The Economics

of Switching to

Battery-Powered Leaf Blowers:

A Cost Comparison

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Contents

Background

Most leaf blowers and other landscaping tools are still powered by the two-stroke engine, a lightweight but highly polluting machine with heavy impacts on air quality, the health of landscape workers, and communities at large.

In recent years battery-powered equipment has improved in many ways, including power output, battery capacity and longevity, and price. Its ability to fully replace gas-powered equipment for most jobs has led to their adoption by numerous commercial landscape companies, school districts, and municipal parks and public works departments and convinced many cities that there is no remaining reason not to ban their gas-powered predecessors. In 2022, at least 25 cities in California alone have full bans on gas-powered leaf blowers, and more are preparing to. Commercial and municipal landscape crews in these cities are already maintaining properties of all sizes effectively with cleaner and quieter battery-powered equipment.

Still, some policymakers considering whether to regulate gas-powered landscape tools in their city or to transition their municipal landscaping crews to battery power are concerned or uncertain about the cost. While the health and environmental benefits of switching to battery equipment are clear and large, there is little clarity on the economics.

(Gas-powered landscaping tools have battery-powered equivalents, but this study focuses on leaf blowers, due to their ubiquity and outsize impacts.)

Key questions for landscapers, cities, and policymakers include: How much does it cost to replace a gas blower with a battery-powered equivalent? How do their operational costs compare? Can the cost of switching pay for itself? If so, how long does it take, and how much money would it save over time?

A cost comparison could look at both the purchase and operational costs of both gas and battery leaf blowers and compare them. That would answer the question, If one is considering the purchase of a new (or extra) leaf blower, which would be cheaper over time? But this study asks the slightly different question, For landscapers who *already* own gas-powered leaf blowers, **what is the net cost of *switching* to battery-powered blowers and using them over time?**

Costs considered

Much of the cost of a power tool is paid not just at the cash register but also at the gas pump, throughout its entire working life. Just as printers require ink to in order to print, power tools require energy and energy costs money.

So the question of whether switching to battery-powered leaf blowers will cost more money than continuing to use gas-powered ones requires also considering the *cost to operate* them, year in and year out.

Santa Cruz C.H.A.S.E. calculated the purchase and operational costs of two sets of commercial-grade leaf blowers of comparable power output in two different operational scenarios. The purchase price of the gas blowers was excluded, to reflect the assumption that the landscaper already owns the gas blower.

The equipment costs were the lowest available at the time of this report, and include local sales tax. The price of gasoline was the current local (Santa Cruz County, California) price per gallon of the cheapest grade of unleaded fuel. The price of electricity was the current average retail price for California (residential sector).

Given that the price of gas varies widely by region, we also ran the analysis using several other price points and show the results in the next section. (The price of electricity varies regionally as well, but has a much smaller effect on the overall cost picture.)

Costs Considered in Analysis		
	Gas-powered	Battery-powered
Purchase of new equipment:	—	Battery leaf blower
	—	Extra batteries, charger, etc.
Ongoing operational inputs:	Gasoline	Electricity
	Oil	Future battery replacement, if applicable
	Yearly maintenance	NA

Operational Scenarios

Professional and municipal landscapers maintain a range of property sizes, from small yards and city properties to office parks and large recreational parks, and use leaf blowers for different lengths of time each day. To capture this variation, we considered two scenarios: one in which the power of the gas and battery blower is suitable for mid-sized properties and the blowers are run for three hours per day, and another in which the power is suitable for large properties and the blowers are run for five hours per day.

These are the scenarios considered and the blower models analyzed:

	Gas-powered	**Battery-powered**
Scenario A		
Model	Husqvarna 525BX	EGO LB7654
Power output (at nozzle)	459 cfm, 192 mph	580 cfm, 200 mph
Battery	NA	2x BA2800T (280 Wh)
Usage	3 hours per day	3 hours per day
		
Scenario B		
Model	Stihl BR 500	Stihl BGA 200
Power output (at nozzle)	544 cfm, 207 mph	553 cfm, 188 mph
Battery	NA	1x AR 3000 L (1,522 Wh)
Usage	5 hours per day	5 hours per day
		

Results

The two charts below show the costs of switching to the battery-powered leaf blower (green line) and of continuing to use an existing gas-powered blower (red line).

The y-coordinate (height) of the green lines at year zero reflects the initial cost of the battery blower and battery equipment. The red lines begin at $0, reflecting no initial cost for continuing to use the gas blower.

The height of the lines across time reflects the added cost of the operational inputs mentioned above. The steepness of the red lines reflects the significant ongoing cost of gasoline to the operation of a gas blower. The green lines slope up as well, but very gradually, as the cost of the electricity which charges the batteries is relatively small. The brief upturn in the green line at year three in Scenario A reflects the purchase of two new replacement batteries (which may not be necessary).

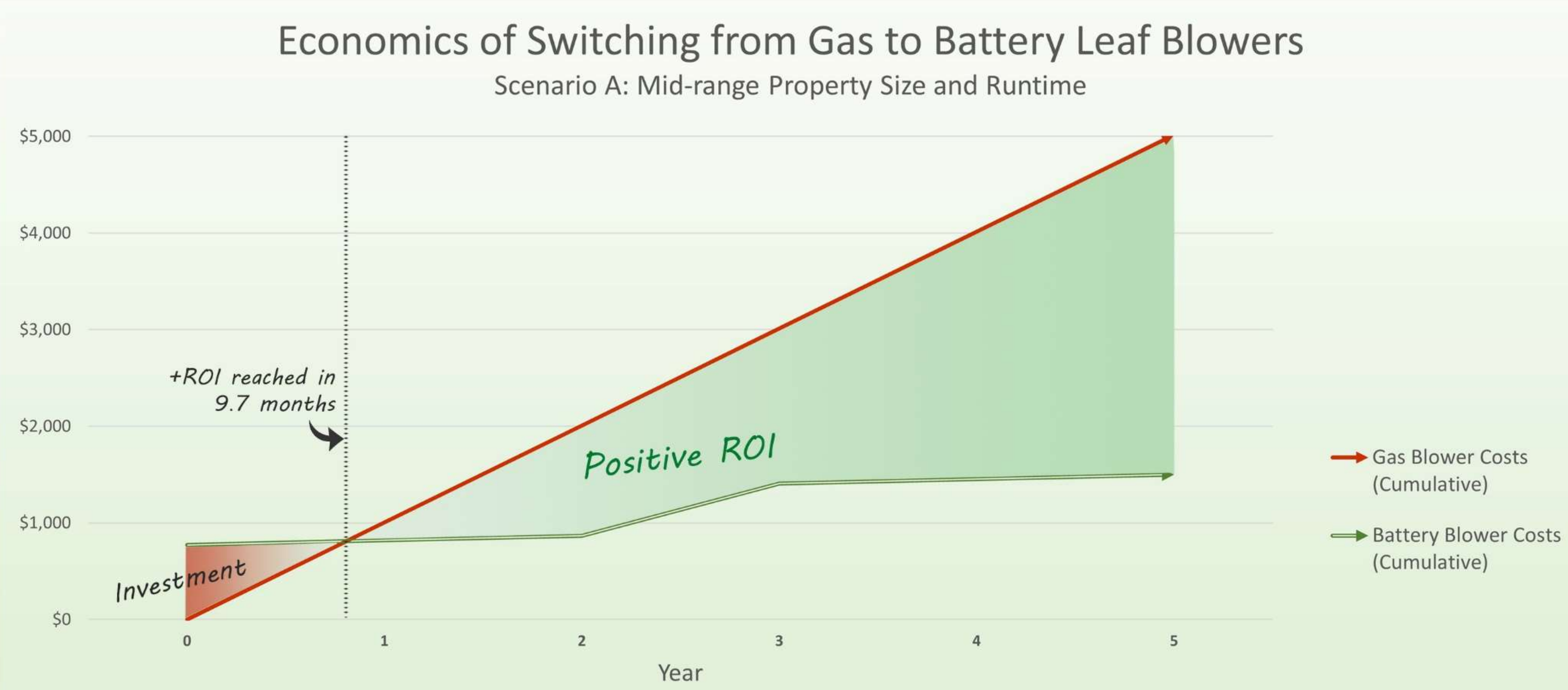
The costs reflected by the lines are cumulative. So the cost displayed at year two, for example, is not what the landscaper would have paid *in* year two, but in total after two years. This allows the visualization of the point in time at which positive return on investment (ROI) is reached.

The point of intersection of the two lines is when the overall cost of switching to the battery blower is *less* than the cost of continuing to use the gas blower. At that point, the purchase of the battery equipment has been recouped. And after that point, the growing gap between the lines reflects the increasing money saved by switching to the battery blower.

Scenario A: Mid-range Property Size and Runtime

In the first scenario, the up-front cost of the battery equipment is $772, including tax. **Positive return on investment is achieved in 9.7 months.**

By the end of the second year, switching to the battery blower would already have saved $1,142.

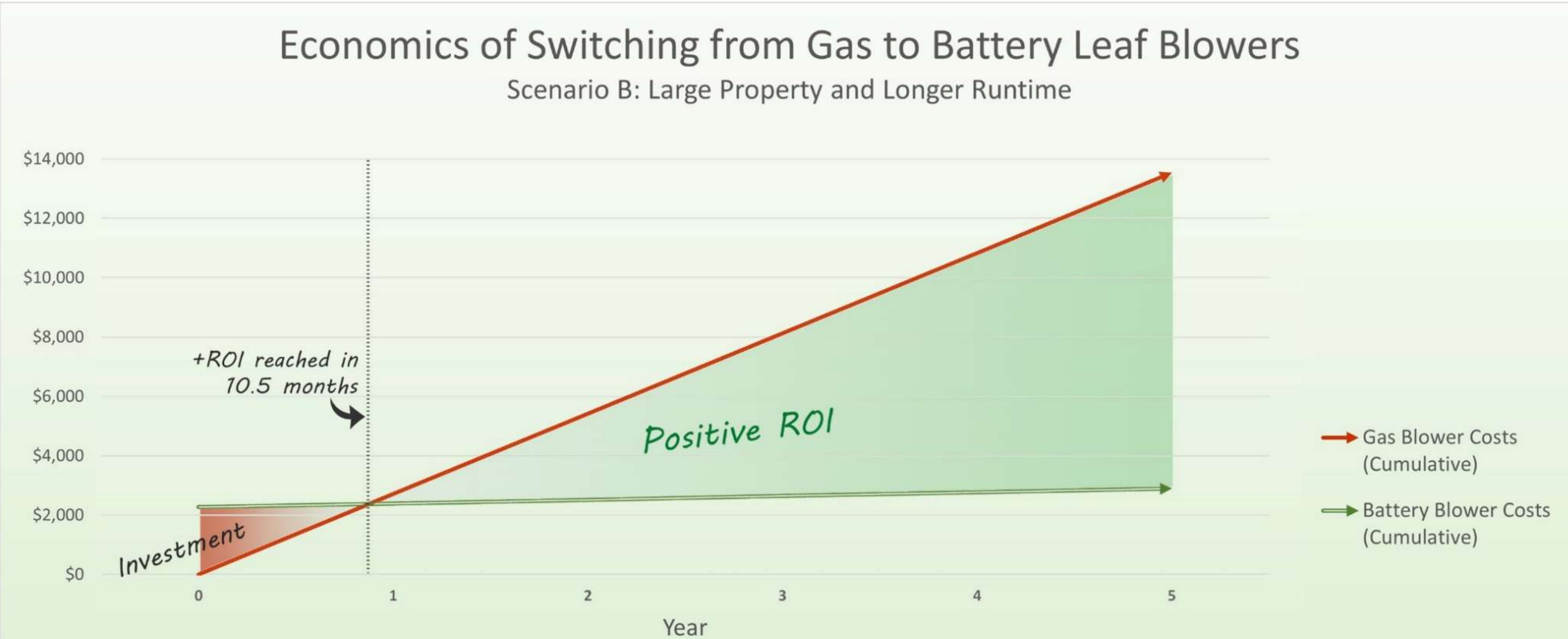


Includes up-front cost of battery leaf blower, 2 batteries, plus accessories, and purchase of two new batteries after year 3, plus tax. Gas costs include 2-stroke engine oil and recommended yearly maintenance. This scenario: gas blower is **Husqvarna 525BX**, battery blower is **Ego LB7654** with 2x 5.0 Ah batteries, and runtime is **3 hours/day**, 281 days/year. At time of calculation (June, 2022), gas price is $6.49 (source: AAA) and electricity cost is $0.27/kWh (source: U.S. Energy Information Administration). Energy consumption data provided by Husqvarna and Ego.

Scenario B: Large Property and Longer Runtime

In the second scenario, the up-front cost of the battery equipment is $2,261, including tax. **Positive return on investment is achieved in 10.5 months.**

By the end of the second year, switching to the battery blower would already have saved $2,904.



Includes up-front cost of battery leaf blower, backpack battery, high-speed charger, and accessories, plus tax. Gas costs include 2-stroke engine oil and recommended yearly maintenance. This scenario: gas blower is **Stihl BR 500**, battery blower is **Stihl BGA 200** with AR 3000 L battery, and runtime is **5 hours/day**, 281 days/year. Battery replacement not required as lifetime is ≥1,500 cycles (>5 years). At time of calculation (June, 2022), local gas price is $6.49 (source: AAA) and electricity cost is $0.27/kWh (source: U.S. Energy Information Administration). Energy consumption data provided by Stihl.

The Stihl battery blower and backpack battery selected for Scenario B are among the most expensive battery blower equipment available, so other capable battery tools are available for less, but we selected this combination for landscapers who demand performance rivaling that of commercial backpack gas blowers. Despite the higher up-front cost, it still achieves positive return on investment quickly—in 10.5 months. And after that, the savings (or increase in annual profits) is serious—over $2,500 per year.

Summary of Results

	Leaf blower specs				Cost over 5 years				
	Air Volume (CFM)	Air Velocity (MPH)	Noise dB(A)	Equipment Price, New[1]	Scenario Usage	Total cost[2]	$/year, annualized	**Time to Pos. Return on Investment (ROI)**	**Avg. annual savings after ROI**
Husqvarna 525BX gas blower	459	192	92	($317)	3 hrs/day, 281 days/yr	$5,017	$1,003	-	-
EGO LB7654 battery blower + 2x 280Wh batteries	580[3]	200	64	($772)		$1,501	$300	**9.7 months**	**$858**
Stihl BR 500 gas blower	544	207	65	$590	5 hrs/day, 281 days/yr	$13,541	$2,708	-	-
Stihl BGA 200 battery blower + 1,522Wh backpack battery	553	188	59	$2,261		$2,889	$578	**10.5 months**	**$2,583**

[1]includes tax and all required accessories; cost of new gas blowers excluded from analysis, included here for reference

[2]includes cost of new battery equipment; excludes cost of gas blower (assumes already owned)

[3]delivers 765 CFM on turbo

Return on Investment at Other Gas Prices

	Scenario A		Scenario B	
Gas price ($/gal.)	Time to + ROI (months)	Avg. annual savings after ROI	Time to + ROI (months)	Avg. annual savings after ROI
3.00	16.2	$471	19	$1,424
3.50	14.8	$527	17.1	$1,590
4.00	13.6	$582	15.5	$1,756
4.50	12.6	$637	14.1	$1,922
5.00	11.7	$692	13	$2,087
5.50	10.9	$748	12	$2,253
6.00	10.3	$803	11.2	$2,419
6.50	9.7	$858	10.5	$2,585

Methods

As noted in the background section, the overall cost is comprised of the purchase price of equipment plus ongoing operational costs.

Initial purchase cost

Gas-powered

For the gas-powered leaf blowers, the current purchase price was excluded as the analysis calculates the cost of *switching* from gas- to battery-powered equipment; the gas-powered leaf blower is already owned.

However, for the sake of comparison, the cost of the two gas blowers in scenarios A and B were $317 and $590, respectively, including tax (see summary of results on prior page). If a landscaper has to replace a broken leaf blower with a new gas blower, or buy an extra one, this of course would need to be added in any comparison with battery-powered blowers.

Battery-powered

This amount includes the new battery-powered leaf blower, plus enough extra batteries to last a full day of use (three or five hours, depending on scenario) *without recharging*, plus required accessories, plus optional fast charger. (Many battery blowers are sold as part of a kit which includes one battery, a charger, and necessary accessories.)

The cost of equipment was the lowest price found locally or online at the time of the study (June, 2022), and includes sales tax.

Annual operational costs

Gas-powered

The annual cost to operate the gas-powered leaf blowers was found by first determining the hourly cost of consumable inputs (gasoline and oil).

The main operational input is gasoline, the cost of which depends on the amount used and the local price of gasoline. Oil is also required for two-stroke engines. The engines also require periodic maintenance (approximately annually) to keep them in working order, including replacement of the spark plug, air filter, and fuel filter.

The hourly cost of gas used was found by first taking the average fuel consumption rate of each gas blower (found in manufacturer-published data) and multiplying by the local cost of regular unleaded gasoline, which at the time of this report is $6.49 per gallon in Santa Cruz County (source: AAA). (The gas price was divided by 128 to convert from gallons to ounces.) The product was then multiplied by 49/50 to allow for the addition of oil at a 1:50 ratio.

$$\text{Hourly cost of gas (\$)} = \text{Fuel consumption rate (fl. oz./hr)} \times \text{Cost of gas (\$/gal)} \div 128 \times 49/50$$

Then the cost of oil was added; at a recommended 1:50 ratio, 1/50 of the fuel volume consumed was multiplied by the price of two-stroke engine oil.

$$\text{Hourly cost of oil } (\$) = 1/50 \times \text{Fuel consumption rate (fl. oz./hr)} \times \text{Cost of oil } (\$/\text{fl. oz.})$$

The resulting hourly cost of inputs was then multiplied by the number of hours of use per day (three or five, depending on the scenario), and the number of days of use per year (assumed a schedule of 5.5 days per week x 51 weeks per year = 281 days per year) to arrive at the annual cost of fuel and oil consumed.

$$\text{Annual cost of consumable inputs } (\$) = \text{Hourly cost of gas } (\$/\text{hr}) + \text{Hourly cost of oil } (\$/\text{hr}) \times \text{Hours of operation per year}$$

Finally, the cost of annual two-stroke engine maintenance was added ($150/year at the local small-engine repair shop), resulting in the total annual cost of operation.

$$\text{Annual operational cost } (\$) = \text{Annual cost of gas and oil } (\$) + \text{Annual maintenance } (\$)$$

Battery-powered

The main operational inputs are electricity, the cost of which depends on the amount used to charge the batteries and the local cost of electricity and, depending on the battery's expected longevity in terms of recharge cycles, potentially the purchase of new batteries after x years. (Battery blowers do not require significant maintenance as they have a simpler design and no carburetor or fuel filter.)

The energy consumption rate of the battery blowers was found by taking the battery content (in kWhs), dividing by manufacturer-published data on the runtimes of the battery/blower combination, and then adding 10% to account for the energy lost in the charging of batteries.

$$\text{Energy consumption rate (kWhs/hr)} = \text{Battery content (kWh)} \div \text{Battery runtime (hrs)} \times 1.10$$

The hourly cost of consuming that electricity (running the battery blower) was then calculated by multiplying by the local cost of electricity (California, residential sector). At the time of this report, this was $0.27/kWh (source: U.S. Energy Information Administration).

$$\text{Hourly cost of operation } (\$) = \text{Energy consumption rate (kWhs/hr)} \times \text{Cost of electricity } (\$/\text{kWh})$$

As with the gas blower calculations, the resulting hourly cost of operation was then multiplied by the number of hours of use per day (three or five, depending on the scenario), and the number of days used per year (281) to arrive at the annual cost of electricity consumed.

$$\text{Annual cost of electricity (\$)} = \text{Hourly cost of electricity (\$/hr)} \times \text{Hours of operation per year}$$

Finally, because rechargeable batteries lose their ability to hold a full charge over time, the analysis treats them as a consumable operational input and considers the need to replace them with new batteries at a later date.

In Scenario B, the high-capacity backpack battery is rated by the manufacturer (Stihl) at 1,500 charge cycles. Even if its capacity dropped significantly after this point, the battery would have lasted longer than the span of this analysis (5 years).

In Scenario A, the batteries are rated by the manufacturer (EGO) at 1,000 charge cycles. At this work schedule, they would maintain their capacity for at least 3 ½ years. To be conservative, this analysis assumes no further usability and therefore adds the cost of (two) new batteries after year three. (This is why the green line on the chart turns upward at year three before resuming its previous slope.)

So the cost of replacement batteries (if indicated by work schedule and charge rating) is treated as an operational cost and is added to the cost of electricity.

$$\text{Annual operational cost (\$)} = \text{Annual cost of electricity (\$)} + \text{Cost of new batteries after x years, if needed (\$)}$$

The annual operational cost was added to the up-front cost of new battery equipment to arrive at the overall cost of switching to battery leaf blowers, at each year up to year five.

Rate of Return

This study also calculated the rate of return of switching to battery blowers. This is a common metric to determine the level of success of an investment, and takes into account the difference between the initial investment amount and its ending value after a period of time. So if a property was purchased for $1 million and was sold for $1.5 million five years later, the profit ($500,000) is a rate of return of 50%. And since it took 5 years to realize, it represents an average annual gain of 10%. (If the investment were one that compounds over time or pays dividends as a percentage of the invested amount, a geometric mean would be used and the annual growth rate would be lower than 10%; but the total gain would still amount to 50%.)

A similar calculation can be applied to the case of switching to battery-powered tools. The profit is the difference between what the landscaper would have paid to operate the gas tool and what they would actually pay to operate the new battery tool, totaled over the five-year time period. This is analogous to profit from the sale of an appreciated stock or property because it is money in the bank which would not be there if the investment were never made. And the cost of the investment is the cost of the new battery equipment. The annual average is arithmetic rather than geometric because the expected gains (savings) are the same amount each year and do not compound.

$$\text{Avg. annual rate of return (\%)} = \frac{\text{Five-year operational cost savings (\$)} - \text{Cost of new battery equipment (\$)}}{\text{Cost of new battery equipment (\$)}} \div 5\ \text{years} \times 100$$

Assumptions

Any economic analysis will rely on the data available at the time, and may be more or less conservative in its assumptions.

For example, the cost of electricity is a factor in switching to battery power and the cost of gasoline is a factor in continuing to use gas blowers, and each of these varies. In the absence of a crystal ball revealing future prices of either, the current (local) prices are used.

Geographically, prices for gas and electricity are generally higher in Santa Cruz, and California as a whole, than most of the rest of the country. Therefore, we added a chart in the Results section displaying the time to ROI based on different gasoline prices so that results can be approximated for other parts of the country (and other points in time), where and when costs may be lower or higher. Assuming lower gas prices results in longer times to ROI for switching to battery blowers, but not dramatically so. For example, even if the gas price in another region is 40% lower than the current price in Santa Cruz, it would extend the time to positive ROI by only about four months.

Running the numbers (for the battery side of the analysis) based on the lower *electricity* prices found in other parts of the country would move the move the needle in the opposite direction, reducing the time to ROI for switching to battery power. However the effect of this would be very small, given the already low price of electricity compared to gasoline.

When it comes to other assumptions, this analysis is conservative in many ways, by which we mean careful or restrained in its assumptions so as to not underestimate the cost of switching to battery blowers. As a result, we have high confidence that the time to positive return on investment is *at least as good* as the results show, for the given inputs, and likely better for the following reasons:

- Landscape businesses already anticipate needing to replace their existing gas blowers when they reach the end of their usable lifespan. But for simplicity, this analysis treats 100% of the cost of (battery) equipment as a new and unanticipated cost. In reality, whatever impact the cost of new battery equipment has on a landscaper's budget, it is effectively reduced by what the landscaper would have paid to replace the existing gas blower at the end of its service life if they continue to use gas blowers. And the older the existing gas equipment is, the cheaper the true cost of the new battery equipment.

- The cost of new equipment is for one battery leaf blower (or kit) plus required accessories, but companies or cities that want to replace several gas blowers or their whole fleet can likely benefit from volume discounts.
- Electric motors are simpler than gas ones, and likely to last longer before needing replacement.
- It assumes the lithium-ion batteries will need replacing immediately after they have undergone the minimum charge cycles guaranteed by the manufacturer. In practice, they often perform well for much longer.
- Some landscapers already using battery tools recharge their batteries on the go, using customers' outlets or inverters in their trucks. We added the cost of a high-speed charger ($129 plus tax) to the EGO blower in Scenario A, which would allow for even more blowing time if the first battery is charged while the second is in use. The 5Ah battery recharges in 40 minutes. (No advantage would be gained with rapid charging in Scenario B as only one battery is required.)
- The use of gas blowers requires extra time to mix the fuel and oil at the proper ratio and refill the tank periodically. This was not added to the cost of gas use.
- Battery technology continues to get better all the time—longevity increases and prices fall. So the economics of switching are likely to continue to improve at a significant rate. On the gas side, the price of gas is highly volatile (a common challenge for businesses that rely on gasoline), and is not assumed by economists to decline in the long term like battery prices are.

For these reasons, the economics of switching to battery-powered leaf blowers are likely even better than this analysis suggests, today and into the future.

Discussion

In either scenario, local landscapers recover the initial cost of purchasing a battery-powered leaf blower in less than a year, and achieve significant savings (higher profits) every year after.

The primary reason for this is the large difference between the cost of gasoline and battery power for the same resulting power output. The differential across time is large enough to dwarf the purchase cost of the battery equipment.

When considering the conversion to battery leaf blowers as an investment, the rate of return is far higher than can normally be obtained in other ways. The average annual rate of return for switching to battery equipment in the two scenarios is 91% and 94%, respectively. It is hard to find a better investment anywhere. Even the broad stock market, one of the best and most reliable investments for the last 25 years, has returned "only" about 10% per year, on average (or slightly higher using arithmetic mean).

The high rate of return and short time to positive ROI also make it easier for a landscaping business of any size to finance the initial cost and to spread it out over time (see section on financing below).

Switching to battery power benefits landscape companies in even more ways—economic and otherwise—beyond what is considered here. It reduces the significant health impacts of two-stroke engine exhaust and noise on the company's workers, who operate the machines for hours each day. This in turn means happier, more productive, and more reliable workers. It also increases the workers' comfort, since they don't have to suffer the noise and high vibration of gas blowers or return home each day smelling like gasoline. And it benefits the company's clients, who also no longer have to suffer the fumes and noise. It could even increase a company's pool of potential clients, as some people avoid hiring landscape maintenance companies because of the expected noise and fumes.

And when a company switches to battery-powered leaf blowers, it immediately improves the economics of switching to other battery-powered landscaping tools too, like string trimmers, edgers, hedge trimmers, etc. The major power tool brands make batteries that work across many of their electric tools. A landscaper can remove a battery from a leaf blower, insert it into a hedge trimmer, and continue working. Since there is no need to buy new batteries for every new battery-powered tool, the cost of buying other battery tools is lower and landscapers can expand their fleet of battery tools as the savings on fuel accumulates further cash reserves.

Despite the highly favorable economics of battery-powered blowers, most landscape companies have not yet made the switch. Reasons include the belief that power or battery longevity are insufficient (the most powerful leaf blowers available are still gas-powered, but even large properties don't require the highest output blowers); the reluctance to purchase equipment that is more expensive than previously-purchased gas blowers (when you include the cost of extra batteries), combined with an underappreciation of the magnitude of savings to be realized; and simple inertia—the tendency to embrace the status quo and avoid change until it is required.

However, many landscapers who are aware of the favorable economics of battery-powered leaf blowers have already made the transition. Santa Cruz C.H.A.S.E. maintains a directory on its website of several such companies. As time passes, and as more cities take proactive steps to reduce air pollution and fight climate change, more landscape companies and municipal maintenance crews are switching to battery power. But absent regulation or major campaigns, wider adoption of new technologies can be slow.

Financing the Transition to Battery Power

The economics of switching to battery equipment are in fact even easier than this analysis shows, for reasons beyond the conservative assumptions mentioned. This study assumes the cost of new equipment will be fully paid, out of pocket and up front, but there are many ways businesses of all sizes commonly finance new purchases and investments, enabling even the smallest of companies to acquire new equipment immediately.

Small business loans, for example, are perfectly suited for investments in equipment that is expected to lower costs or increase profits. Even a loan with terms of 13% interest (the upper end of the U.S. Small Business Administration's interest rates for microloans) could be easily repaid, with interest, within a year because the first-year savings from switching from gas to battery is greater than 113% of the cost of the equipment, in both of the scenarios analyzed. And all the savings after the loan repayment are essentially free money.

There are also financing options for companies unable or unwilling to apply for a loan. For example, large retailers like Home Depot commonly offer interest-free financing on new purchases for periods like six months. The savings at the end of six months would amount to more than half of the cost of the new equipment, so the landscaper would already have about 60% of the cost of new battery equipment in hand.

There are numerous other ways to smooth the transition for landscaping companies: manufacturer incentives; rent-to-own, low-interest offers, and other retail purchase incentives; and battery equipment rental, which allows the savings on gasoline to build until it reaches the purchase price of new equipment.

Landscapers can also add a temporary surcharge to customers' bills, and remove it when it has paid for the new equipment. Many businesses already add a temporary "gas surcharge" when gas prices are high, which customers are accustomed to and understand. And businesses are much more amenable to charging a temporary surcharge when there is a level playing field among their competitors, as there is when a policy applies city-wide. This also advances equity as it ensures that the people who are chipping in for the transition—the customers—are the ones who are benefiting from the landscaping service.

There are also non-commercial options for landscapers and municipalities.

California passed AB 1346 last year, which bans the sale of new small, off-road engines like gas-powered leaf blowers by 2024. (It doesn't ban their use, so without local regulation, existing gas blowers will still be in use for years.) The bill came with an initial $30 million to help small landscaping businesses make the transition, and lawmakers may allocate more such funding in the meantime.

Finally, grants that fund programs to improve local air quality and reduce greenhouse gas emissions are commonly offered through air pollution control districts, community choice aggregators, government agencies, and other institutions. These are becoming more common as electrification of the highest-polluting machines and technologies is increasingly recognized as a cheap and easy path to fighting climate change and achieving cleaner air.