

Sustainable Landscaping Project

Economic and Environmental Considerations

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CAPERS



A Note on Equipment Performance

- Battery-powered handheld tools, including blowers, string-trimmers, hedge-trimmers, and chainsaws, now offer enough power to keep up with commercial landscapers' demands under normal conditions, such as late spring through summer.
- They still struggle under more-taxing conditions, such as the heavy grass of early spring and, most importantly, the leaves of fall.
- The force of the best battery backpack blowers is still about half that of the best gas-powered backpack blowers.



Economics - Assumptions

- All current commercial landscaping services can feasibly be transitioned to battery-powered equipment on a 1-to-1 basis (e.g. one ICE backpack blower = 1 battery-powered backpack blower bare tool).
- Batteries cannot be recharged throughout the day.
 - The crew must have enough fully charged batteries to get them through the entire day's required runtime.
 - Charge time is not an influential factor in charger choice.
 - Each battery requires its own charger.
- Equipment is used at the maximum power setting.



Economics - Methods

- We calculate tool, battery, charger, and accessory costs incurred by standard types of crews (e.g. mowing, gardening, etc.). based on their specific equipment needs and runtimes based on two usage scenarios: normal (standard spring/summer operations) and max (spring/fall cleanup).
- We use retail costs for American Green Zone Alliance-Approved commercial-grade equipment.
 - For handheld tools, we average the costs of comparable packages of EGO and Husqvarna equipment.
 - For mowers, we use single prices for Mean Green Mowers and EGO equipment.
- We specify a greater number tools (e.g. string trimmers) than might be used on a typical job to account for variance in tasks and job sites.



Economics - Example Husqvarna Equipment Packages

	Unit Cost	Normal Pieces per Mowing Crew	Max Pieces per Mowing Crew	Normal Pieces per Independent Gardening Crew	Max Pieces per Independent Gardening Crew
31 Ah Battery Backpack with Harness and Adapter	\$970	4	12	4	8
Charger for Battery Backpack	\$180	4	12	4	8
Backpack Blower Bare Tool	\$470	3	3	2	2
String Trimmer Bare Tool	\$300	3	3	2	2
Hedge Trimmer Bare Tool	\$450			2	2
14 in. Chainsaw Bare Tool	\$450			1	1



Economics - Per Crew Equipment Replacement Costs

Estimated Per-Crew Costs of Transitioning to Various Packages of Battery-Powered Equipment

	Normal Mowing Crew Cost	Max Mowing Crew Cost	Normal/Max Add-On Gardening Crew Cost	Normal Independent Gardening Crew Cost	Max Independent Gardening Crew Cost	Normal/Max Hardscaping Crew Cost
Avg. Total Cost per Crew for All Handheld Equipment	\$7,676	\$20,780	\$1,123	\$8,025	\$14,977	\$574
Total Cost per Crew for Mowers ONLY	\$55,981	\$55,981	\$0	\$0	\$0	\$0
Avg. Total Cost per Crew for ALL Equipment (Including Mowers)	\$63,657	\$76,761	\$1,123	\$8,025	\$14,977	\$574
Avg. Total Cost per Crew for Only Backpack Blowers	\$3,526	\$19,732	\$0	\$3,526	\$13,155	\$574



Economics - Per Crew Equipment Replacement Potential Subsidy Levels

Potential Subsidy Levels for Mowing and Independent Gardening Crews' Total Equipment Cost by Use Case

Use Case	Crew Type	Subsidy (%)	Cost
Normal	Mowing	10	\$6,383
		25	\$15,957
		50	\$31,914
	Indep. Gardening	10	\$825
		25	\$2,062
		50	\$4,124
Max	Mowing	10	\$7,722
		25	\$19,304
		50	\$38,609
	Indep. Gardening	10	\$1,534
		25	\$3,835
		50	\$7,671



Environmentals - Assumptions

- The current GHG emissions intensity of the electricity grid in New Jersey remain constant.
- The self-reported yearly gasoline cost from the 2021 SP survey of Princeton landscapers is an accurate representation of that for all Princeton landscapers.
 - Because some landscapers likely included the gasoline required for their trucks in their reported figures, the calculated emissions from gasoline likely represent an upper bound, and thus the reduction likely represents an upper bound.
- All commercial crews doing business in Princeton do all their business in Princeton.



Environmentals - Methods

- We estimate the existing fuel consumption of a typical landscaping crew during a typical year using data from the 2021 SP landscaper survey.
- We calculate the GHG emissions associated with providing the electricity required to run the battery equipment specified in the economic analysis for the required runtimes.
 - We combine the normal and max use cases; therefore, the GHG estimate for battery-powered equipment likely represents an upper bound.
 - We calculate the weighted average electricity usage across crew types.
- We calculate a 90 percent confidence interval for the number of landscaping crews operating in Princeton to calculate the aggregate emissions reductions for all commercial crews doing business in Princeton.



Environmentals - GHG Emissions Reductions

Estimated Average Per-Crew Yearly Combined Normal and Max Use Case Commercial GHG Emissions and Potential Reductions

Equipment Type	Weighted Average (Across Crew Type) Tonnes CO2e
ICE	28.1
Battery	1.1
Reduction	27.0
Equivalent # Passenger Vehicles Taken Off the Road	6

Estimated Average Aggregate Princeton Yearly Combined Normal and Max Use Case Commercial GHG Emissions and Potential Reductions

Equipment Type	Mean Tonnes CO2e	Lower Bound (C=.9) Tonnes CO2e	Upper Bound (C=.9) Tonnes CO2e
ICE	5,082.7	2,137.5	8,037.8
Battery	192.9	81.1	305.1
Reduction	4,889.8	2,056.4	7,732.7
Equivalent # Passenger Vehicles Taken Off the Road	1,061	446	1,678



Thank You!

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This presentation pulls information and data from a CAPERS working paper that contains all citations and references. Please contact Jack Green at jpgreen@princeton.edu with any questions.

