A Guide to

Electrifying the Future:

Converting Vehicles and Preparing Automotive Students for the Road Forward

An insightful guide for considering the integration of electric vehicles into education communities. This resource was developed from GreenLearning's pilot project, "*Re-Energy: Electrifying the Future of Transportation*" with Calgary high schools and other partners to capture the process and learnings in converting internal combustion vehicles to electric vehicles and installing charging station infrastructure.

Land Acknowledgement

In the spirit of respect, reciprocity and truth, we acknowledge and honour Moh'kinsstis, and the Treaty 7 region of Southern Alberta where this pilot project was conducted. This land is the traditional Treaty 7 territory of the Blackfoot Confederacy; Siksika, Kainai, Piikani, as well as the Tsuut'ina and the Îyâxe Nakoda Nations. This territory is home to the Métis Nation of Alberta, Region 3 within the historical Northwest Métis homeland.

With gratitude, we acknowledge the land and the Indigenous people that have taken care of it since time immemorial, and continue to honour and celebrate this territory.

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An Introduction to “Electrifying the Future of Transportation”

This pilot project offered high school students and educators in Calgary, Alberta, the opportunity to convert two internal combustion engine (ICE) vehicles to electric vehicles (EV) and install an electric vehicle charging station. We also worked with post-secondary institutions to determine opportunities for expanding learning at this level and ways to connect high school and post-secondary learning for the needs of future careers to support the EV transition.

The intention behind this pilot was to explore the connection between current automotive education in Alberta with novel, in-demand automotive skills needed to support the growing trends in electric vehicles. With the results of this pilot and by sharing our findings and experience we intend to help other organizations keep pace with this transition toward the electrification of transportation.

Guide Objectives

What can you expect from this document? We’ve created this guide to:

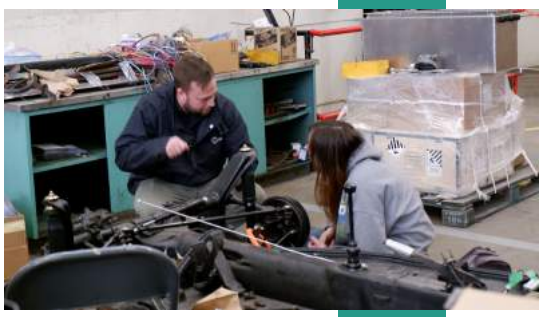
- Provide insight from an electrification project in Calgary
- Outline and explain the key steps we took to:
  - Convert an ICE vehicle to an electric vehicle in a high school setting
  - Install an EV charging station at a public high school
- Share our experience - what went well, what we learned, and what steps we’ve identified that are needed to prepare automotive programs at high school and post-secondary levels for the electric vehicle transition
- Connect you with learning resources and tools that we’ve developed to create some of the first steps for student learning

Why Electrify in Schools?

Decarbonization of transportation is a key strategy to solve our climate crisis and youth want to be at the forefront of leading this change. With governments, manufacturers and consumers on board to achieve major transformation by 2035, the electrification of transportation is a solution that is growing rapidly across Canada and around the world, leading to an extraordinary increase in demand for technicians and other skilled tradespeople and professionals.

More importantly, education systems are struggling to keep pace with providing the programming required to support this transition - often leaving youth unable to actively participate in the process. With the Canadian Government requiring that all new passenger vehicles must be electric by 2035 (Canada, 2022), GreenLearning identified the need to pilot a project at a high school to better understand how curriculum, infrastructure and the workforce must change in order to help make that transition possible.

GreenLearning provides free education programs about energy, climate change and green economy that engage and empower students to create positive change for our evolving world. Our GreenLearning community is committed to engaging learners in environmental activities that allow them to explore the world around them, while developing skills to positively shape the future.



Together, GreenLearning, Crescent Heights High School, and the Career and Technology Centre from the Calgary Board of Education, in collaboration with Chargepoint, Southern Alberta Institute of Technology (SAIT), Zeno Renewables, High Voltage Garage and the University of Calgary's Relectric Car Team, developed and piloted an innovative solution for the Electrification of Transportation to guide other schools across the country in preparing youth for careers in green technologies. This project, "Re-Energy: Electrifying the Future of Transportation'' (ETF) was made possible with financial contributions by Natural Resources Canada, RBC Tech for Nature, and the Calgary Foundation. This pilot project intends to engage youth in leading the transition to a clean energy future through awareness and adoption of Zero Emission Vehicles and related infrastructure.

Teachers and students at Crescent Heights High School and the Career and Technology Centre led the electric vehicle restoration and conversion. To support the necessary infrastructure for this transition, this project also included the installation of a charging station in the student parking lot at Crescent Heights.

Why not start smaller?

There are a number of fantastic projects across the country already engaging with smaller conversions - we encourage you to check out New Myrnam School's successful golf cart conversion (click here to visit their website)!

We took on the challenge of a full ICE vehicle conversion to EV, as that's where we identified a need. Automotive classes prepare youth for future engagement with ICE vehicles, and we recognize that as the demand for EVs increases, students with experience and skills related to EVs will be better prepared for success in the automotives industry. The conversion project allowed us to explore what is really needed to begin the transformation of automotive programs at high school and post-secondary and to share these learnings with educators across Canada.

Guide Introduction

The purpose of this guide is to help other organizations, schools and groups interested in electric vehicles, conversions, and EV infrastructure bring similar opportunities to their community. We've done our best to ensure this resource shares our experience and suggestions as you evaluate starting off on an electric project of your own.

A note:
While both components of this project overlap and often involve the same team members, we recognize that other communities may only be interested in working on one of these components.

We've separated the part of this document that details our timelines and approach into two sections. First, we've detailed a guide on converting a vehicle, and then after, we explain our recommendations for installing a charging station.

This guide lays out necessary information and steps taken in this pilot project for Re-Energy: Electrifying the Future of Transportation Project: documenting the process, capturing the learnings and helping pave the way for transforming automotive programs. You'll still need the support of a qualified mechanic, technician, or installer to guide the detailed conversion or installation work; our goal is to successfully guide you through the logistics and planning to reach that stage.

We documented as much of the process as possible to help share our learning with other educators and the broader community to communicate what went well, what we would do differently, and how this can pave the way for transforming automotive programs in high schools or post-secondary schools across Canada. We've included an overview of the process, the challenges, lessons learned, impact on student learning, student highlights and feedback and contributions from our partners.

While this guide tends to focus on traditional educational environments like grade schools and post-secondary establishments, we're confident that it can support any group looking into starting their first vehicle conversion project. This pilot project also allowed students to develop a deeper awareness of the growing EV industry, and learn about the necessary infrastructure to support this change. A project like this in any community can help pave the way in introducing and preparing youth in your community with the skills and opportunities for future careers and engagement with electric vehicles.

We hope this guide can serve as a resource for educators to begin transforming automotive programs to provide a hands-on, fun, safe, and novel learning opportunity for students in electrifying the future of transportation.

Project Overview

Our Project Team

This pilot project required contribution and expertise from many groups!

We found it beneficial to create an Advisory Committee to help support the project before setting anything in motion. This Committee was intended to help move the project forward with the guidance of experts in different fields and organizations. In our case, many of those on our Advisory Committee were identified as project partners in our funding applications to ensure the guidance and expertise needed for a successful pilot was in place early on. Our Advisory Committee consisted of Calgary Board of Education members, ChargePoint, Zeno Renewables, High Voltage Garage, University of Calgary's Relectric and SAIT.

As you consider developing your own team, we recommend establishing expectations to ensure successful collaboration between different groups. We created a Letter of Understanding (LOU) with each partner group to articulate how the partnerships were expected to work prior to the start of the pilot. Depending on the organizations you partner with, a more detailed Memorandum of Understanding (MOU) may be needed - this may be applicable for groups like school boards that may not already have existing procedures in place for collaborating with external groups and partners on pilot projects such as this one.

Project Lead

GreenLearning

We were responsible for the overall management of this project. GreenLearning led the collaborative team, ensuring funding and finances, scheduling, resource allocation, documentation, and overall project progress.

Vehicle Restoration and Conversion

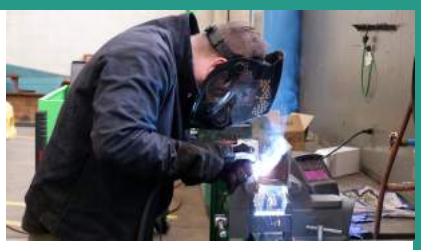
Calgary Board of Education (CBE)

Students and Staff at Crescent Heights High School, Career and Technology Centre

Staff supported student work over the course of this project. With an emphasis on the student experience and learning process, approximately 300 students were directly engaged with one of the converted vehicles while approximately 12,000 students were indirectly reached.

Crescent Heights Team

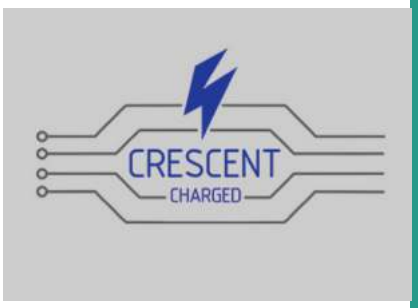
Automotive Class *- Automotives Instructor*
The automotive team all contributed expertise and insights to the project, with teacher Cody Price acting as the main lead. Cody led and supervised the automotive classes that worked on the project vehicles. Cody made curriculum connections during disassembly and reassembly of the vehicles, and introduced students to wiring, forming brake lines, battery connection and logistics, the welding of battery boxes, and the installation of the drivetrain.



Cody also received training through BCIT to receive the necessary high voltage certifications needed to do the conversion. At the time of this project Alberta did not have courses available to meet these requirements. Cody was the first CBE High School teacher to receive this training. There were many students interested in the project and some aspects fell outside of current curriculum so Cody created an EV club and supervised this weekly. This allowed for passionate students to dive further into the conversion, while still ensuring that connections between the conversion and regular class content could be explored with all Cody's automotive students. **Advisory Committee Member.**

Automotive Class, EV Club *- Students*
All Crescent Heights High School automotive students which Cody taught interacted with the restoration and conversion of the vehicles in this project, in varying capacities. As components were removed and added, students learned about the similarities and differences between ICE vehicles and EVs. EV Club is a group of dedicated students from automotive and other classes that continued work on the vehicles on Mondays, after class.

Intermediate-Advanced Design Class *- Science and Robotics Teacher and Students*
Design class students created logos for the VW Beetle. After a fierce competition, the winner of the Crescent Charged Logo Competition was Waylon C., design shown.



Career and Technology Centre (CTC) Team

Automotive Class *- Auto Body Teacher and Technicians*
The automotive staff at the CTC, led by teacher Jason Budd, guided students through the bodywork and painting of the VW Beetle. The automotive teachers and technicians worked tirelessly with their students to ensure they could safely take on this challenge. In one form or another, all intermediate, advanced, and apprenticeship level students worked on the vehicle.

Automotive Class *- Students*
All automotive students at the CTC during the 2022-2023 school year were involved in the restoration work on the VW Beetle. This work addressed the extensive body work required to restore the exterior of the vehicle, as well as the priming and painting of this unique but challenging shape to work with.

CBE Administrative Support

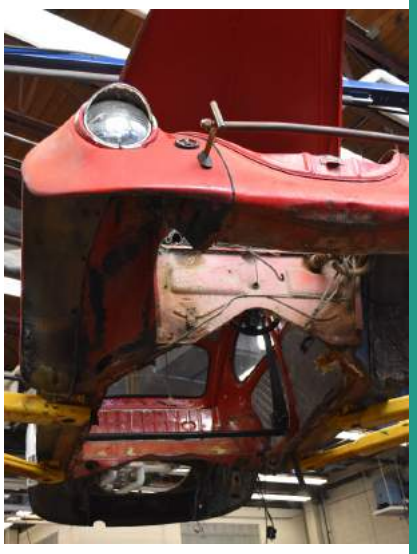
This complex project involved many different groups within the Calgary Board of Education (CBE), one of the largest school boards in Canada.

In School Support - the Career and Technology Studies Team Lead at Crescent Heights assisted with providing support and guidance to the automotive staff and classes. The Facilities Manager connected with the charging stations partners and provided charging station support. The Principal and Vice Principal were involved in moving administrative details along, including coordinating the Letter of Understanding with the CBE, teacher release time, and numerous charging station aspects.

At the board level, this pilot project involved working with the Sustainability Coordinator and those involved with the facility department on the charging station project due to its impact on the school's infrastructure. We also worked with Education Directors who coordinated approvals with Superintendents and Trustees. Safety Advisory Services was regularly involved and conducted inspections to ensure that safety requirements were met.

Charging Station

The charging station aspect of the project involved partnering with the manufacturer (ChargePoint) and the installer (Zeno Renewables). Having both charging station manufacturers and the installers involved in the project led to the best understanding as to how charging stations work and what would be best for the school for the project and for the future. Be sure to follow your own organization's procurement policies when collaborating with other groups that may provide a service or item to your project.



ChargePoint

As the manufacturer of the charging station, ChargePoint was able to provide key advice and insights as to how charging stations work and the best suitability for the school. They were also key in providing resources and guidance for the project. **Advisory Committee Member.**

Zeno Renewables

When schools/buildings are making infrastructure changes to the grounds there is a learning curve as to what is required. Zeno was able to advise on a number of different aspects including finding the best location for the charging station, the electrical requirements that were needed, etc. Walk throughs with school and board facility members to go through the process were integral to heightening understanding and expectations for the project. **Advisory Committee Member.**

Guidance and Content Development

This pilot benefited from the guidance and support of a number of other organizations experienced in one or more components of our project. These groups were readily available with advice, support and encouragement. We would recommend having similar organizations involved to share their expertise and guidance if you are considering an electrification project of your own. Another aspect of the project was working alongside these groups to aid in creating learning opportunities and resources of their own, especially for the post-secondary groups.

Southern Alberta Institute of Technology (SAIT)

Automotive Students and Staff

SAIT allowed us to understand post-secondary options for the automotive students with this type of project. A field trip to their facilities allowed the students to see first hand what post-secondary options included. The partnership with SAIT also helped in lending some needed safety equipment. As an Advisory Committee member, the Academic Chair of Automotives provided critical thoughts and advice as the project unfolded. The capstone projects created by SAIT students better informed the project and added context to the guide (you can find these in the resources section on page 35). **Advisory Committee Member.**

High Voltage Garage

High Voltage Garage was an integral part of the project to serve as a guide over the course of the project. Having completed several conversions previously, High Voltage Garage provided many tips and tricks throughout the conversion process, as well as being a sounding board for the development and delivery of EV-related educational workshops. When considering doing a similar project, we recommend having someone who has completed a conversion to be able to offer insights. **Advisory Committee Member.**

Relectric Car Team

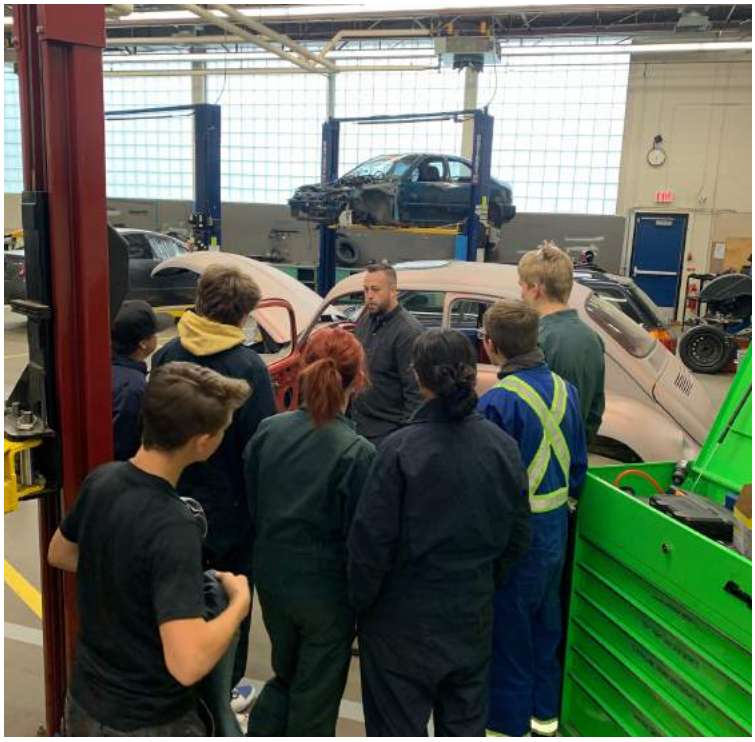
This student led team is currently working on converting a Volvo. Their involvement provided insight into University level post-secondary opportunities and provided additional insight into the conversion. These students also designed a Motor Controller Simulator for the project. Reaching out to your local University to find similar projects like Relectric's is a great way to engage enthusiastic students and to better understand post-secondary options. **Advisory Committee Member.**

Student Learning

A goal of the project was to engage as many students as possible, especially at Crescent Heights High School. This was achieved through a number of activities.

"If this is the direction that lots of cars are going to go, then having that background knowledge is so useful and helpful for us for the future."

Becca,
Crescent Heights Student



In-class learning offered an opportunity to connect this project with every automotive student taught by Cody Price over the 2022-2023 academic year. As components were removed, restored, or installed, Cody was able to teach students how ICE vehicles and EVs compare and contrast.

Cody found curricular connections between current curriculum and the learning opportunities presented by this project (outlined below).

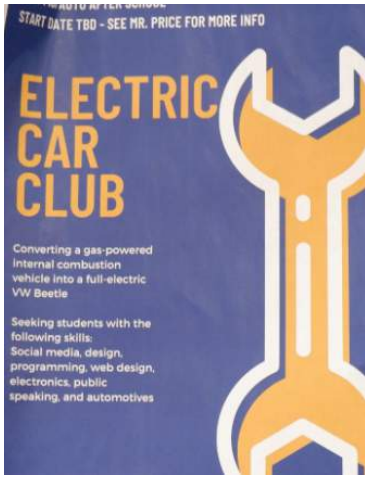
Connected Courses & Outcomes

• MEC2090: Electrical Components	2. Describe the function and operation of a vehicle's electrical systems and components 2.6 Identify and describe the ratings that are given to electrical components: e.g., resistance, Voltage, amperage and power rating 3. Identify electrical faults, by using standard diagnostic and testing procedures 3.2 Calibrate correctly, connect accurately and read the appropriate test equipment to determine: 3.2.3 Current Draw 3.2.4 Component resistance
• MEC3050: Engine Replacement	1. Use Engine lifting equipment and related tools safely 1.1 Demonstrate knowledge of types of lifting tools/equipment available for engines 1.2 Demonstrate knowledge of where to attach devices 3. Apply mechanical skills to remove and replace engine accessories 3.1 Identify the most appropriate method and remove and replace the following: 3.1.1 Wires 3.1.2 Cables
• MEC3080: Alternative Energy Systems	2. Describe the use of different fuels and engine designs in modern vehicles 2.3 Examine and report on the present initiatives to build electric-powered cars and batteries of sufficient capacity to power them
• MEC3090: Computer Systems	2. Identify the principles that apply to all computer management systems 2.5 Identify the principles and functions of computer control systems 3. Locate the components of selected computer management systems and describe their function 3.1 Locate and identify the parts of selected computer management systems 4. Demonstrate how computer management systems operate 4.1 Describe the function of the parts of a selected computer management system

Curricular connections courtesy of Cody Price

The Electric Car Club, nicknamed "EV Club" was an after-school opportunity for students passionate about this pilot project to dedicate extra-curricular time to the vehicles' conversion. These weekly gatherings were open to all students.

Every Monday after school, a core group of Crescent Heights students of different ages met to take on additional tasks required for the conversion of the vehicle. This group formed strong bonds with each other - once, when the club was cancelled due to a public holiday, Cody offered to hold not one, but two make-up club days for later that week. In response to the news, a student shouted "This is the best week ever!".



Engaging students outside of the automotive classroom was also a goal. We offered a few introductory workshops about EVs to different classes at Crescent Heights. **The Intermediate-Advanced Design Class** at Crescent Heights ran a logo contest, led by Mr. Tim Mo. After a fun competition, the results were announced over Instagram Live - congratulations to Waylon C.!

"GreenLearning had the opportunity to speak at the 10 Peaks Conference alongside students from EV Club. It was a fantastic opportunity to hear about the project from the students perspective and to see how excited and passionate they are about the project. 10 Peaks is a student facing conference and it was wonderful to have students in the audience ask insightful questions and be genuinely interested in the electrification of transportation."

Andreana Salouk,
GreenLearning Project Manager

"I think this project is really important because it shows people that EVs aren't too out of reach, and that anybody can convert a car into an electric vehicle. "

Mishaal,
Crescent Heights Student

A number of off-campus visits were also offered to students - from **fieldtrips to SAIT**, presenting at **conferences** like the 10 Peaks Innovation Xchange, or checking out our booth at the **World of Wheels Car Show**, there were opportunities for learning and celebration throughout the year.

"This project has allowed us to build amazing partnerships with local organizations and institutions in Calgary, one of which is SAIT. SAIT generously hosted Crescent Heights automotive students with a tour of the Clayton Carroll Building and their automotive shop. This was an excellent opportunity for students to ask questions about SAIT's post-secondary automotive program, and receive insight from current teachers and students at SAIT. These hands on experiences are incredibly valuable for students!"

Andreana Salouk,
GreenLearning Project Manager

"Wow! I wish we had this when I was in school!"

Anonymous Attendee,
World of Wheels Car Show

To measure this project's impact on student learning and engagement, we shared an anonymous survey with students in the automotive class at Crescent Heights. Students were asked the same set of questions before they began work on the vehicles, and then at the end of the academic year.

When asked the following questions, we saw an increase in self-reported student confidence and understanding (from baseline survey to end-of-year survey):

Self-reported increase in learning from baseline to end-of-year surveys

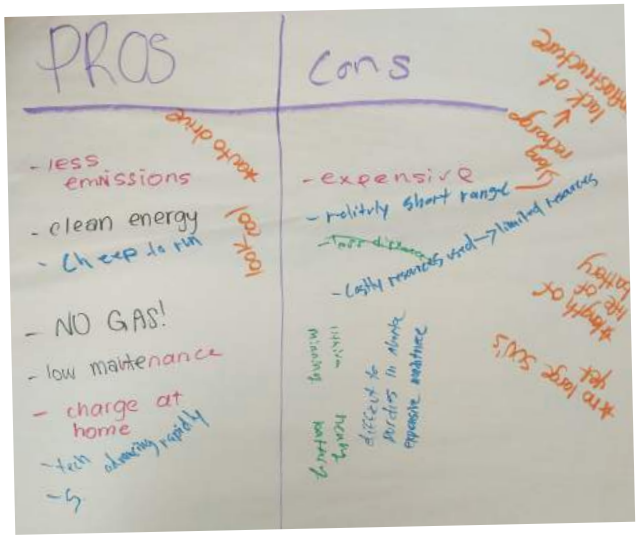
- 36% increase: *What is your current level of knowledge about electric vehicles?*
- 34% increase: *What is your current level of knowledge about electric charging stations to charge electric vehicles?*
- 155% increase: *What is your current level of knowledge about the operations and maintenance of electric charging stations?*
- 28% increase: *What is your current level of knowledge about the innovation taking place to transition to zero-emissions vehicles such as electric vehicles?*
- 67% increase: *How familiar are you with careers in the electric vehicle industry?*

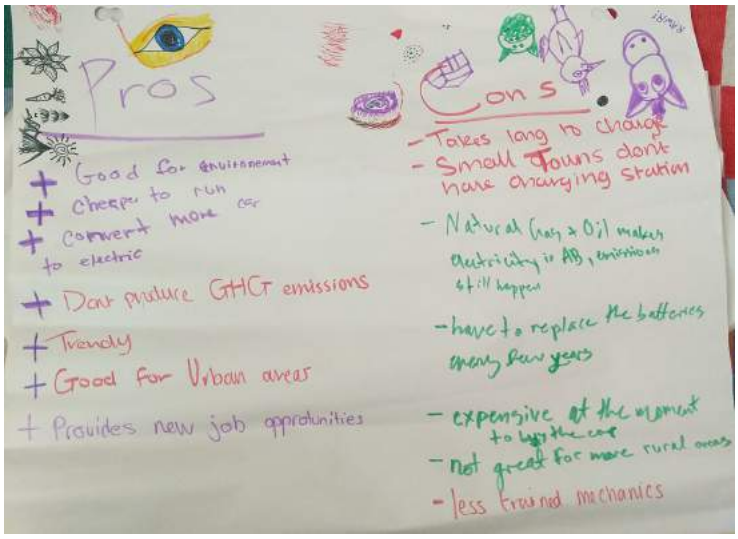
In the baseline survey, **8% of students** indicated that they were already **considering choosing a career in the electric vehicles industry!**

When asked "If you had your driving license and you could have a choice of winning an electric vehicle that doesn't generate tailpipe emissions vs. a gasoline-powered vehicle that generates emissions, how likely are you to choose an electric vehicle?", ***72.8 % of students in the end-of-year survey indicated they would choose an EV!***

We joined the Inside Education Generate & Navigate Conference to show students interested in sustainable energy and transportation what we're up to. We were thrilled to see our partners, the Relectric Car Team from UCalgary also sharing their Volvo conversion, offering a post-secondary connection to a similar project.

It was really exciting to hear what students' preconceptions about EVs are. With so much interest and conversation, educators have many opportunities to continue the learning with an interdisciplinary project or classroom inquiry. The tables below show what high school students from around Western Canada currently believe or know about EVs. These tables were built before we dove deeper and shared current information and checked misconceptions.





Ready to Spark a Change?

There were many aspects to this pilot project with the two major components being:

- Converting a vehicle from gas-powered to electric (p.14 - 27) , and
- Ensuring that there was appropriate infrastructure - a charging station - to support the converted vehicle (p. 28 - 32).

The following two sections of this guide share our experience, learnings, and suggestions.

Vehicle Conversion

The following section of this guide is intended to provide key steps to prepare for and work through the conversion of a vehicle from an internal combustion engine vehicle (ICE) to an electric vehicle (EV). A key checklist, suggestions, and additional information can be found in each stage of the process.

- **Preparatory Steps:** This stage includes the tasks that should be done prior to the conversion of your vehicle.
- **Conversion Process:** This stage covers any considerations you may have during the actual conversion of the vehicle
- **Post-Conversion Considerations:** This stage offers guidance on how to manage your new resource in a shared, educational setting.

Any tips or tricks for future groups collaborating to convert a vehicle?

"Think the whole process through from start to finish. Know what the end goal of the vehicle is - understanding if it's going to be a community thing, is it going to be a school vehicle, is it going to be sold later, is it a project that will go from school to school? Then picking a vehicle that fits those needs."

Cody Price,
Automotives Teacher

Preparatory Steps

Key Checklist

- [ ] Identify team roles, responsibilities, and expectations
- [ ] Outline project outcomes
- [ ] Make a budget: Your time and money
- [ ] Explore grants, funding, and reporting
- [ ] Understanding internal processes: Identify permissions
- [ ] Safety precautions and training

Identify Team Roles, Responsibilities, and Expectations

This process takes time, and collaboration! We recommend outlining expectations with each other; from who is responsible for decisions like paint colour and battery location, to purchasing authority, ownership details and project timelines. With various organizations or departments collaborating and juggling other responsibilities and tasks, it can be difficult to maintain momentum if team members are unsure of their responsibility or decision-making power. Consider setting aside some time before the conversion to outline all of the key decisions related to purchasing and designing the vehicle, and identify the person who will have the final say in those decisions.

A tool like a responsibility assignment matrix (such as a RASCI Chart) may be useful to establish expectations and keep roles and communication streamlined. Working through a RASCI Chart together creates a resource that indicates who is Responsible, Accountable, Supporting, Consulted, and Informed about steps and decisions throughout the project.

This is an example of what a few lines on a RASCI Chart for your project could look like:

Task	**Responsible** (gets the task done)	**Accountable** (has final say)	**Supporting** (helps "Responsible" complete task)	**Consulted** (asked for input on task)	**Informed** (updated about task)
Bringing the vehicle to a car show	• Project Manager (PM)	• PM's Leadership Team • Vehicle Owner	• PM's Colleagues	• Advisory Committee • Automotive Teacher	• Advisory Committee
Choosing vehicle paint colour	• Automotive Teacher	• School Administrator	• Project Manager • Automotive Class	• Advisory Committee	• PM's Colleagues

Additionally, establish expected response times and key communication lines to ensure continuity and momentum. A diverse team encompassing multiple organizations may have varying seasonal demands and commitments. With communication expectations in place, it allows a grace period for people working at full capacity, as well as an opportunity for teammates to recognize when a follow up prompt is appropriate.

Depending on the timeline of your project, it's possible that there may be organizational changes or disruptions. We recommend that you determine who will be responsible for taking on responsibilities during periods of absence or staffing changes.

Outline Project Outcomes

Before diving in, it's helpful to determine what your key project and learning outcomes are.

Is it to have a road-ready EV you can drive to shows? Are you looking to support student skill development, tied to the curriculum?

These questions can help you evaluate what types of funding you may seek out, and will influence your timeline and approach to the project.

Once the main project outcomes are identified, consider what the smaller milestones may be - ours included purchasing the vehicle and the conversion kits, then completing the restoration (body work and paint), receiving permission for high voltage tasks, installing the drivetrain, and then wiring the vehicle together. Our final landmark was to celebrate the conclusion of the conversion with all of the students and staff that had contributed to the project with a wrap-up event.

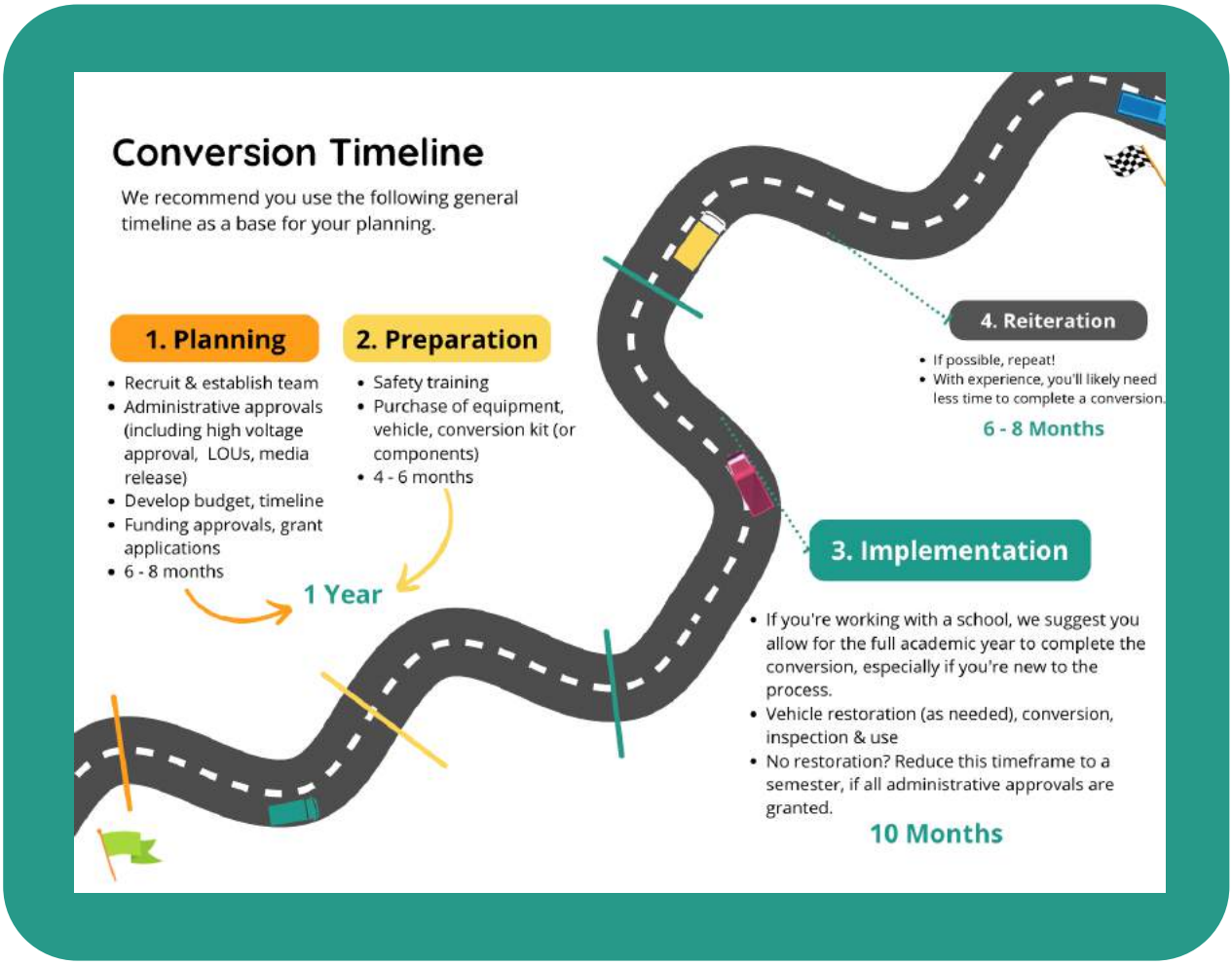
If the purpose of your conversion project is to focus on developing and practicing EV automotive skills, we suggest working with a vehicle that needs very little work to become road-ready. While a challenging and engaging vehicle, our vintage Volkswagen (VW) Beetle required extensive repair and preparation before we could even begin the conversion. For this reason, we sought out a more modern Ford Ranger for the second conversion; it was a vehicle that was ready for conversion as soon as disassembly was complete. We explain our rationale for choosing these two very different vehicles later in the guide - however, we encourage you to consider what type of vehicle may help (or hinder!) you to reach your project goals.

Finally, while establishing project outcomes, consider the final destination of your conversion project. The conversion process itself may provide you with all of the learning outcomes you seek, but planning for future use and ownership of the vehicle allows for a smooth transition from conversion project to finished resource. An idea could be to establish a rotation where the vehicles can be used by different automotive classes within the school board for exploration by other automotive students and enthusiasts.

Or instead, use the vehicle for transportation to key sporting and band events - carrying equipment and serving as a mascot for school pride. Perhaps feasible for different groups, you could even consider whether the successful auction of an inspected, converted vehicle could contribute funds to continue the conversion cycle of vehicles into the next year.

Make a Budget: Your Time and Money

Between scheduling and establishing your budget, allow for some wiggle room. This project began during the COVID-19 pandemic, and the repercussions of this global event led to delays in supply chains for key capital pieces like the EV conversion kits or charging stations. The schedules of the students working on this project also influenced when work could be done on the vehicle. In an educational setting, it's especially important to consider the academic calendar and key events like exam breaks, semester changes, and holidays, especially if classes and clubs will be highly involved in the vehicle conversion.



We chose to share this project at a few large-scale events to garner interest and share the project with the public. SAIT's Transportation and Manufacturing Industry Night, and the Calgary World of Wheels Automotive Show were two opportunities we took to showcase the project here in Calgary. The dates of these events also dictated when certain tasks needed to be completed, and influenced our schedule. Having a budget line in the budget for attending events is advised if this is a priority in your planning.

Finally, consider safety, training, and miscellaneous expenses when creating your budget and timeline. Through collaboration, some of the safety materials required for a conversion were lent to the Crescent Heights class from SAIT, reducing the cost of supplies. We've included a list of the safety materials we purchased later in the guide (p.20 - 21). Additional training for educators or community leaders may need to be scheduled into your plans to ensure a safe conversion.

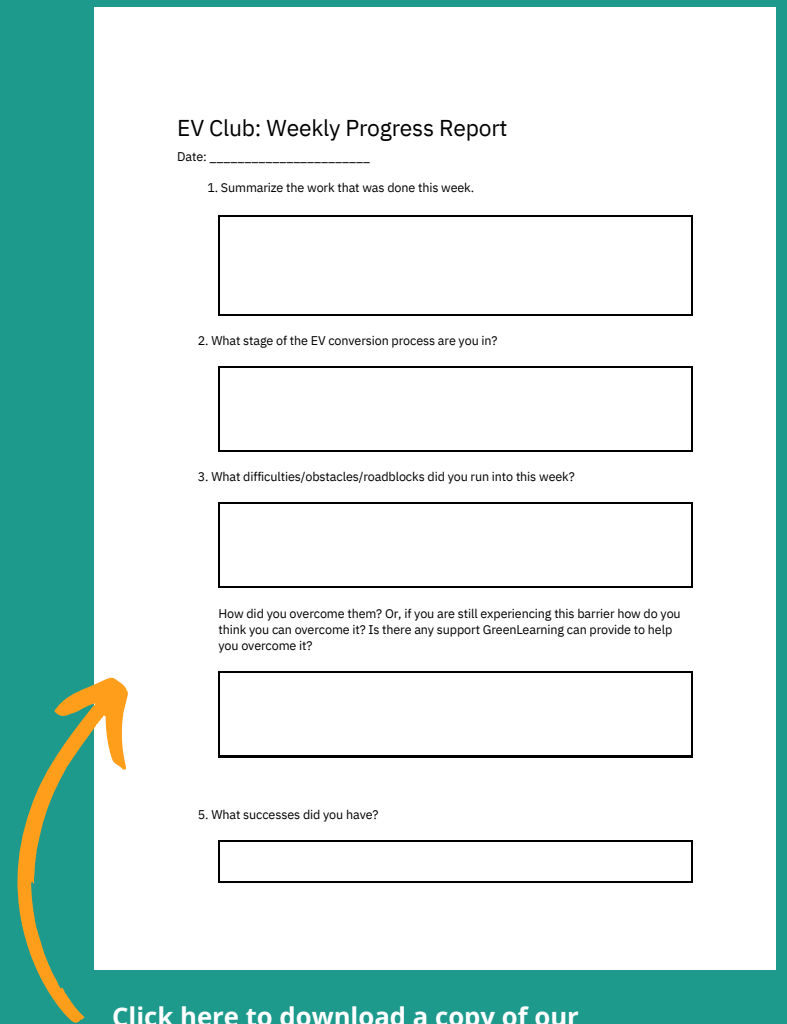
Explore Grants, Funding, and Reporting

Without the financial support of various grants, RBC Tech for Nature, NRCan Zero Emission Vehicle Awareness Program and the Calgary Foundation, this pilot project would have remained on the drawing board. Once you understand your budget, the next step is to secure your funding.

You can look into many different areas for funding. Consider exploring current government initiatives (we were successful with NRCan's ZEVA initiative), community or other foundations and other corporate funders.

Our pilot project was complex, with many opportunities to document activity, collect data, and report on progress. We used a weekly report to collect information, and developed surveys for students to complete before and after their time on the project. Consider the documentation and reporting requirements of the grants you may receive, and make a proactive plan to ensure the information you need in your reports is collected regularly, or well in advance. Our project saw many changes over the months, and it was important for us to continue documenting everything to provide our funders with an accurate understanding of the project progress.

These grants may influence your documentation, as well as your timeline and budget. Some grants may have constraints or allowances that require you to adjust your plans. We encourage you to allow for some contingency room on your timeline and budget, to proactively prepare for unforeseen challenges. The documentation process may also mean that there are additional administration duties that you need to plan for, outside of the conversion itself.


EV Club: Weekly Progress Report

Date: _____

1. Summarize the work that was done this week.

2. What stage of the EV conversion process are you in?

3. What difficulties/obstacles/roadblocks did you run into this week?

How did you overcome them? Or, if you are still experiencing this barrier how do you think you can overcome it? Is there any support GreenLearning can provide to help you overcome it?

5. What successes did you have?

Click here to download a copy of our Weekly Progress Report for your own use!

Understanding Internal Processes: Identify Permissions

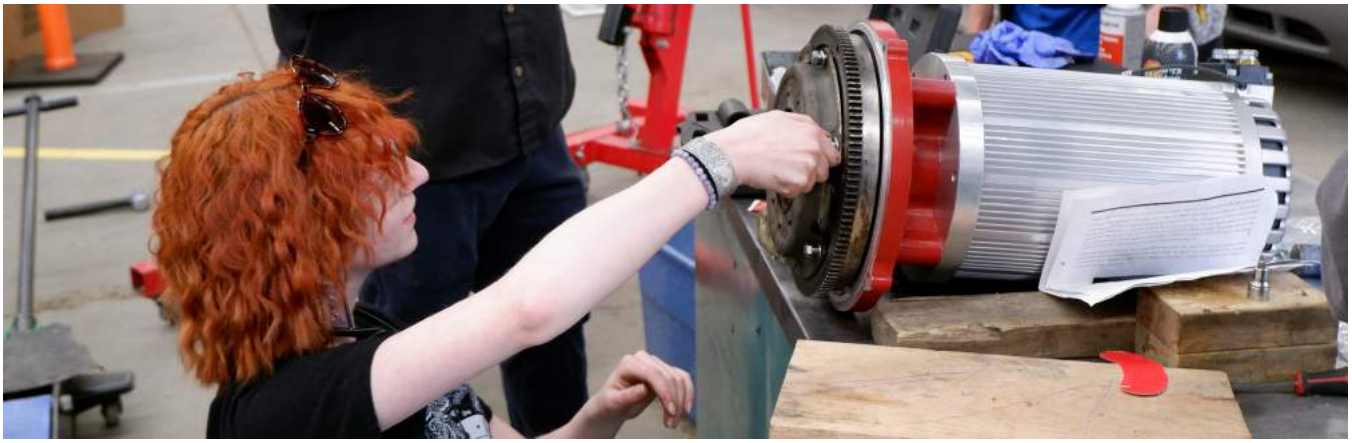
"It's worth doing these pilot projects, even though they seem challenging and slow. It is worth trying these things out. I encourage any group to keep on. If they can provide a good rationale for the reason why they want to engage in a particular project then go for it! Make sure that you're engaging all the right people. Don't be shy about asking questions, or asking leaders in the organization. Say "I want to do this, who should I talk to?""

Olena Olafson
CBE Sustainability Coordinator

Due to the innovative nature of our pilot, there were many new processes and updated procedures that needed to be in place to ensure student and staff safety, especially to allow the completion of high voltage tasks. This provided an opportunity for the school board to understand how they may need to adapt in the future as Canada's transportation sector shifts towards electrification.

There were a few key items we felt were a priority: first, an agreement, or "Letter of Understanding" (LOU) with the school board was required prior to collecting data from students, or sharing Media Release Forms to allow for documentation of student work. Second, a Safety Work Practice was developed in response to an Administrative Regulation (AR) that was in place to ensure safety; this AR ensured that high voltage work would not take place by staff or students. With the Safe Working Procedure, an appropriate alternative or approach to high voltage work was agreed upon between the school board and conversion team.

This is something we encourage you to consider looking into immediately if also working on your conversion in an educational setting as many boards have not had the opportunity to understand what a project like this may entail. It can be an exciting opportunity to pioneer something but keep in mind that internal processes may take time to be established and approved.



Safety Precautions and Training

It's important that those involved in the conversion are trained and prepared well in advance of starting your conversion. The lead Automotives Teacher, Cody, attended an Electric Vehicle Technology and Service training course at BCIT to ensure he was adequately prepared and trained. This is a relatively new field so you will need to explore if there are any training opportunities near you and what cost and timing is needed for this training.

As this conversion was taking place in a public high school, we also needed to be aware of the additional safety measures the Calgary Board of Education had in place to ensure that students and staff remained safe.

Primarily, the two safety measures central to our preparations were to take proactive fire safety measures with the lithium ion batteries, and ensure that training, precautions, and permission was granted for Cody to complete high voltage tasks on the electric vehicles.

In order to complete the high voltage tasks, a new Safety Work Practice was developed as mentioned earlier. Additionally, the school board's Safety Advisory Services needed to visit the site with the local fire department and ensure that all precautions were being taken and appropriate measures to ensure a safe project were in place.

Finally, there were a number of tools we purchased (or borrowed!) that were required for high voltage work. A comprehensive list is below - these are the items we used for the vehicle conversions, in addition to the standard automotive shop fare.

Currently, the voltage of an EV battery can range from 40 V to 900 V. This means that most EV batteries have the potential to allow a dangerous electrical current flow through you, or a conductive item. This current could be seriously harmful, even fatal! This is why it's really important for anyone involved in the high voltage conversion tasks to be fully trained and safely prepared for the tasks.

Safety Tools:

Precision MilliOhm Meter		*To verify that a motor is in good shape, a milliOhm meter can verify that the windings aren't failing. This is something that would be useful if you were considering using a pre-used motor.*
Insulated Rescue Hook		*Trained individual connecting or disconnecting high voltage systems? This tool is a backup safety measure that allows someone else in close proximity to pull the person working on the high voltage system away if they were to get electrocuted (as they would be unable to let go).*
Orange safety pylons, stanchion and chains		*Mark off your high voltage workspace with high visibility safety markers. In addition to being bright, did you know that orange safety indicators typically represent high voltage?*

Digital torque wrench		*Ensures that connections between batteries in a high voltage system are done securely (preventing an increase in resistance due to a loose connection), and the terminals aren't damaged by over torquing.*
Insulated sockets and ratchets		*Rubber insulated tools (rated to 1000 V) prevent accidentally shorting out your system!*
Hydraulic crimper (yellow) **Cutters** (black)		*The crimper is designed to provide an accurate, tight crimp to the high voltage cable.* *The cutter is well suited to cut the thick copper wire (below) used for the high voltage components.*
High Voltage Wire		*Wire should be ORANGE if carrying 40V or more.*
Digital Insulation Multimeter (CAT3)		*Two main tasks:* • *Ensures high voltage battery has indeed been disconnected before it's worked on (often by doing a "live-dead-live test" with a 12 V auxiliary car battery before and then after testing the high voltage system).* • *Can confirm by measuring the amperage that there are no "electrical leaks" in the HV system (ie. battery cables that were crimped or insulation damaged)* *A safe working voltage is less than 30 V.*
Insulated Rubber Gloves (Class O)		*Class 0 insulated rubber gloves, or lineman's gloves, are required whenever working near high-voltage parts on an electric or hybrid electric vehicle.* *These need to be reinspected every 6 months.*
Combustible Metal Fire Extinguisher (Class D)		*Fire mitigation safety tool - a heavy-duty fire extinguisher better suited for this conversion project.*

Conversion Process

Key Checklist

- [ ] Purchase vehicle
- [ ] Purchase conversion kit
- [ ] Prepare vehicle
  - [ ] Restoration (if applicable)
  - [ ] Drain fluids, remove & dispose of all ICE components (gas tank, engine). May need to remove transmission (for ease of access to adaptor plate, motor).
- [ ] Preparing for conversion
  - [ ] Kit may not have battery box (may need to fabricate and weld battery box)
  - [ ] Determine how power steering/brakes will work
- [ ] Convert vehicle
  - [ ] Mount motor and controller and install other electric vehicle components
  - [ ] Wire vehicle
  - [ ] High voltage tasks

Purchase Vehicle

When choosing your vehicle, consider the outcomes you established with your team. Is the goal to develop a learning tool? Are you looking for something flashy? We chose to convert a Volkswagen Beetle, and a Ford Ranger.

1975 VW Beetle

- Affordable, great learning opportunity, "cool" factor when considering aesthetics, have been successfully converted before. This vehicle wasn't working previously - added bonus of bringing the car back to "life" and bringing in elements of a circular economy.
- More challenging to remove body from frame, this specific vehicle required a lot of bodywork and restoration due to condition and age

2009 Ford Ranger

- Body on frame, manual brakes and steering, better suited for learning tool and future use (can lift the body off much more easily), and could be driven/towed as a school spirit item (transporting equipment to games, etc).
- Power steering and brakes are more complex to convert than manual.

When considering your project, we recommend you consider only converting one vehicle at a time to save space in the shop, and for ease of post-conversion management. It's also ideal to have manual brakes and steering (not power brakes or steering) to simplify the conversion. For a unique approach, you could also look into converting golf carts, a zamboni, or a forklift!

Purchase Conversion Kit

There are two types of electric conversion kits available: custom kits, which are tailored to specific vehicle models, and universal kits that can be installed in a variety of vehicles. Universal kits contain all the essential drive-system components but rely on the builder to create custom parts like battery racks or boxes. Custom kits include the entire drive system and battery racks and boxes, customized to suit a particular model.

We used the same type of universal kit for both of our vehicle conversions, purchased from CanEV. For your reference, each "Educational Builder's Kit" was approximately $35 000.00 at time of purchase (2022), and included:

- Drive System (Hyper 9 LV Drive System)
- Contactor Box
- Battery System (including 36 3.2V lithium ion batteries)
- Additional Options (custom battery boxes, CAN BUS Kit, Heater Element)

In addition, we needed to purchase an adaptor plate, specific to each vehicle. The price for our VW Beetle adaptor plate was approximately $1700.

There is a wide range of kits available - along with a wide price range! The kit we used for our VW Beetle conversion included many parts, and was expensive. However, we found this a more efficient way to get the pieces we needed, and we knew the kit pieces were chosen to work well together. Instead of sourcing and troubleshooting each individual component, we could focus on executing the conversion and ensuring our proof of concept was successful and could be expected to perform well.

However, keep in mind that there are other options available. A basic EV can be powered by a 36 - 48 volt DC battery, currently at a price range of about $5000. The additional parts needed for your conversion may vary greatly in price, and those prices can fluctuate rapidly with supply and demand. We suggest you establish a clear budget prior to ordering your pieces, and keep it updated while placing orders to remain aware of any changes to your expenses.

Prepare vehicle - Restoration (if applicable)

Each vehicle will have its own needs; at this point in your project, we suggest you ensure the vehicle you purchase is now restored and/or driveable. For many, that means this step is complete! This was the case with our Ford Ranger - we were confident it drove, and no bodywork or paint was needed.

However, if you're interested in a challenge or purchased an antique, you may have your hands full with some restoration work! This was the case with the VW Beetle. The Beetle, after years of waiting in a farmer's field, was in dire need of some body work and a fresh paint job to restore and protect the body of the vehicle. Before we could move forward with the conversion, this restoration work was sorely needed. While an additional step, this was a rewarding choice. The decision to restore a vehicle meant that it was rescued from a junkyard fate and recycled into a zero-emission vehicle.

The majority of the restoration work on the VW Beetle was completed at the Career and Technology Centre. First, students worked to restore the fenders, base and hood of the vehicle. This was an extensive task, as the condition of the vehicle was very poor. Once the body work was complete, the vehicle was primed, and then later coated with a single stage paint. The old, and unique shape of this vehicle made for challenging work and a great opportunity to redirect a vehicle from the fate of a landfill back into drivable condition.

What are you most proud of from this project?

"The fact that these students get to work on this project. They got to work on something a bit older that's essentially becoming a "resto-mod", so it's getting a whole electric package. They got to learn the whole structure."

Jason Budd,
Senior Auto Body Program Teacher

From snowy field to fresh start!

Prepare vehicle - ICE Components

In preparation for the vehicle conversion, you'll need to drain the fluids from the vehicle and ensure that all ICE and associated components are removed (gas tank, engine, etc.). Depending on your vehicle, you may also need to remove the transmission. We found it much easier to mount the adaptor plate and motor to the VW Beetle transmission after removing it from the vehicle.

Finally, consider what the disposal of your internal combustion engine and components could look like. If the vehicle you're working on has a working engine, you may be able to sell it for funds to contribute to your EV conversion, and provide the necessary parts for someone to repair their ICE vehicle. Taking the vehicle apart creates a great learning opportunity for learners to have an up-close understanding of how an internal combustion vehicle works.

Preparing for conversion- Battery Box and Power Steering/Brakes

Now that your vehicle has been "emptied" of the ICE components, this is a great opportunity to take a closer look at how everything will fit together. With the VW Beetle, the old floor of the vehicle wasn't sturdy enough to safely anchor the weight of the two custom battery boxes that would contain the 32 batteries. Instead, a few additional supports were fabricated and welded to the battery boxes to ensure safe mounting. It's possible that your conversion kit may not include battery boxes, so you might need to get fabricating!

Most vehicles made in the last few decades will have power steering and power brakes. You can avoid purchasing a vehicle with power steering and brakes by purchasing an older vehicle to help simplify your conversion. The VW Beetle had manual brakes and steering.

If you're taking on the more challenging option of working with power steering and brakes, you'll need to determine how you want this to work - typically these systems rely on the ICE components of the vehicle. The Ford Ranger had vacuum assisted power brakes, so a vacuum pump was installed. The Ranger used a belt-driven hydraulic power steering pump; one conversion option is to install an electric motor to turn this belt. An "electric over hydraulic" power steering pump was chosen.

Convert Vehicle

While converting your vehicle, there will be many hands-on opportunities to share with your learners how ICE vehicles and EVs compare and contrast. We recommend proactively planning to ensure that you know which steps you think your learners would benefit from and which topics you'd like to highlight. In our experience, conversions and timelines can rapidly become complex and demanding, so it's helpful to identify learning opportunities early to plan for and support regular participation and engagement by learners.

Learning can easily extend outside of the garage! With the support of SAIT, we have linked a number of capstone projects created by post-secondary students to teach others about electric vehicles. When diving deeper into the workings of an EV, we found an online course (https://evworkshops.com/) was another helpful resource that could be used to teach the intricacies of EVs. Finally, with the support of UCalgary's Relectric Car Team we've built an introductory level motor controller simulator that allows learners to gain an understanding of how the various components in an EV are wired together. All of these free resources (and more) can be found near the end of this guide under "Resources & Tips" or on our website at www.greenlearning.ca.

Each vehicle will vary; the following list provides an overview of the general conversion steps taken by the automotive teacher and his classes:

- Prepare the chassis (possible restoration, check driveline components, brakes and suspension in a safety check, clean/paint)
- Mount the motor and adapter plate onto the transmission (and/or driveline)
- Install electric vehicle components
  - Mount the battery boxes
  - Install the motor controller
  - Replace the brakes and hydraulic power steering (if applicable)
- Install a convenient charging port to your vehicle
- Wire EV components (converter DC-DC, vehicle (auxiliary wiring) - we also purchased a State of Charge (SOC) display for the VW Beetle to monitor the battery's remaining charge
- High voltage tasks (for our conversions, this step was relatively small compared to the rest of the restoration and conversion. However, it did not allow for student involvement, and could only be completed when an Administrative Regulation exemption was granted)

Post-Conversion Considerations

Key Checklist

- ☐ Inspection and registration of vehicle
- ☐ Showcase opportunities
- ☐ Plans for future use

Inspection and Registration of Vehicle

If you intend to drive the converted vehicle, keep in mind that you have made some big modifications! Consider the rules and regulations of your area. If the vehicle was unregistered and unlicensed when you purchased it (like our VW Beetle), you will likely need to pass an inspection before hitting the road. Depending on how the chain of ownership has occurred within your team, you may also want to confirm who (or which organization!) currently owns the vehicle before pursuing the appropriate paperwork.

Showcase Opportunities

With all the hard work you've invested into your project, you may be interested in submitting your vehicle in an automotive show, community event or sustainability fair!

GreenLearning was invited to attend and showcase the project at SAIT's Transportation and Manufacturing Industry Night. This was a fantastic opportunity to speak with post-secondary students, SAIT employees, industry professionals, and the general public on the growing interest and importance of EVs. The Beetle was also showcased at the 56th annual Calgary World of Wheels where there were 41,249 attendees! We had a booth to showcase the Beetle to the general public about the project. Students from both Crescent Heights and the Career and Technology Centre who worked directly on the vehicle stopped by during their spring break from school to share their excitement and experience.

The excitement about the project from these events was so inspirational, and reached a large audience. We felt it was well worth the money and time to participate in these events.

Plans for Future Use

At this point, your conversion is complete, lessons learned, and tools put away. Consider what will come next for your converted vehicle. If your project outcome was centered on student skills and development, do you have the opportunity to auction off the vehicle to repeat the process for a new cohort? Is there potential to share the vehicle with other schools or learning communities for them to learn from your work?

Charging Station

This section of the guide provides key steps for the selection and installation of an electric vehicle charging station in your community. A key checklist, suggestions, and additional information can be found in each stage of the process.

- **Preparatory Steps:** This stage includes the tasks that should be done prior to the purchase and installation of your vehicle charging station.
- **Installation Process:** This stage covers any considerations you may have during the installation of your charging station.
- **Post-Installation Considerations:** This stage offers guidance on how to manage your new resource in a shared, educational setting.

Preparatory Steps

Key Checklist

As with the Vehicle Conversion Preparatory Steps (p.14), we recommend that you:

- [ ] Identify team roles, responsibilities, and expectations
- [ ] Outline project outcomes
- [ ] Make a budget: Your time and money
- [ ] Explore grants, funding, and reporting
- [ ] Understanding internal processes: Identify permissions

Additionally:

- [ ] Choose a charging station
- [ ] Identify charging station location

Choose a Charging Station

Identify which charging station is best suited for your community. Who will have access to it? What will they use it for- a quick boost, or a longer charge? Are there charging stations already installed at other schools or in the community? Should you purchase the same kind or a different type? Be mindful of your organization's procurement rules. Do you need a minimum of 3 quotes before choosing a suitable product?

Currently, there are three commonly used types of charging stations available; Level 1, Level 2, and Level 3.

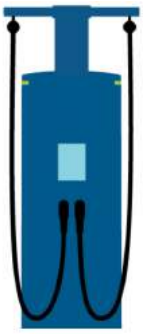
	What can it do?	Who is this suitable for?
 **Level 1**	• Uses household plug to charge (120 V) • Slower charging rate • Portable	• Personal use, especially for overnight charging of smaller batteries like those used in plug-in electric vehicles (PHEVs) • Emergency charge (portable)
 **Level 2**	• Uses 240 V plug • Can charge an EV in 5-10 hours	• Personal or public use • Public buildings, businesses, schools; locations where vehicles typically park for at least a few hours or overnight.
 **Level 3** (aka Direct Current Fast Chargers, or DCFC)	• Can charge an EV's battery to 80% in as little as 30 minutes; fastest charging rate available for EVs • Power output typically 50 kW (but can be MUCH higher depending on the charging station)	• Designated charging stations, for users requiring a rapid charging (like a gas station, for EVs)

Table information gathered from MCCAC Charging Guide, 2023
Icons courtesy of ChargePoint

We chose a Level 2 charging station, which seemed best suited for use for the converted vehicles, and eventually, student and staff use. A CT4000 Dual Port charger was purchased from ChargePoint that has a standard electrical output of 7.2 kW (per port).

This charging station can be managed digitally, allowing waitlists to be created, data to be tracked, and the station to be activated or inactivated during key times. As this charging station is installed on public school grounds, it has been important to have many conversations with the CBE to ensure student privacy and security is respected. The installation of this charging station at Crescent Heights will help inform the CBE charging station strategy. For now, this charging station will only be activated to charge the converted VW Beetle and Ford Ranger.

Identify Charging Station Location

With permissions granted, your finances and budget in place, the last preparation step is to choose where your charging station will fit best.

Our Project Manager met with the school's Facilities Project PM, and Zeno (the charging station provider and installer). Some of the key questions they discussed while narrowing down location were:

- **What kind of electrical supply does your community have?** If the available grid capacity doesn't meet the needs of your charging station, the next step is to get in contact with your energy provider.
- **How much electricity will the charging station use?** This will depend on your users: when, how many, and how often?
- **How much space do you have?** Is there an opportunity to add more stations in the future, as needed?
- **How close are you to your electrical panel, or power source?** The further away, the more conduit and labour will be needed to install the station, increasing the cost of installation.
- **How accessible is this location?** Think about how people will find, get to it, and use this station. Are there barriers in place?
- **Are there security measures in place?** Consider video surveillance, lighting, and possible security measures like fencing-in the station to prevent vandalism.
- **Are you able to communicate easily with station users?** Consider how you will communicate who can use the charger, when, and for how long. Will there be signage, an app, or something else?

We decided to install the charging station in the student parking lot. The student lot is a high traffic area, well lit, and already under video surveillance. Additionally, it is close to electrical panels in a tech classroom located just inside the school. Electrical panels are the easiest points of access, and this classroom has high ceilings which makes installation easier. The school's back up generator is located right beside where the charging station will be installed; installation is more affordable and efficient because they don't have to run conduit underground very far. It may be worth exploring whether there are any similar projects scheduled for your community that you can connect to your charging station project.

Installation Process

If all goes smoothly, it's possible for a Level 2 charging station to be installed in about two weeks. This can really depend on the local context - stock, labour, and scheduling need to line up!

Our timeline changed frequently, as stock shortages and scheduling conflicts occurred. However, once the station arrived and an installation schedule was confirmed, the process was quite straightforward. With conduit already laid, it was a matter of pouring a concrete pad, scheduling a time with our installer and the Facility Projects PM to deliver the station and complete the electrical work to put the receptacle in place, and then confirming that the charging station was safe and ready to use. Some behind-the-scenes training for the administrators managing the charging station's activity was needed, as the station can be managed digitally.

Depending on your location, you may consider adding signage or additional security measures to ensure welcoming, efficient, and safe use of the charging station. This could look like a sign communicating active hours, permitted users, noting video surveillance, or instructions for general use. It may be reasonable to consider installing a fence and lockable gate around the charging station to discourage vandalism if it's a concern in your community. This is also a great opportunity to create some passive learning material, if it suits your environment. Signage explaining what a charging station is, how it works, or where the electricity in your community comes from can help educate your community.

We worked with Zeno Renewables, a local solar solutions and sustainable energy company willing to take on the installation of the charging station. The process with Zeno involved:

1. Consultation (complementary)
2. Assessment of site
3. Installation
4. Certifications and Inspection

Post-Installation Considerations

Typical maintenance for a charging station depends on its environment - charging stations are generally made to last if used respectfully, and are designed for a longevity of around 10 years. A common cause for maintenance is damage to the charger, especially if users forget to return it to its holder after charging.

As technology advances, updates to the charging station could include new software, but the physical charging station is unlikely to undergo many upgrades or changes. If anything, it's possible that connector changes could occur if the industry makes a change, but for many organizations, field upgrades or retrofit kits would be readily available.

The visibility of charging stations is important for people that may be "on the fence" about whether or not charging stations bring a benefit to their community. Learning that infrastructure for EVs is readily available in their community shows people that an electrified option is available to them. It also confirms an interest and dedication to sustainability and the environment in their community.

There are plenty of considerations to be made regarding the use of the charging station. Many charging stations include software to help manage usage. You will need to determine if it will be available for charging 24/7 or during school or business hours. Will users pay and if so, how much? This pilot has helped further inform the Calgary Board of Education in developing guidelines around charging stations at their schools.

What impact do you hope this project has?

"I hope that it allows the CBE to seriously consider implementation of the technology (charge stations), and spurs the discussion of "what role do we play?". On the learning side, also considering "how are we preparing students for this inevitable future?"

Olena Olafson
CBE Sustainability Coordinator

Conclusion

This pilot provided numerous learning opportunities for a wide variety of students and also helped them explore post-secondary and career options. The partner connections allowed the students to see first-hand the post-secondary options and showcased real career opportunities.

As a testament to the interest in the project, student involvement was continuous over the academic year. EV Club, classroom presentations, and design class engagement all indicated student interest beyond the automotive classes. Being able to engage with numerous classrooms, as well as additional high schools in the board, created excitement about the project amongst students and created life long learning. Our pilot allowed students to become ambassadors of the project and can readily speak to the project at conference presentations and to the media.

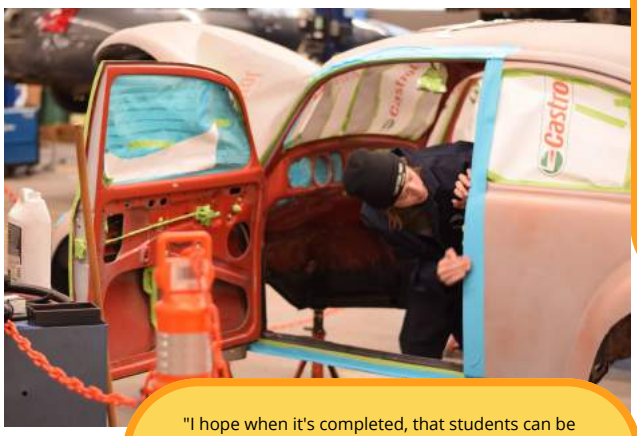
A full EV conversion project is valuable in providing direct experience in understanding the differences between ICE and EVs. However, we recognize that it can be costly and there are many training and safety considerations. There are a variety of intermediate alternatives or supporting options that can help. Some of these will take time and resources to further develop. There are also a few observations that we note, recognizing that this is an industry full of potential for development.

Considerations

- A full conversion provides in-depth learning about both ICE vehicles and EVs. It is costly and takes time; we recognize that it may not be possible for every high school to complete a full conversion. Instead, a school board could consider doing just one conversion, and the converted vehicle could be showcased in the community and shared among schools in the school board as a learning tool.
- As a first step for those new to conversions, consider exploring smaller scale transitions such as converting golf carts from gas to electric or electric ones to using solar power. Zambonis or forklifts could be another approachable vehicle.
- Utilize EV mechanics, owners of EVs or others that have completed conversions as a learning resource.
- Use some of the learning resources identified in this guide to support student learning.
- Dual-credit opportunities through partnerships with post-secondary schools may be an option, as many institutions are beginning to offer them. This could alleviate some of the up front costs and help bridge the financial gap.
- School boards will need to create safety policies in relation to students and teachers working with high voltage EVs and also create charging station policies as more EVs are on the road including electric school buses.
- Automotive curriculum will eventually need to keep pace with the EV transition as will teacher training and equipment.

The future of electrification is bright! It may have some bumps in the road but with all the engagement and encouragement from partners and supporters, coupled with the excitement from the students we are confident we will reach that destination together.

What's Next?



"I hope when it's completed, that students can be proud of the fact that they can do the work to electrify cars old AND new; to see that things can be rebuilt and reborn from the old and that it's not just gasoline or electric that's powering it, there's options available provided that infrastructure is in place to handle it."

Jason Budd
Senior Auto Body Program Teacher

"We have an amazing partnership that we've created with SAIT through this project. In fact, we were just at an event where they got some considerable sponsorship from RBC, and they're starting an electric component to their programming. We're just down the street from SAIT so a lot of our students who want to go on to explore automotives will have the opportunity to do that and will be stars in their class based on their experience, because most of the other students won't have had an experience like that. This will set them up for next steps in their education as well as next steps in their career."

Tim Kitchen
CBE Specialist, Unique Pathways

Do you think the skills that you learned working on the vehicle will be helpful for finding a job?

"Sure, this would be great for a job in engineering or robotics - you've worked on a car!"

Leo
Crescent Heights Student

"It's a great thing to have on your resume! "

Mishaal
Crescent Heights Student

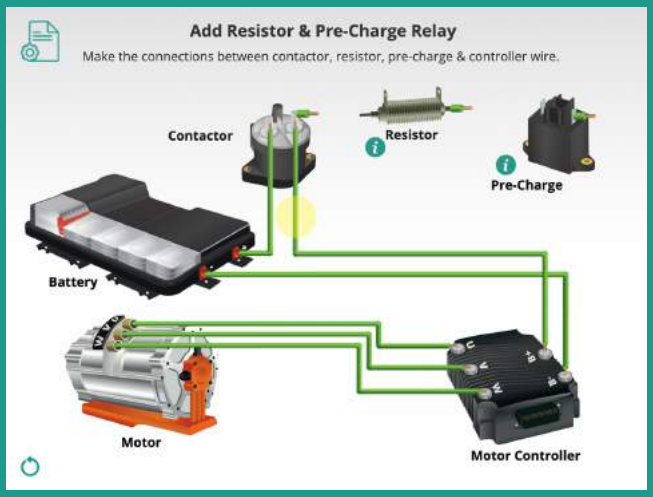
At GreenLearning, we're excited to continue increasing the positive impact of this project. Here are the landmarks we're aiming for in the next year or two:

- Completing a detailed engagement plan for the project and a mapping exercise of the audiences to engage. August 2023
- Completing a communication plan on how to use our social media platforms to engage and inform our target audience on the project and associated events. August 2023
- Delivering eight workshops with 240 automotive and career educators to outline options for enhancing electric vehicle education and providing them with the newly created education materials (e.g. simulators, videos) created in the pilot. May 2024
- Continuing to share the Crescent Heights High School story from the students and teachers involved at four community events such as electric vehicle expos and three workshops for educators and students. May 2024
- Delivering sessions and sharing the information with school boards and ministries of education on the options needed to prepare automotives education for an electric vehicle future to support in this transition and the role of charging stations at schools. March 2024
- Showcasing opportunities for connections between high schools and post-secondary programs based on the partnerships in the pilot through the post-secondary capstone project. March 2024
- Develop a needs assessment for new learning materials that embrace technology that are based on learnings from interactions with teachers, school boards and Ministries of Education. December 2023.
- Continued addition of learnings in the 'learning guide'. June 2024

Additional Resources

Learning Resources

The following resources are ideal for people learning about EVs or charging stations, and may be participating in your project in a student or learner capacity.



Motor Controller Simulator

In collaboration with UCalgary's Relectric Car Team and Funktion Design, we've built a motor controller simulator. This introductory-level simulator allows learners to explore how the various components of an EV are wired together, and the role they play in making the EV move.
LINKED HERE

SAIT Capstone Projects

Capstone Projects developed by SAIT Automotive students to share information about EVs. Check them out at the link below!
LINKED HERE

GreenLearning's EV Learning Resources

Check out our blog post about the ETF Pilot Project here!
Take a minute to explore an electric vehicle: Electric Vehicles: Tesla 3 Video Tour
Explore our other EV resources here!

Vehicle Conversion Resources

We found the following resources beneficial for the community leaders in our project - these are great training offerings or resources that can help you teach your learners about different electrification components in your project.

BCIT Course - linked here, you can find the training that the automotive teacher attended to prepare for high voltage tasks.

This EV workshop can provide insight into how EVs work. This is especially helpful for those looking for in-depth explanations behind different stages of their conversions.

The Municipal Climate Change Action Centre has a great resource on how driving an EV might save you some money. Electric Vehicle Savings Calculator linked here.

Charging Station Resources

If you’re on the lookout for resources that can help you better understand charging stations, or communicate how they can impact a community, consider the following:

Municipal Climate Change Action Centre Resources:

- EV Charging Install and Operations Guide Link
- Electric Vehicle Charging Program

Charging Guides:

- Chargehub's Charging Guide
- Zeno's Home Charging Guide

Career Potential:

- Chargepoint Electrification Blog Post

Final Thoughts

We'd love to see what you accomplish. If you take on a conversion project, please feel free to reach out and keep us informed about your progress. We can be reached at programs@greenlearning.ca or tagged @greenlearning.