

The goal of this project was to develop an inexpensive and simple ICE (internal combustion engine)-to-electric ATV conversion kit. The kit is meant to only require technology and tools commonly available to remote northern communities, so it can be easily replicated to provide these communities with an opportunity to use cleaner and cheaper energy for transportation.

The converted ATV created as reference for the kit is a 2004 Arctic Cat 4X4 Automatic ATV equipped with a 1-cylinder, four stroke, gasoline engine rated for 24.7 HP.

Join us to learn more about the project's technical specifications and design solution!

ABSTRACT

The Arctic Institute of North America's Kluane Lake Research Station is taking a step towards reducing the heavy reliance on fossil fuels in northern and remote Yukon communities. The station has proposed an electric vehicle conversion kit for allterrain vehicles (ATVs) as a sustainable solution.

After careful consideration of factors such as budget, timeline, and reliability, the team has decided to convert a 2004 Arctic Cat 4X4 Automatic ATV with a Motenergy ME1306 Brushless Motor paired with a KLS H controller. The power source for the motor and controller will be a system of three parallel Discover Lithium Professional 48V batteries.

Furthermore, we have created an instructional manual to facilitate the replication of the conversion process on similar ATVs.

BATTERIES AND CHARGER

For our battery system, our goal was to achieve a drive time of approximately 1 hour. Working off some rough calculations and knowledge from last year's electric Kubota project we estimated this would correspond to an approximate 4kWh system.

Discover Lithium Professional Batteries (Figure 4)

- Lithium-Ion
- 48V rated voltage
- 51.2V nominal voltage
- 1.5 kWh * 3 parallel = 4.5 kWh
- 30 Ah * 3 parallel = 90 Ah system

We determined that a 48V, lithium-ion compatible charger with a target full-charge time of 10 hours or less would be suitable for the project.

DeltaQ IC1200 Charger (Figure 9)

- Lithium-Ion compatible
- 1200W output
- 25A charge current
- ~4-hour charge time

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ELECTRIFIED VEHICLE MK2: ARCTIC CAT ATV









Figure 8. KLS 72501-8080H Controller







Figure 7. Drive Reduction Assembly

ITEM	PRICE (\$CAD)	
Motor	\$1114	
Batteries	\$ 3 7 3 6	
Controller	\$ 499	
Charger	\$ 611	
Throttle	\$ 69	
Drive Reduction Parts	\$ 205	2:1 chai
Wiring and Extras	\$1277	V
Total	\$7511	

3 x DLP-GC2-48V (Figure 4) KLS72501-8080H (Figure 8) DeltaQIC1200 (Figure 9) Kelly 0-5V Throttle Pedal (Figure 3) in drive reduction (*raw materials free from makerspace) (Figure 7) Vires, relays, switches, etc. (Figure 6) **Project Budget: \$8 000**



MOTOR AND CONTROLLER

A brushless AC motor was chosen for its small size, low weight, high power, and robust design. The Kelly controller has a simple programming interface and is compatible with the ME1306's Hall effect sensors. Although the Kelly brand is lesser known it was the best viable option for this project.

ME1306 (Figure 2) **12 KW continuous power** 125 amp continuous current 90 Nm peak stall torque

KLS8080H (Figure 8) 500 Amp DC input

DRIVE REDUCTION

To use the full power range of the motor and increase the output torque, a drive reduction was implemented.

Differential 3.6:1 ratio, 635mm tall tires Results in ~2400 rpm @80 km/h

Drive Reduction (Figure 7) Additional 2:1 ratio (7.2:1 Total) Results in ~4800 rpm @80 km/h Up to 650 Nm to rear wheels

Simple analysis was done on the steel housing under motor weight and chain loads with applied power. (Figure 10)



Figure 10. Stress and FOS Analysis