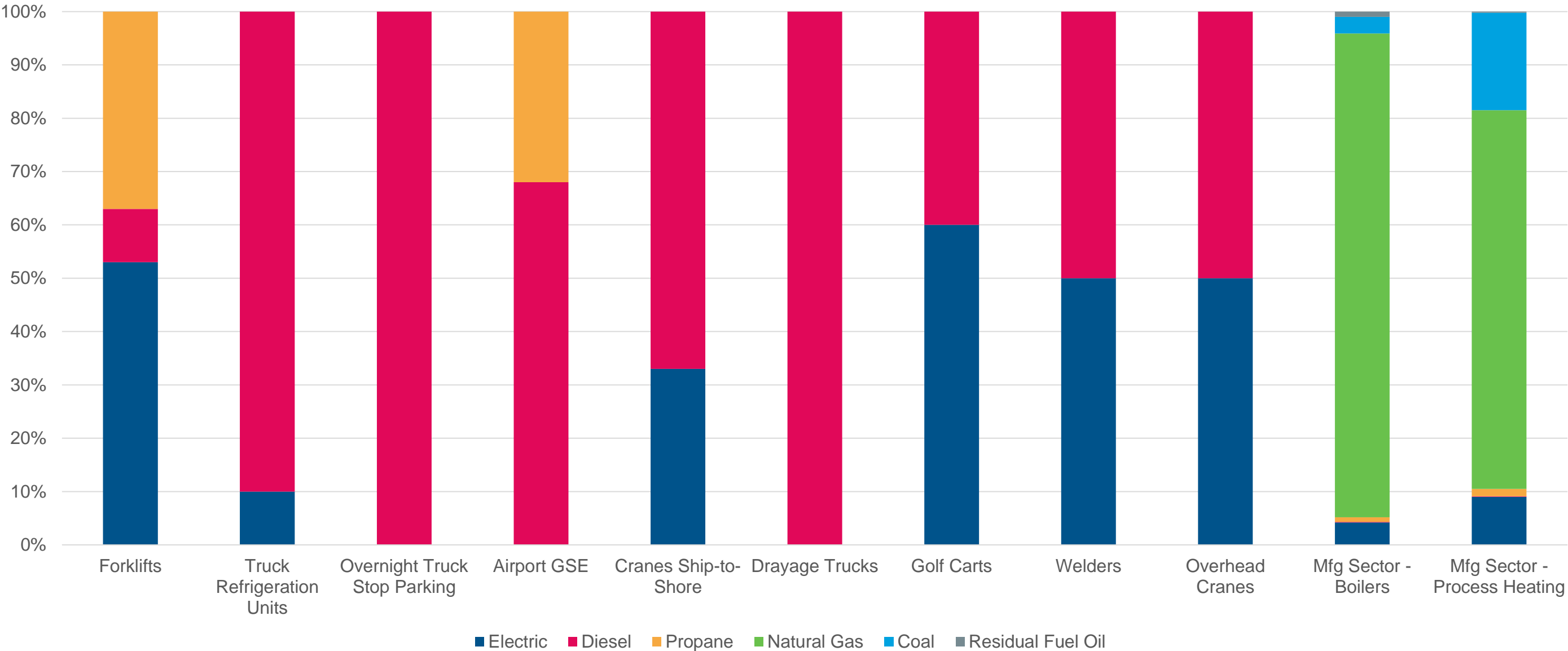
Market Assessment Results

	Existing Convertible Population				Baseline Electric Population			
	Units	Demand (MW)	Annual Electricity (MWh)	Lifetime Electricity (MWh)	Units	Demand (MW)	Annual Electricity (MWh)	Lifetime Electricity (MWh)
Material Handling Equipment	14,464	139.8	315,392	3,884,946	15,571	156.5	375,212	4,629,757
Port Equipment	492	58.1	79,234	1,368,830	3	2.9	1,749	43,725
Airport GSE	193	4.4	23,143	429,542	-	-	-	-
Manufacturing Process Equipment	112	52.5	365,747	7,051,442	141	120.0	871,041	17,107,344
On Road	6,883	44.5	19,949	299,240	205	1.2	820	12,302
TOTAL	22,144	299.3	803,465	13,034,000	15,920	280.5	1,248,823	21,793,127

**Convertible Market
Load Growth Potential**



Local Technology Energy Profiles



Market Assessment: Material Handling

Key Takeaways:

- Since program inception, the **local electric forklift** population grew from 44% to 53%. There is still potential to increase electric forklift sales and add smaller prescriptive measures such as **scissor lifts, boom lifts, and scrubbers**.
- Lack of infrastructure is still a challenge for **Truck Refrigeration Units**.
- There is still no **Truck Stop Electrification** within the territory, without significant external funding assistance, it is hard to justify the cost.
- 4 Golf Courses participating in the JEA NRE Program and converted their **golf cart** fleets to electric. There are still potential to convert additional fleets and add the larger **beverage carts** as a measure.
- Welders** were added as a prescriptive measure last year and there is still potential to displace diesel powered welding equipment with electric.
- Several JEA NRE custom projects have displaced fossil fuel or hydraulic material handling equipment with **overhead cranes** and **conveyor systems**. There is continued potential to add these.
- The Skyway **Monorail** may potentially expand over the next several years to additional areas, there is also exploration of new technologies such as autonomous vehicles to displace certain parts.

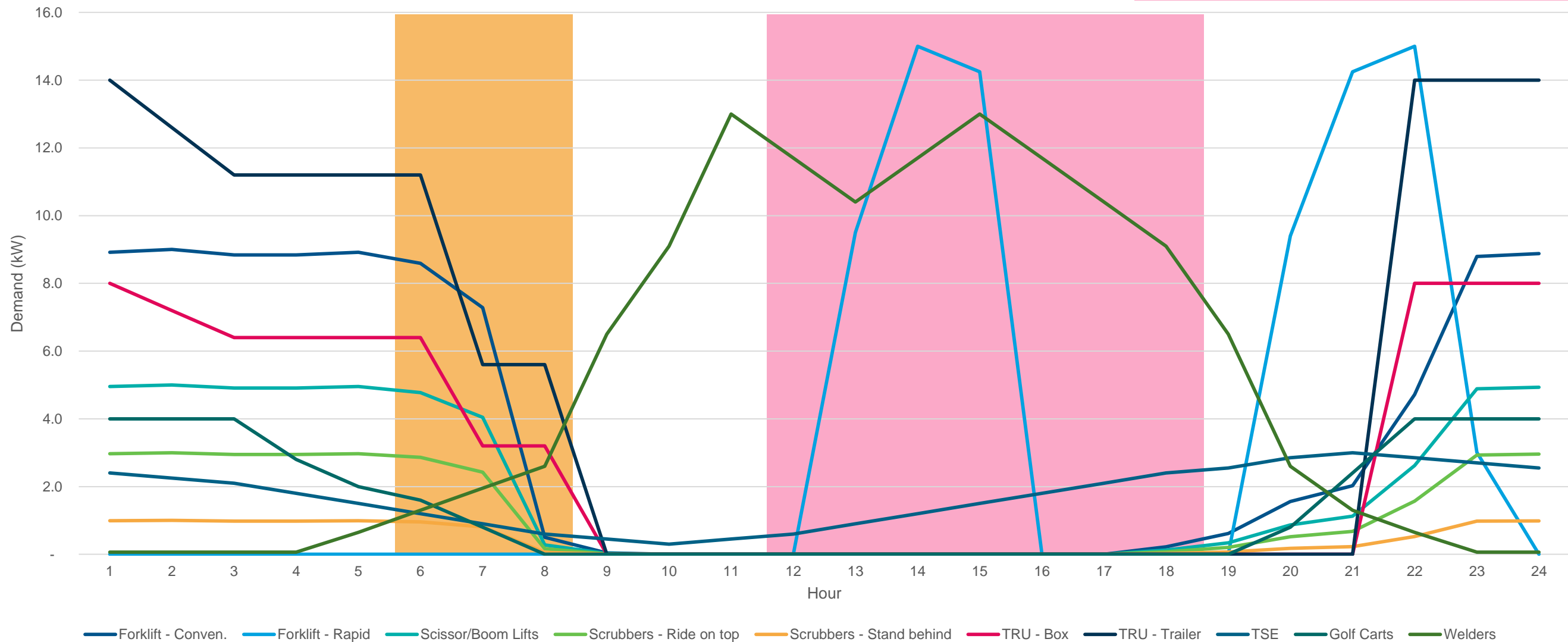
	Existing Convertible Population			
	Units	Demand (MW)	Annual Electricity (MWh)	Lifetime Electricity (MWh)
Material Handling Equipment	14,464	139.8	315,392	3,884,946
Forklift - Conven.	4,152	37.4	113,350	1,360,195
Forklift - Rapid	2,768	41.5	69,477	833,722
Scissor/Boom Lifts	1,700	8.5	21,250	255,000
Scrubbers - Ride on top	1,140	3.4	8,550	102,600
Scrubbers - Stand behind	760	0.8	1,900	22,800
TRU - Box	690	5.5	8,280	99,360
TRU - Trailer	1,610	22.5	32,200	386,400
TSE	147	0.4	1,020	20,404
Golf Carts	488	2.0	2,672	26,718
Beverage Carts	19	0.2	208	2,081
Welders	555	7.2	31,469	314,685
Overhead Cranes	375	7.5	16,982	254,734
Monorail	2	1.2	4,555	136,648
Conveyor Systems	58	1.7	3,480	69,600

Market Assessment: Material Handling

Average Weekday Load Shapes

JEA SYSTEM WINTER PEAK

JEA SYSTEM SUMMER PEAK



Market Assessment: Port & Airport

Key Takeaways:

- Increased equipment and expansions of fleets will follow the dredging and deepening of the St. Johns River.
- 3 JAXPORT **Ship-to-Shore cranes** participated in the program but there are 6 diesel cranes left to be converted.
- The majority of the 350 diesel **drayage trucks** are owned and leased by one company, with advancements in electric yard trucks from Orange EV and BYD there is significant potential for conversion.
- There is still opportunity for **shorepower** and hybrid electric **tug boats** at the port, but may not happen within the current program time frame due to the high infrastructure costs.
- There is still significant potential to convert **airport ground support equipment** at Jacksonville International to electric. The challenge has been that as many airlines electrify their fleets at larger airports, they shift their old equipment to smaller airports like JAX.

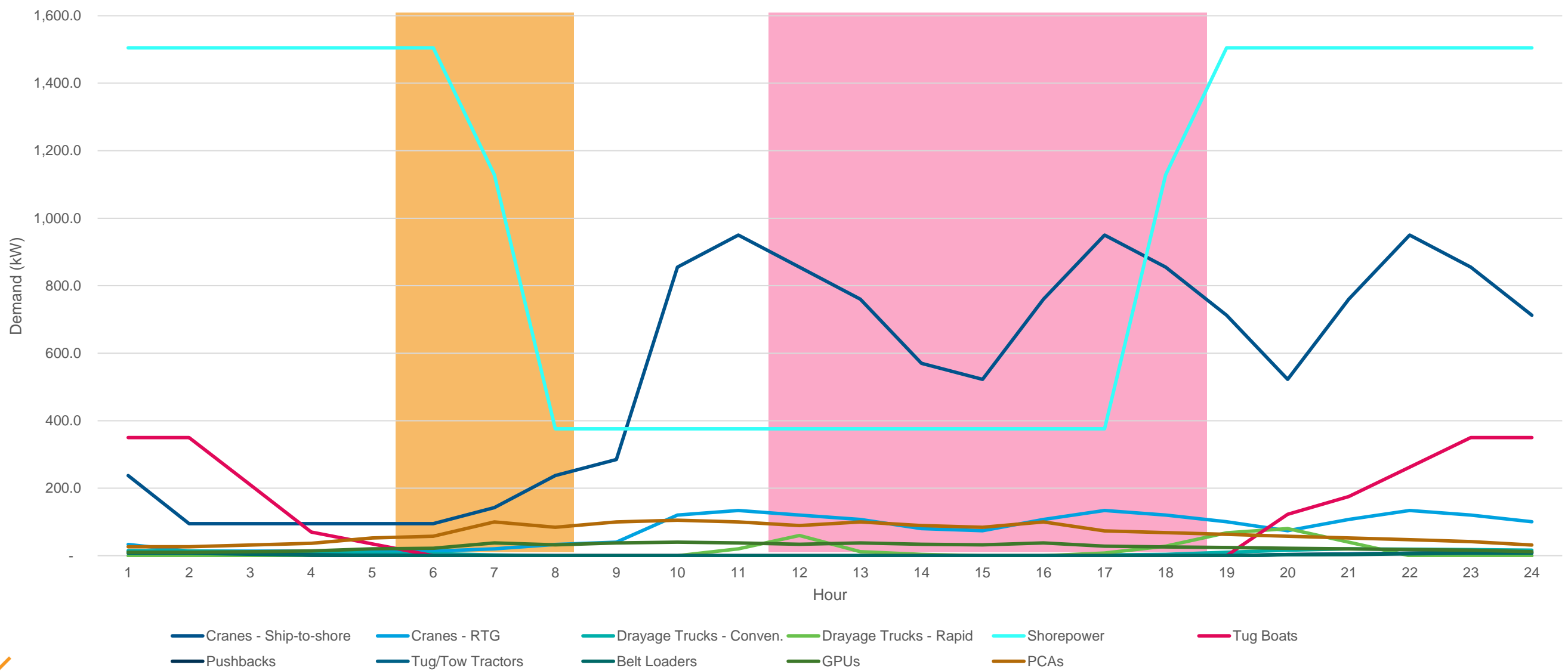
	Existing Convertible Population			
	Units	Demand (MW)	Annual Electricity (MWh)	Lifetime Electricity (MWh)
Port Equipment	492	58.1	79,234	1,368,830
Cranes - Ship-to-shore	6	5.7	3,498	87,450
Cranes - RTG	99	13.3	36,930	738,599
Drayage Trucks - Conven.	262	5.2	13,100	131,000
Drayage Trucks - Rapid	88	7.0	7,040	70,400
Shorepower	12	18.1	12,278	245,568
Tug Boats	25	8.8	6,388	95,813
Airport GSE	193	4.4	23,143	429,542
Pushbacks	28	0.3	899	8,994
Tug/Tow Tractors	75	0.8	2,190	21,900
Belt Loaders	49	0.3	242	2,421
GPUs	20	0.8	5,256	105,120
PCAs	21	2.2	14,555	291,107

Market Assessment: Port & Airport

Average Weekday Load Shapes

JEA SYSTEM WINTER PEAK

JEA SYSTEM SUMMER PEAK



Market Assessment: Manufacturing

Key Takeaways:

- ICF identified **75 manufacturers** within the JEA service territory to serve as the basis for its analysis of the manufacturing sector
 - In terms of kWh, the manufacturing sector in JEA's service territory is more concentrated in **Fabricated Metals Mfg & Paper Mfg** compared to the national average, largely because of the two largest customers (Gerdau & WestRock)
 - Many of the manufacturers identified belong to large **multi-national corporations** (e.g. WestRock, J&J, Kraft), so there may be a need to engage with these customers at a higher corporate level in order to influence their decision making
- There are many different electrotechnologies available to the manufacturing sector, however some technologies (**electric boilers, resistance heating, electric drives**) are unlikely to be cost-effective options for manufacturers given modest efficiency gains over low-cost natural gas alternatives
- The best opportunities in JEA's service territory appear to be **electric IR, microwave processing, and UV curing**, which can be used for various curing and/or drying applications
- Some manufacturing customers may be hesitant to adopt some of the larger electrotechnologies, as it may force them to switch to a higher rate class (e.g. GSD to GSLD)

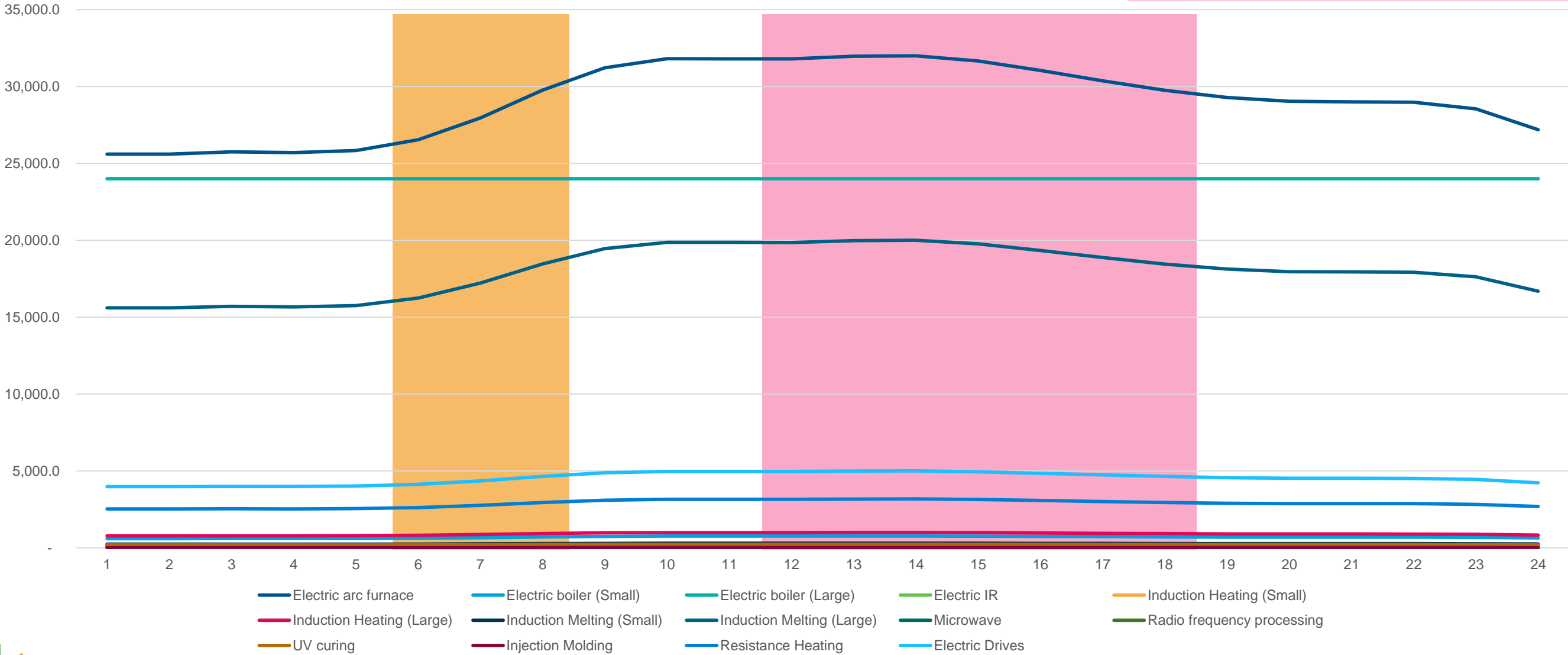
	Existing Convertible Population			
	Units	Demand (MW)	Annual Electricity (MWh)	Lifetime Electricity (MWh)
Manufacturing Process Equipment	110	44.36	307,957	5,895,642
Electric arc furnace	-	-	-	-
Electric boiler (Small)	3	3.00	15,840	316,800
Electric boiler (Large)	1	24.00	210,240	4,204,800
Electric IR	47	9.40	26,696	400,440
Induction Heating (Small)	14	0.04	289	5,778
Induction Heating (Large)	1	1.00	6,878	137,561
Induction Melting (Small)	-	-	-	-
Induction Melting (Large)	-	-	-	-
Microwave	14	2.10	14,444	216,657
Radio frequency processing	16	1.60	11,005	275,120
UV curing	14	3.22	22,566	338,486
Injection Molding				
Resistance Heating	1	3.18	19,040	380,800
Electric Drives	1	5.00	38,750	775,000

Market Assessment: Manufacturing

Average Weekday Load Shapes

JEA SYSTEM WINTER PEAK

JEA SYSTEM SUMMER PEAK



Market Assessment: On-Road

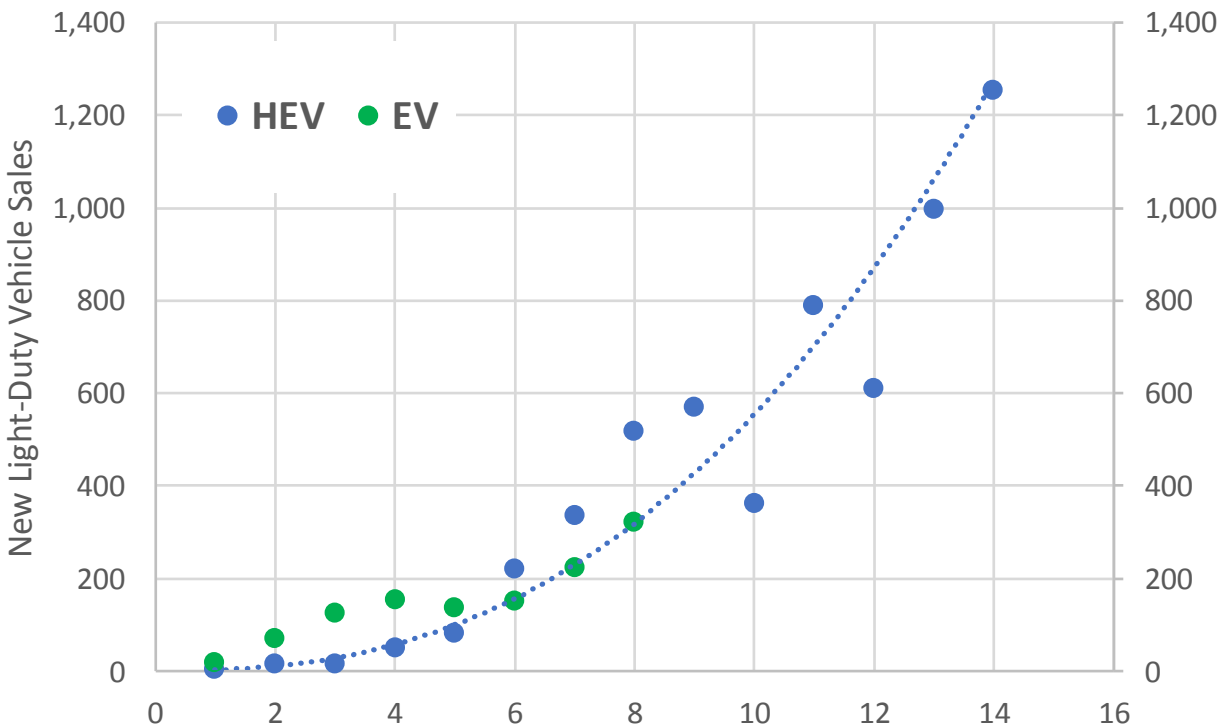


Light-duty Vehicles

- About 1,200 EVs on the road in JEA service territory
- About 40% PHEV / 60% BEV
 - Chevrolet Volt is 35% of PHEV market
 - Tesla (Model S, Model X, and Model 3) is 75% of BEV market
- To date, sales track early years of hybrid sales well, with modest improvement compared to conventional hybrid gasoline-electric vehicle (HEV) sales
- Registration type is also similar to HEV breakdown

Charging Infrastructure

- About 120 Level 2 charging ports/plugs—public and workplace charging ports. Roughly 2 ports per EVSE
- About 35-40 DC fast charging ports/plugs in the region



Vehicle Type	Personal	Fleet Type			
		Dealer	Small (<10)	Large (>10)	Government
PHEV	94.1%	0.4%	4.5%	0.4%	0.6%
BEV	84.5%	0.5%	6.3%	0.4%	0.0%
HEV	96.3%	0.6%	2.3%	0.5%	0.3%

Market Assessment: On-Road

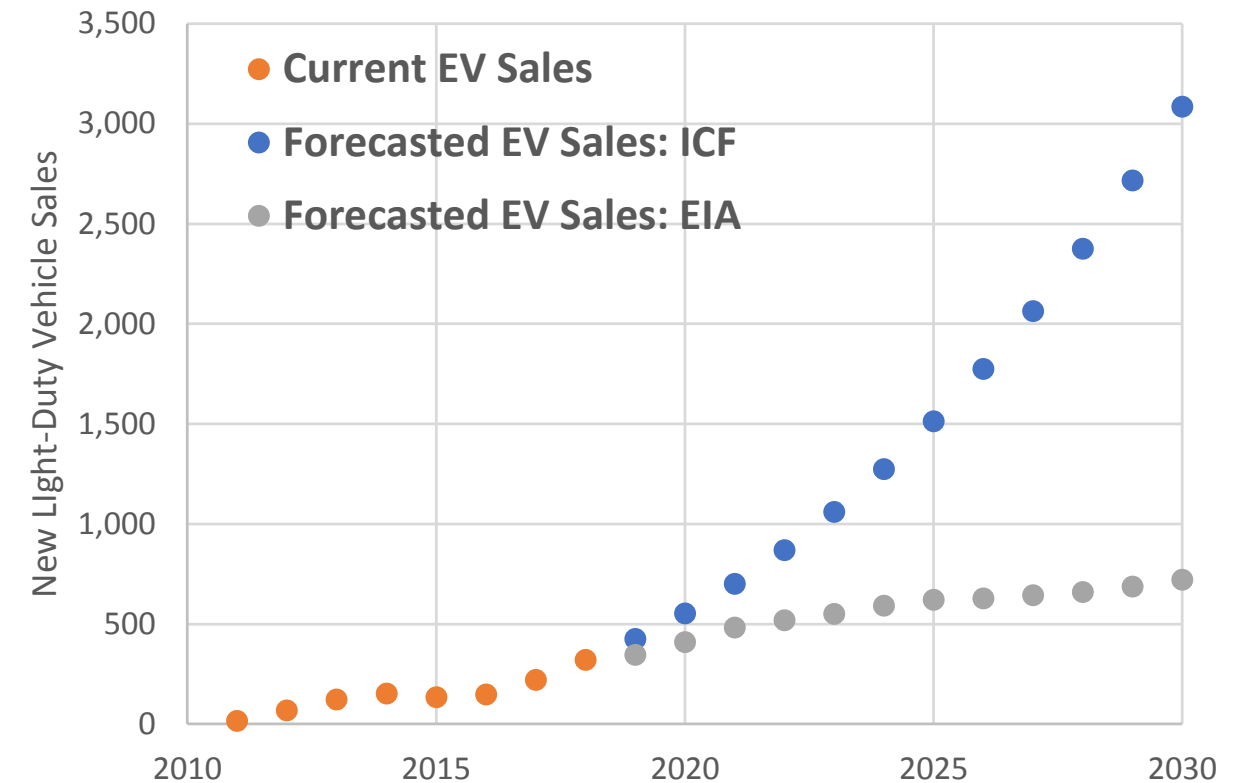


Light-duty Vehicles

- Forecasted growth is substantial over next 3-5 years; with more rapid growth assumed post-2025 as battery prices decrease.
- Year over year increased indicate 1,500 new EV sales by 2025 and doubling to 3,000 new EV sales by 2030.
- Total EVs on the road by 2025: 7,000
- Total EVs on the road by 2030: 17,500

Charging Infrastructure

- Need to deploy the infrastructure that will support this forecasted rate of adoption, or adoption curve will falter.
- Market still seeks more information on **where, when, and for how long people charge**.
- Major charging infrastructure markets: residential, workplace, public, fleet, and opportunity or destination charging



residential



multi-family



workplace



destination



fleet

Market Assessment: On-Road








Charging Infrastructure Needed

- Residential: Assume 35% of people want Level 2 charging at home
- Multi-Family: Modest market. Assume 5-10% of EV adoption in these units. Assume that 50% of EV adopters at multi-family units need L2 charging at home
- Workplace: Used EVI-Pro Lite Tool (via NREL) to estimate L2 charging ports needed under proposed adoption scenario
- Destination, L2 and DCFC: Used EVI-Pro Lite Tool (via NREL) to estimate charging ports needed under proposed adoption scenario

Incentives for Charging Infrastructure

- Varied the addressable market for JEA depending on focus across market segments
- Varied incentive amount for each charging market for JEA depending on preferred strategy
- Investment scenarios represent 25%, 50%, and 75% of the estimated total investment required by 2025

Market Segment		2025	2030
 Residential		2,300	5,800
 Multi-family		180	440
 Workplace		140	340
 Destination, L2		110	240
 Destination, DCFC		9	19

Market Assessment: On-Road



Heavy-duty Vehicles

- Focused on school and transit buses
- School buses
 - Several models available
 - Transit buses can use Level 2 charging
 - Potential for vehicle-to-grid demonstration given duty cycle of school buses (not used during the day as much)
 - About 25,000 kWh per school bus annually
- Transit buses
 - Jacksonville Transit has been focused on CNG as part of 5-year plan. 100 CNG buses purchased
 - Transit buses will require DC fast charging deployment
 - Need to form strong partnerships and identify path to success for transit bus deployment
 - About 75,000-90,000 kWh per transit bus annually

Vehicle Specifics	Manufacturer	Battery Size	BEB Cost	Comments
30' Transit Bus	BYD	197 kWh	\$520,000	Base cost, no add-ons
35' Transit Bus	BYD	270 kWh	\$700,000	or volume discount;
40' Transit Bus	BYD	324 kWh	\$770,000	40-80kW charging;
60' Articulated Bus	BYD	591 kWh	\$1.2 Million	ability to do 100-200
23' Coach	BYD	135 kWh	\$250,000	kW at AC Charging as
40' Coach	BYD	365 kWh	\$800,000	well as 150-300kW DC
45' Coach	BYD	365 kWh	\$850,000	Fast Charging
35' Transit Bus	Proterra	440 kWh	\$650,000	Small Volume,
40' Transit Bus	Proterra	440-660kWh	\$750,000	standard features
Type A School Bus	Motiv	85-127 kWh	\$250,000-\$275,000	208V, 25kW charging
Type C School Bus	Motiv	106-127 kWh	\$250,000 - \$300,000	208V, 25kW charging

Market Assessment: On-Road

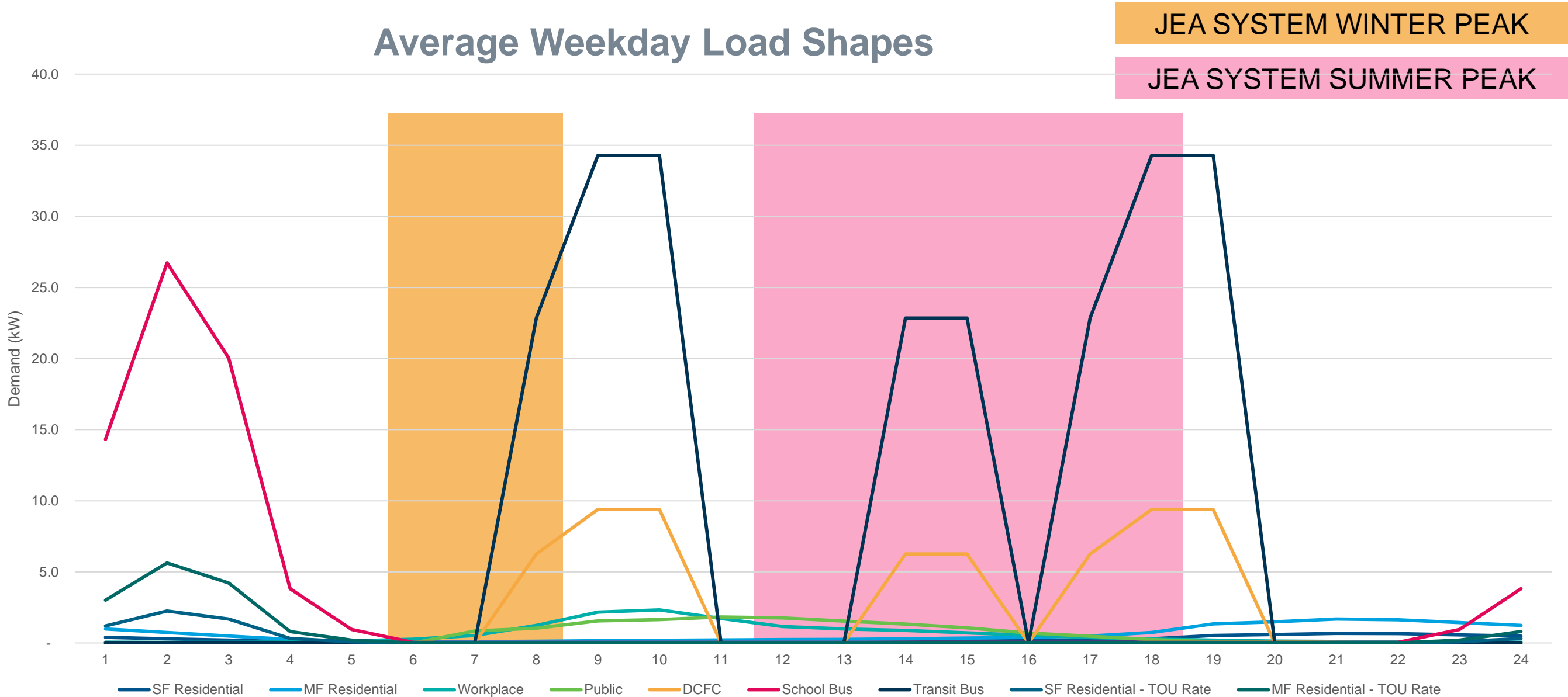


Heavy-duty Vehicles: Charging

- School bus can be used with Level 2 EVSE, capable of delivering upwards of 19 kW
 - Bi-directional charging should be considered as part of pilot
- Transit buses will require DC fast charging equipment with high powered charging, 200-450 kW
 - Can occur in-route or at depot; route planning is essential for electric-bus deployment
 - Space considerations and constraints critical as part of planning
 - Potential for co-location of renewables or battery back-up to offset potential higher demand charges

Year	Measure	Cost	Additional Considerations
2013	50 kw wireless charger	\$350,000	Equivalent to \$7 per watt
2015	Charging infrastructure	\$1,000-\$350,000	
2015	70 kW (208 VAC/200A)	\$5,000-\$10,000	Installation is \$20,000-\$75,000
2015	450 kW (480VAC/640A)	\$350,000	Installation is \$150,000-\$200,000
2016	Proterra depot charger	\$50,000	Maintenance is \$500 per year
2016	Proterra on-road charger	\$349,000	Maintenance is \$13,000 per year
2016	On-route charger installation	\$250,000	
2016	250kW WAVE wireless charger	\$286,000	Installation is \$220,000; receiver is \$103,000
2017	200 kw	\$400,000	Equivalent to \$2 per watt
2017	In-depot charger	\$50,000	
2017	Two 500kW Eaton overhead fast chargers	\$665,000	Maintenance on chargers is \$1,500 per month
2017	Infrastructure upgrades (\$/bus)	\$20,000-\$75,000	Depends on site conditions, charging strategy, number of chargers, and other factors

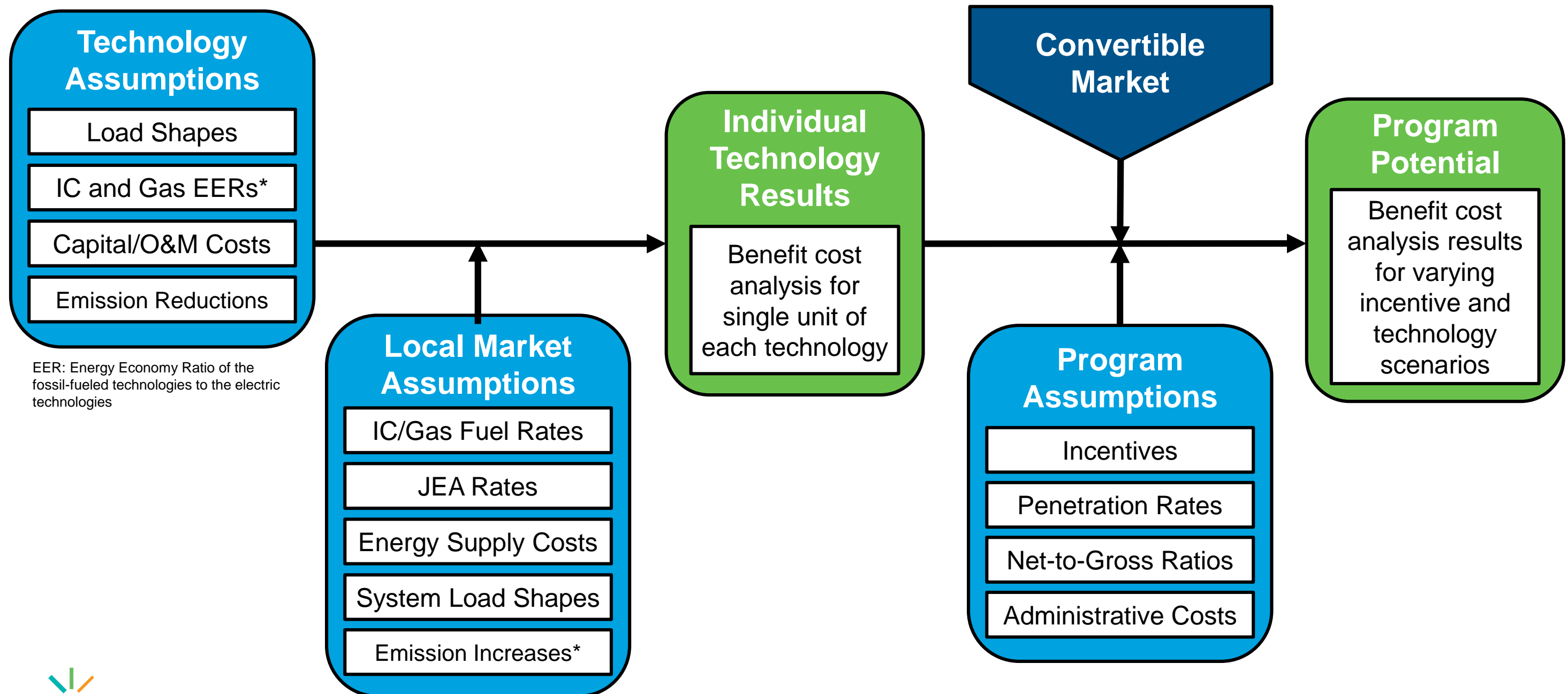
Market Assessment: On-Road



Benefit Cost Analysis

JEA Beneficial Electrification

Benefit Costs Analysis Process



Benefit Costs Analysis Tests

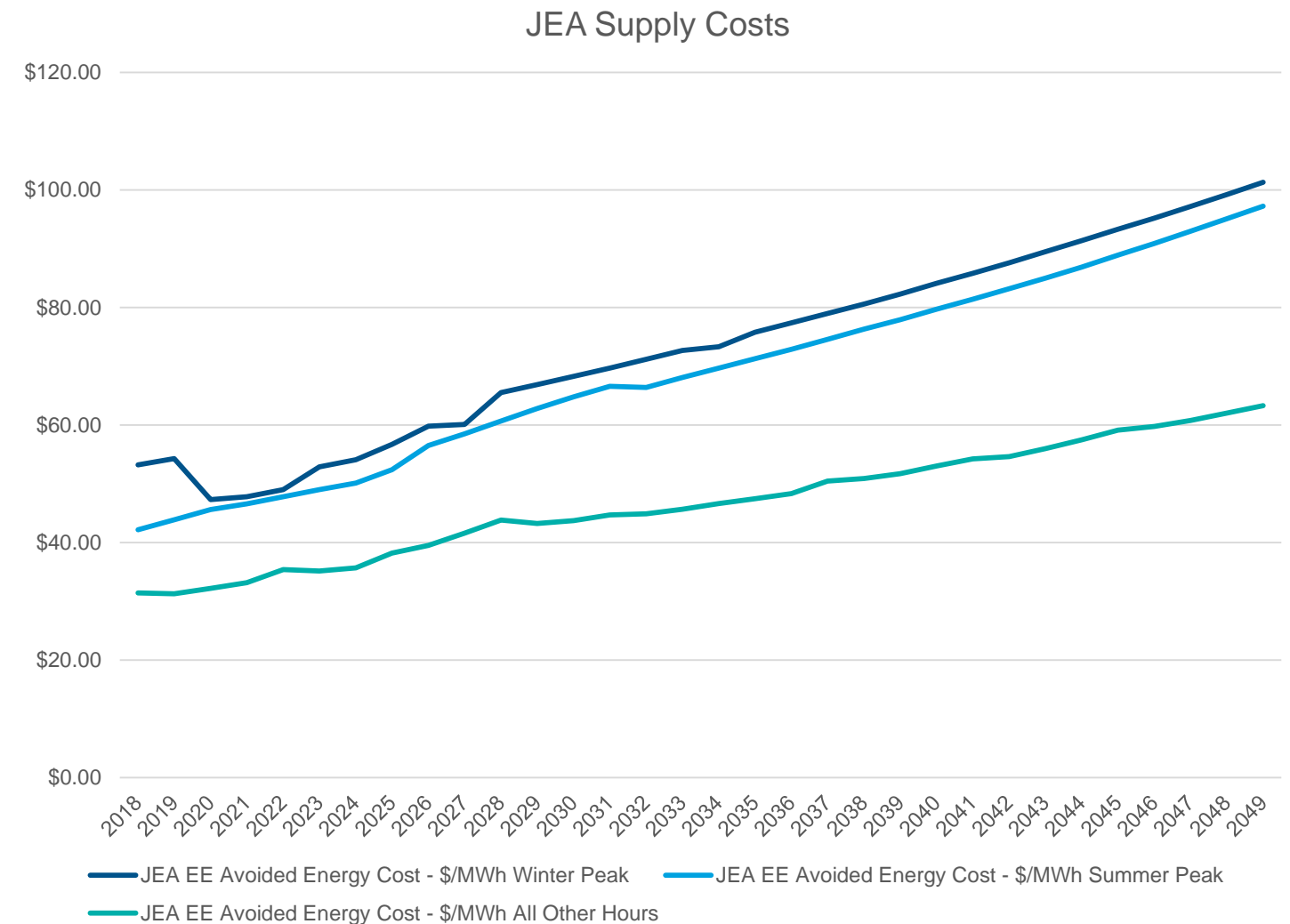
Benefit Cost Tests	Key Question Asked	Benefits	Costs
Ratepayer Impact Measure (RIM)	Will utility rates increase?	<ul style="list-style-type: none"> ▪ Incremental Revenue 	<ul style="list-style-type: none"> ▪ Program Incentives ▪ Program Overhead ▪ Incremental Electricity Supply Costs
Participant (PCT)	Will participants benefit over the measure life?	<ul style="list-style-type: none"> ▪ Incentives ▪ Fuel Savings ▪ O&M Savings 	<ul style="list-style-type: none"> ▪ Incremental Equipment Costs ▪ Incremental Electric Bills
Modified Total Resource Cost (mTRC)	Will the total cost of energy in the utility service territory decrease?	<ul style="list-style-type: none"> ▪ Net Participants O&M Savings ▪ Net Participants IC (Propane, Diesel, and Natural Gas) Energy Supply Costs 	<ul style="list-style-type: none"> ▪ Net Participants Electric Supply Costs ▪ Net Participants Incremental Capital Costs ▪ Program Overhead ▪ Program Incentives Paid to “Free Riders”

- **Coincident On-Peak Demand** = Technology peak demand which coincides with utility system demand
- **Combined Non-Coincident Demand** = Technology peak demand regardless of time of day or system demand

Electric Rates and Supply Costs

- Used JEA Rate Calculator to calculate baseline and incremental customer bills:

- GSD – Smaller non-road/material handling equipment
- GSLD – Large non-road and manufacturing process equipment
- RS – On-road residential charging

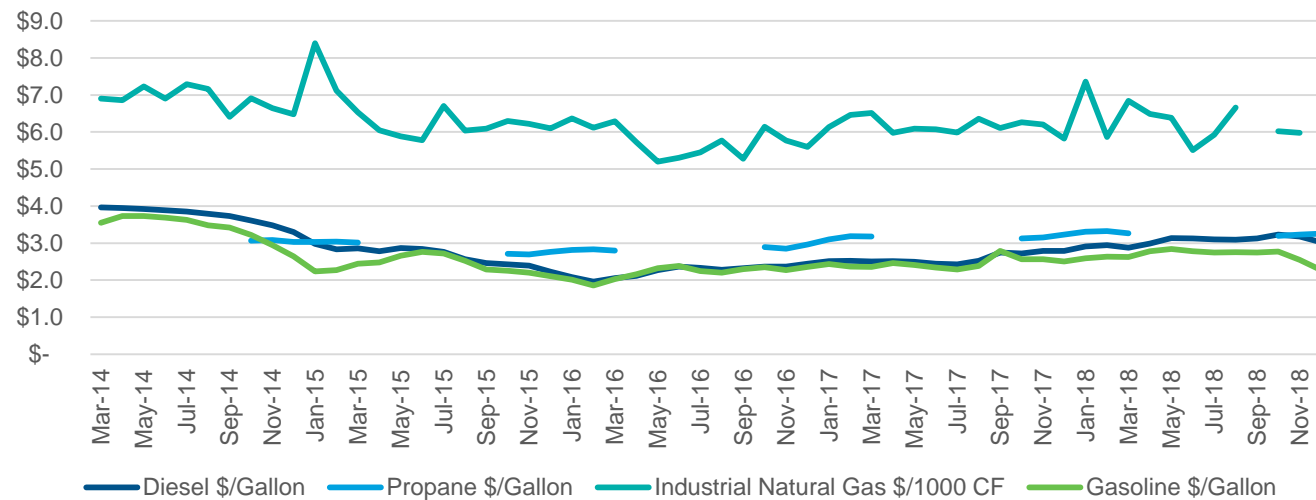


Fossil Fuel Rates and Supply Costs

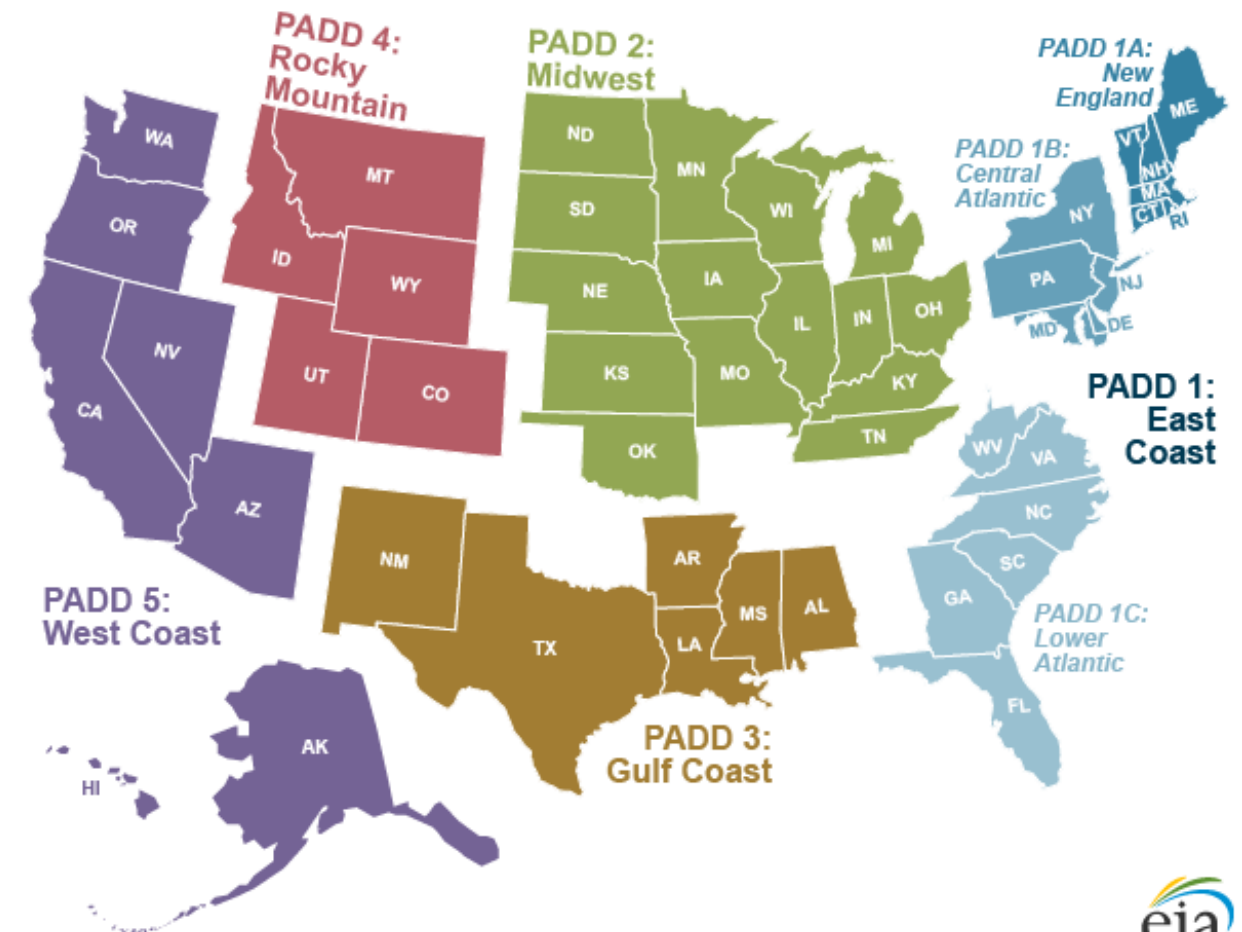
IC Fuel Retail Rates				
	Diesel	Propane	Industrial Natural Gas	Gasoline
Florida	\$2.83/Gallon	\$3.07/Gallon	\$6.29/CCF	\$2.59/Gallon
IC Fuel Supply Costs (% of Fuel Rates)	46%	25%	58%	59%
Escalation Rates	0.7%	1.5%	1.2%	0.7%

Source: US EIA: Average Monthly Prices 2014-2018, Annual Energy Outlook 2019
Supply costs based on crude oil (diesel) and wholesale (propane) prices

PADD 1: 2014-2018 Fuel Costs



Petroleum Administration for Defense Districts



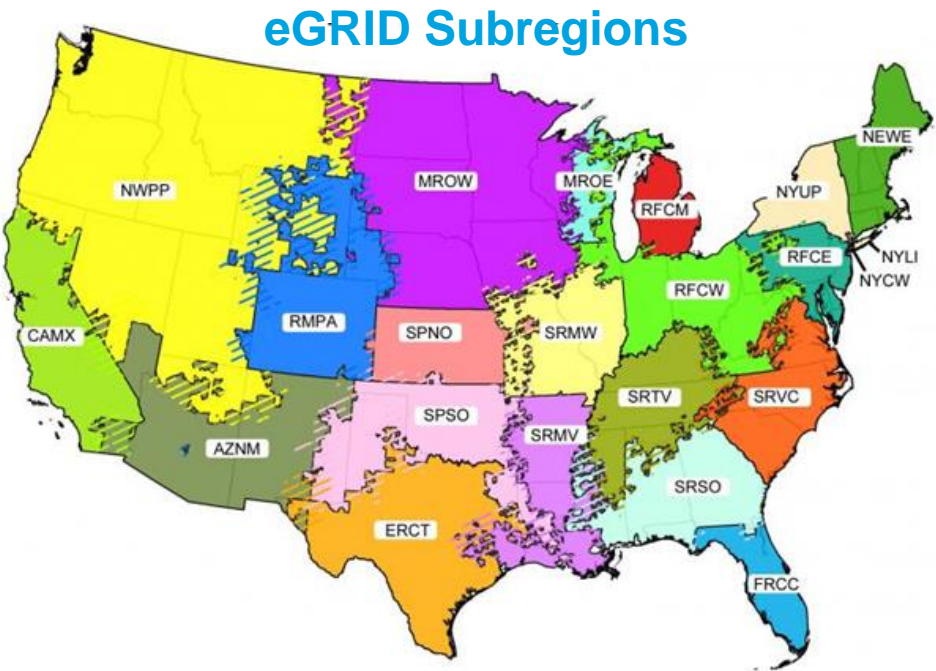
Emission Reductions

- Site Reductions

- 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
- EER and emission factor sources: California Air Resource Board’s Off-Road Model and EPRI

- Source Increases

- eGRID Generation Resource Mix by Subregion (FRCC)
- Argonne GREET Model



SAMPLE SITE REDUCTION CALCULATION

Diesel Assumptions	
3.60	MJ/kWh
134.47	MJ LHV/gallon Diesel
0.03	LHV gallon diesel/kWh

19,395	gCO2e/MMBtu upstream (CA-GREET 2017)
79,635	gCO2e/MMBtu Operation (CA-GREET 2017)
1055.06	MJ/MMBtu
93.86	gCO2e/MJ

Forklift Assumptions	
27,300	Annual kWh (Conventional Charge)
0.60	Diesel Energy Economy Ratio

Site Emission Reduction Calculations	
0.02	Gallons Diesel/kWh
0.0002	GHG Emissions (MT/kWh)
5.53	GHG Emissions (MT) per Forklift

Individual Technology Analysis (No Incentive)

	Material Handling													
<u>Benefit Cost Ratio</u>	Forklift - Conven.	Forklift - Rapid	Scissor/Boom Lifts	Scrubbers - Ride on top	Scrubbers - Stand behind	TRU - Box	TRU - Trailer	TSE	Golf Carts	Beverage Carts	Welders	Overhead Cranes	Monorail (per Mile)	Conveyor Systems
RIM	2.8	3.7	2.8	3.1	2.3	4.5	4.4	2.7	4.6	4.3	3.0	3.2	2.8	3.6
Participant	3.1	2.2	2.9	3.1	2.7	1.7	1.5	2.6	1.8	1.7	1.3	1.1	N/A	8.7
mTRC	1.9	1.4	1.8	2.2	1.5	3.1	2.4	2.4	3.2	2.4	1.7	1.2	N/A	5.6
<u>Net Benefit</u>	Forklift - Conven.	Forklift - Rapid	Scissor/Boom Lifts	Scrubbers - Ride on top	Scrubbers - Stand behind	TRU - Box	TRU - Trailer	TSE	Golf Carts	Beverage Carts	Welders	Overhead Cranes	Monorail (per Mile)	Conveyor Systems
RIM	\$22,128	\$31,352	\$10,773	\$6,752	\$1,866	\$16,843	\$28,513	\$10,293	\$6,854	\$13,420	\$38,093	\$57,435	\$3,421,189	\$106,848
Participant	\$90,448	\$67,467	\$40,789	\$25,354	\$8,940	\$16,714	\$22,349	\$35,080	\$7,949	\$13,461	\$16,571	\$13,971	N/A	\$1,327,061
mTRC	\$13,180	\$7,742	\$5,773	\$4,522	\$1,288	\$10,373	\$13,290	\$11,658	\$4,638	\$7,042	\$11,684	\$7,162	N/A	\$201,432

	Port						Airport				
Benefit Cost Ratio	Cranes - Ship-to-shore	Cranes - RTG	Drayage Trucks - Conven.	Drayage Trucks - Rapid	Shorepower	Tug Boats	Pushbacks	Tug/Tow Tractors	Belt Loaders	GPUs	PCAs
RIM	9.5	3.2	3.1	4.7	6.9	5.4	2.8	3.3	3.8	2.5	2.5
Participant	1.4	1.7	2.3	1.1	0.6	0.7	1.8	4.0	3.0	1.8	1.3
mTRC	0.8	1.5	3.3	1.5	0.5	0.6	2.3	4.0	4.2	2.2	0.9
Net Benefit	Cranes - Ship-to-shore	Cranes - RTG	Drayage Trucks - Conven.	Drayage Trucks - Rapid	Shorepower	Tug Boats	Pushbacks	Tug/Tow Tractors	Belt Loaders	GPUs	PCAs
RIM	\$3,986,252	\$558,770	\$40,974	\$120,632	\$4,015,813	\$590,631	\$21,040	\$21,445	\$7,226	\$270,000	\$711,086
Participant	\$3,458,496	\$793,226	\$103,750	\$21,264	(\$3,325,893)	(\$378,395)	\$34,310	\$96,841	\$27,446	\$420,251	\$531,952
mTRC	(\$999,793)	\$195,229	\$68,441	\$36,952	(\$1,634,519)	(\$231,078)	\$18,352	\$25,239	\$14,613	\$160,387	(\$51,219)

Individual Technology Analysis (No Incentive)

Manufacturing Process Equipment														
<u>Benefit Cost Ratio</u>	Electric arc furnace	Electric boiler (Small)	Electric boiler (Large)	Electric IR	Induction Heating (Small)	Induction Heating (Large)	Induction Melting (Small)	Induction Melting (Large)	Microwave	Radio frequency processing	UV curing	Injection Molding	Resistance Heating	Electric Drives
RIM	2.6	2.6	2.5	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.5	2.7	2.7	2.5
Participant	3.6	0.3	0.3	2.1	2.3	2.6	8.6	11.8	1.6	1.9	2.5	N/A	0.8	0.9
mTRC	14.0	0.4	0.4	4.6	4.0	5.2	15.3	108.7	2.4	2.9	4.0	N/A	0.0	0.7
<u>Net Benefit</u>	Electric arc furnace	Electric boiler (Small)	Electric boiler (Large)	Electric IR	Induction Heating (Small)	Induction Heating (Large)	Induction Melting (Small)	Induction Melting (Large)	Microwave	Radio frequency processing	UV curing	Injection Molding	Resistance Heating	Electric Drives
RIM	\$275,632,149	\$5,382,982	\$194,063,386	\$444,697	\$21,067	\$7,012,185	\$2,548,225	\$169,883,612	\$807,723	\$849,408	\$1,251,470	\$43,688	\$20,694,188	\$37,516,320
Participant	\$1,037,011,127	(\$6,404,445)	(\$234,533,081)	\$765,747	\$46,029	\$18,729,296	\$36,447,199	\$2,517,311,340	\$885,839	\$1,325,686	\$3,051,756		(\$6,461,580)	(\$7,154,560)
mTRC	\$570,145,705	(\$1,105,650)	(\$43,988,027)	\$526,193	\$24,165	\$10,193,973	\$20,715,583	\$1,463,766,115	\$509,655	\$575,869	\$1,514,855		(\$7,171,238)	(\$4,362,114)

On-Road Charging Infrastructure							
<u>Benefit Cost Ratio</u>	SF Residential	MF Residential	Workplace	Public	DCFC	School Bus	Transit Bus
RIM	3.6	3.6	4.0	3.5	3.7	2.6	3.7
<u>Net Benefit</u>	SF Residential	MF Residential	Workplace	Public	DCFC	School Bus	Transit Bus
RIM	\$2,427	\$6,066	\$6,953	\$5,820	\$28,816	\$16,578	\$105,262

Program Penetration Rates

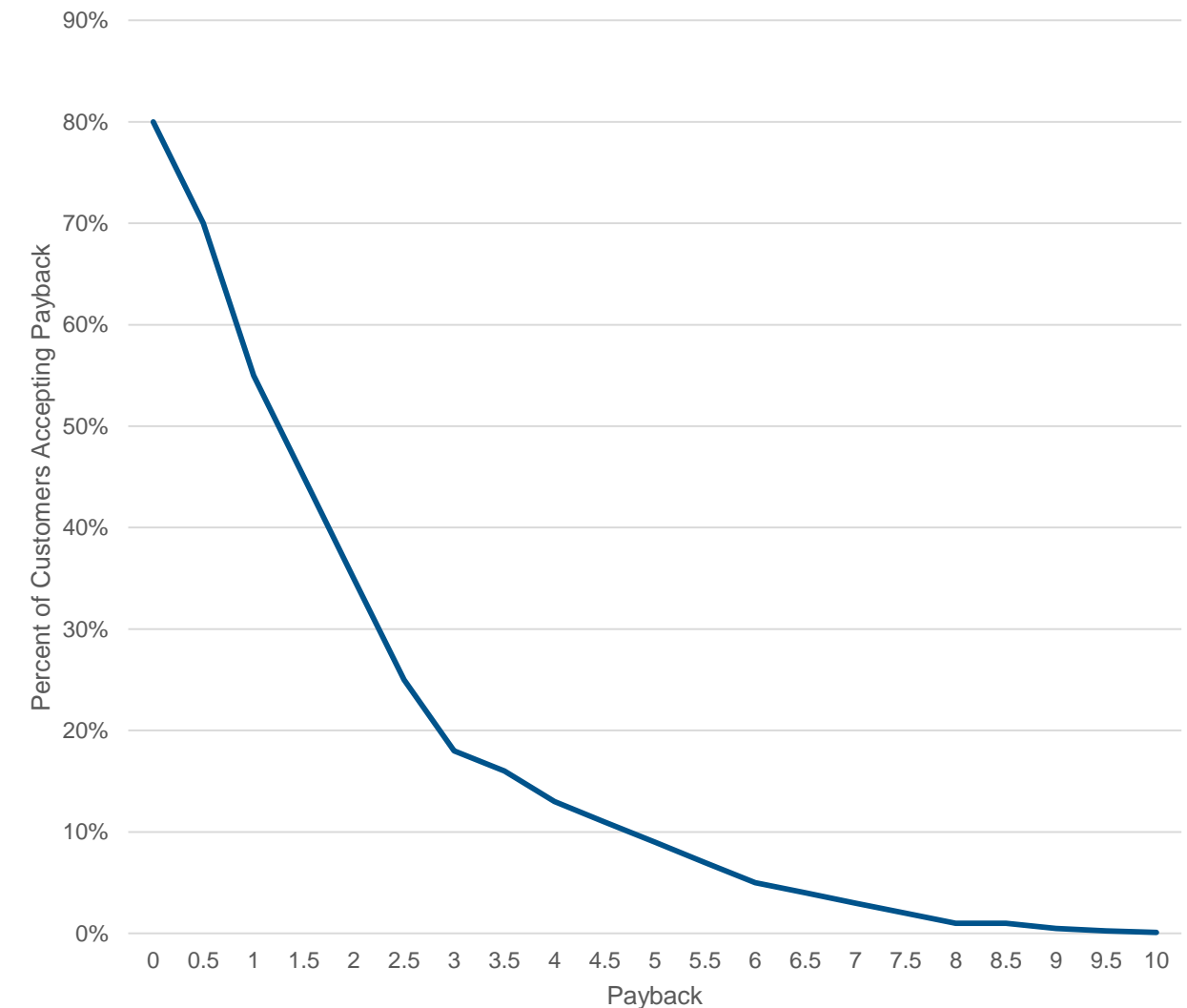
Incentives are based on:

- Market assessment feedback
- Implementation experience
- Incremental capital cost

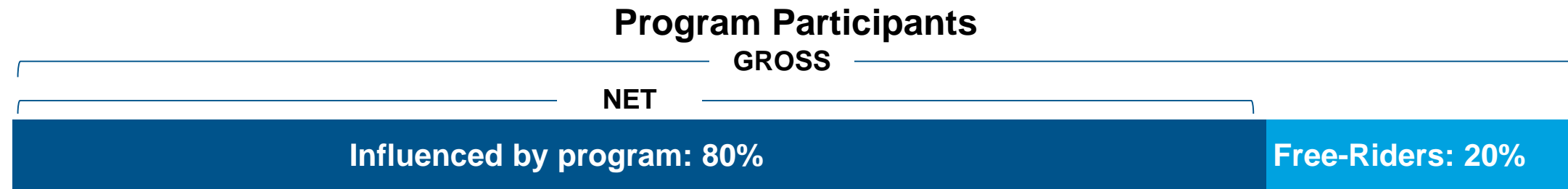
Penetration rates factor in:

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

Sample Payback Acceptance



Net to Gross (NTG) Ratio



Net to Gross Ratio

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

Reduced Free-Ridership Tactics

- Electric-to-electric conversions not allowed to participate
- Applications must be submitted within certain window of invoice date

Strategic Plan Framework

JEA Beneficial Electrification

Strategic Design

- **Focuses on engaging hard-to-reach commercial and industrial customer segments** and overcoming longstanding attitudes about converting traditional, natural gas-, propane- and diesel-powered equipment to more environmentally friendly electric-powered alternatives.
- **Employs a marketing campaign to create program awareness** and one-to-one engagement which is critical to gaining substantial customer participation.
- **Leverages multiple stakeholder groups** including utility large account managers, equipment dealers, and trade associations to maximize the impact of customer engagement efforts.
- **Uses personal interaction to educate stakeholders** about the benefits of the program, provide appropriate training depending on stakeholder role, and tools to engage and help enroll customers.

Marketing Tactics and Targets

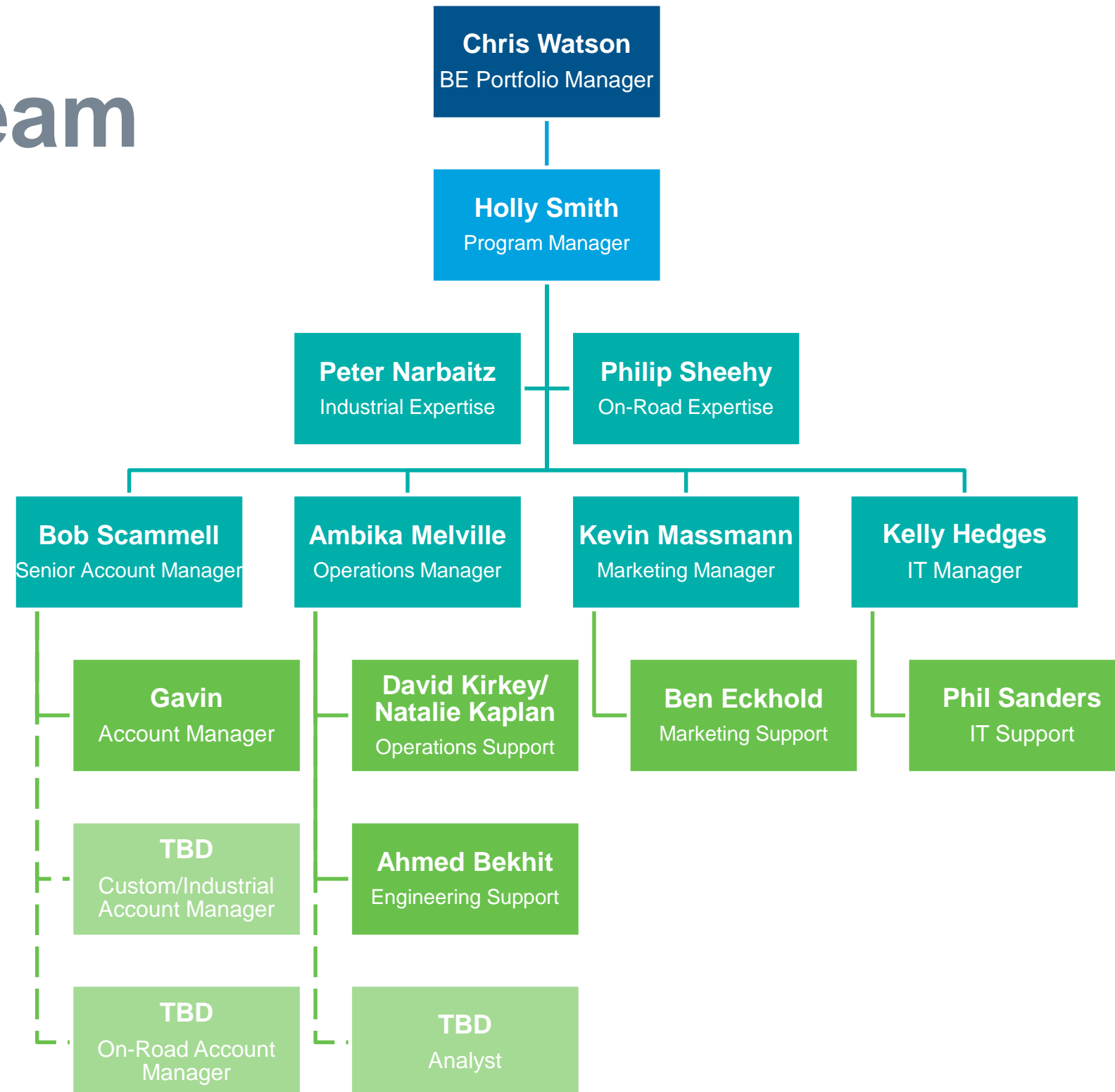
Non-Road and Industrial

- Collateral Refresh
- Trade Association/Show Support
- End-user Communications
 - Email
 - Direct Mail
 - Search
 - Trade Publication Media
- Dealer Communications
 - Co-branded Materials
 - Case Studies

On-Road

- Collateral Development
- End-user Communications
 - Email
 - Digital
 - Search
 - Social
- Dealer Communications
 - Co-branded Materials
 - POP
 - Trainings
- Ride and Drive Events
- EV Advisor

Program Team



Strategic Partners

Internal JEA Resources

- JEA Account Executives
 - Primarily for T1 and T2 customer accounts
- Program Managers
- Associate Program Managers
- Marketing Manager
- JEA Website

External Resources

- Technology Dealers and Sales Personnel
- Industrial Technology Manufacturers and their Test Application Centers
- Existing Customer Base
- Community Memberships and Associations
 - Jacksonville Chamber of Commerce
 - North FL Manufacturing Association
 - TCJAX – Transportation Club of Jacksonville

Risks and Mitigation

Sample Risk from Risk Mitigation Plan*



Risk Description	Precise Risks	Risk Mitigation - Action Items
A. External changing market conditions prevent program from achieving overall load growth goals	1. Diesel, Propane, Gasoline, and Natural Gas prices decrease significantly	1a. Highlight additional production and operational benefits associated with electric equipment during sales discussion, such as: Fume-free, quiet, lower center of gravity/safer, more compact, no clutch/inching pedal, no need to “rev” the engine for fast lift or hill starting.
	2. Projected 5% growth due to expansion of Jacksonville industries (including deepening of the St. Johns River) are delayed past anticipated year (2022).	2a. Regularly review and assess forecast to understand market forces and future potential.
	3. Proposed on-road strategy focuses on providing charging infrastructure to meet rising demand of electric vehicles and depends on increased vehicle sales	3a. Utilize CRM tool to identify high confidence targets. Carefully and accurately forecast to understand market forces and future potential.
	4. Alternative funding opportunities (DERA and VW) are delayed or do not focus funds on selected technologies	4a. Train Account Managers on grant funding to give client clear understanding of funding potential (or restrictions) + emphasize other benefits if funding is unavailable. Regularly update database of funding opportunities.

Applicable Alternative Funding Sources

■ Volkswagen Mitigation Fund

- **Description:** In October 2016, Volkswagen settled with the U.S. government over claims regarding knowingly selling diesel vehicles that violated the Clean Air Act. As a state beneficiary of the fund created by this settlement, Florida received \$166.3 million for diesel emission reduction projects.
- **Eligible Mitigation Actions:** Class 8 Local Freight and Drayage Trucks, Class 4-8 Buses, Freight Switchers, Shore power, Class 4-7 Local Freight Trucks, Airport Ground Support Equipment, Forklifts and other Cargo Handling Equipment.
- **Latest Update:** As of May 12, 2018, the Florida Department of Environmental Protection concluded a state-wide public survey and began drafting a Mitigation Plan which has been in it's final stages since October 2018.

■ Diesel Emissions Reduction Act (DERA)

- **Description:** A voluntary state program to reduce diesel emissions from existing diesel engines that were not manufactured to meet more stringent post-2006 emission standards.
- **Eligible Projects:** Port Drayage Truck and Marine Vessel Diesel Engine Replacement. (Eligible projects vary from year to year. Past projects have included idle reduction, cargo handling equipment, and cranes.)
- **Latest Update:** Applications for the current grant year closed on February 15, 2019.