



# **The NGSL Solar Backpack Project: Providing Sustainable Power and Hope**

## **Next Generation Sustainable Living Team at Ivy Academy.**

Advisor: Jerry Webb

Portable Solar Generator

100 watt folding Solar Panel

12 Volt 10 Amp MPPT Charge Controller

450 Watt Inverter

12 Volt, 20 AH, Lithium Battery



# **Goal: Provide Portable, Sustainable Power Systems for Disaster Relief, Emergency Shelters, Field Hospitals, and Remote Aid Stations.**

In times of crisis, access to reliable power can mean the difference between safety and uncertainty. The Next Generation Sustainable Living (NGSL) Solar Backpack Project was created by students at Ivy Academy to address this urgent need, starting with a mission to help students and teachers in Ukraine.

With much of Ukraine's infrastructure destroyed or damaged due to the war, parents were afraid to send their children to school. Communication was nearly impossible, as cell phones—the only lifeline between students and their families—could not stay charged. When students took shelter in bomb shelters, their parents had no way of knowing if they were safe. Ivy Academy's NGSL students designed a solar-powered backpack to charge cell phones, laptops, and power ventilation fans while in bomb shelters, ensuring that students and teachers could stay connected and safe in the most difficult conditions.

## ***A Growing Impact***

What started as a response to the war in Ukraine has evolved into a global humanitarian effort. The NGSL Solar Backpack is now being designed and deployed for multiple applications, including:

**Ukraine CTE Training** – With many technical educators in Ukraine serving in the war, others have stepped in to use the solar backpack as a hands-on teaching tool for solar energy, electrical systems, and battery storage training.

**Disaster Relief** – The backpacks are being distributed to storm-hit areas in North Carolina and East Tennessee, where power outages leave communities vulnerable.

**Medical Support in Africa** – Recently, the project caught the attention of Access Health Africa, who will take several solar backpacks on upcoming missions to provide power in remote areas of Africa without electricity.

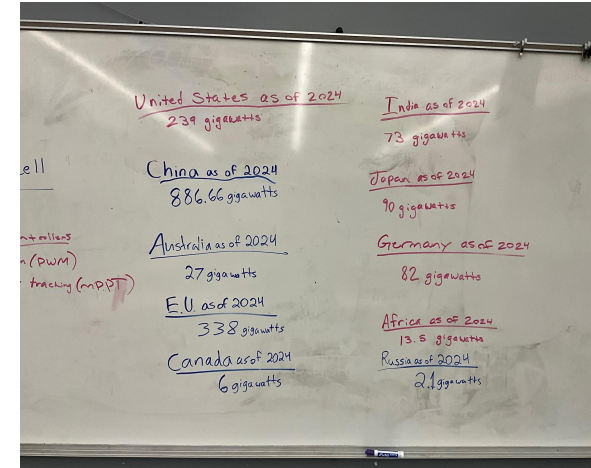
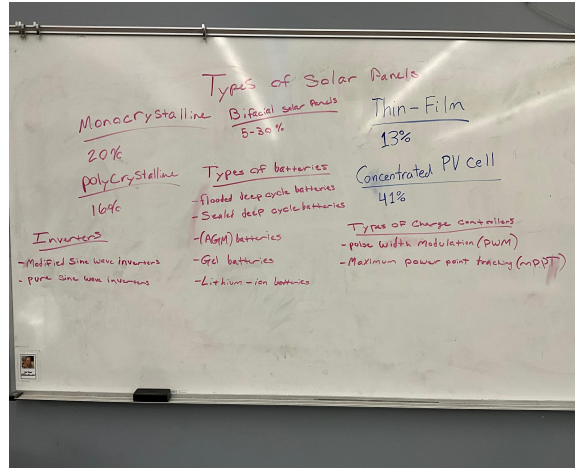
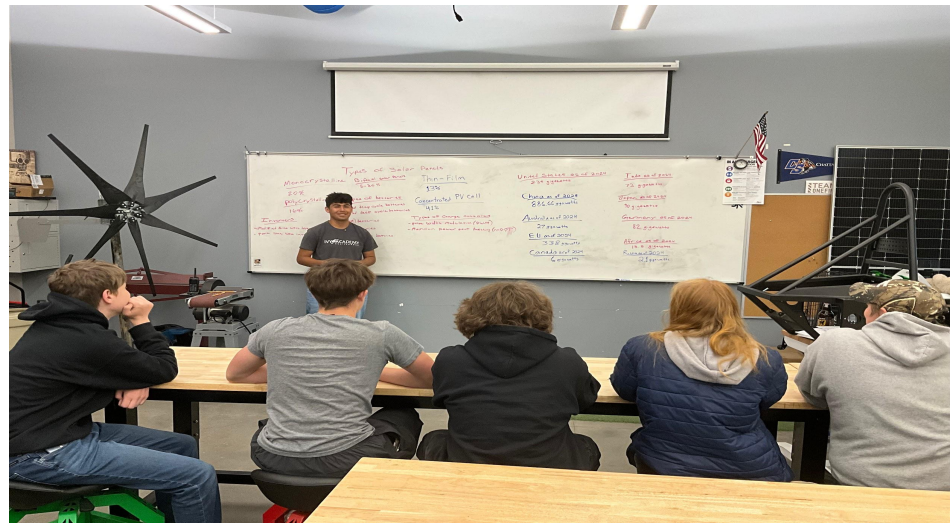
# Energy Focus Areas

Solar Energy Basics.

Energy Storage & Battery Efficiency.

Electrical Circuits & Power Distribution.

Identifying Real-World Needs for Disaster Response & Medical Aid.





# Renewable Energy Research & Planning

Investigating Types Of Solar  
Panels & Their Efficiency.

Understanding Battery Storage &  
Charge Controllers.

Planning For Weather-Resistant,  
Portable Design.





# Hands-On Energy Activities

Solar Panel Testing: Measuring Voltage & Current Under Different Lighting Conditions.

Battery Storage Experiment: Determining Charge/Discharge Rates For Efficient Power Use.

Circuit Building: Wiring Inverters, and Charge Controllers.



# Solar Energy In Disaster Relief

How Solar Energy Provides A Reliable Off-Grid Power Source.

Why Solar Is Ideal For Hurricane-Prone Areas & Remote Medical Sites.

Comparing Traditional vs Renewable Energy Solutions In Emergencies.



Out of Fuel

No Fuel Needed

No Fuel Needed

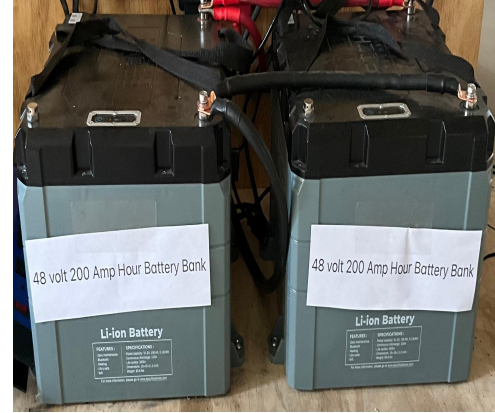


# Energy Efficiency & Battery Storage

Importance Of Energy Conservation In Disaster Relief Scenarios.

Choosing The Right Batteries For Long-Lasting Energy Storage.

Preventing Energy Loss Through Efficient Circuit Design.



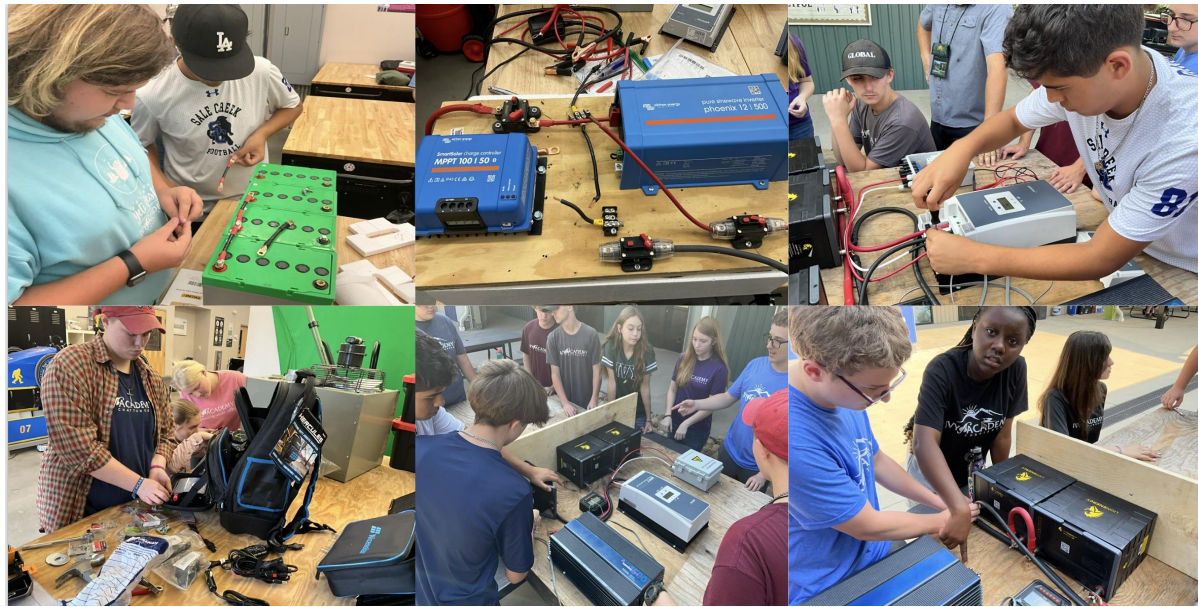


# Electrical Circuits & Power Distribution

Understanding DC vs AC  
Portable Energy Systems.

How Inverters Convert Stored  
Solar Power Into Usable  
Electricity.

Designing Safe, Efficient Wiring  
Systems For Multiple Devices.





# Testing & Data Collection

Measuring Solar Input vs Power Output.

Comparing Performance In Direct, Cloudy Conditions, And Shade.

Recording Data To Improve Efficiency.





# Impact In North Carolina Disaster Relief.

How The Backpacks Will Support Storm Shelters, Emergency Responders, and Displaced Families.

Reducing Dependence On Fuel-Powered Generators.





# Impact For Access Health Africa & Ukraine

Powering Medical Equipment,  
Lighting, And Communication  
Devices.

Supporting Doctors Working in  
Remote, Off-Grid Areas.

Providing An Eco-Friendly,  
Sustainable energy Source For  
Aid Missions.



# Evaluating & Improving The Design.

Reviewing Test Results & Identifying Areas For Improvement.

Enhancing Durability For Harsh Weather Conditions.

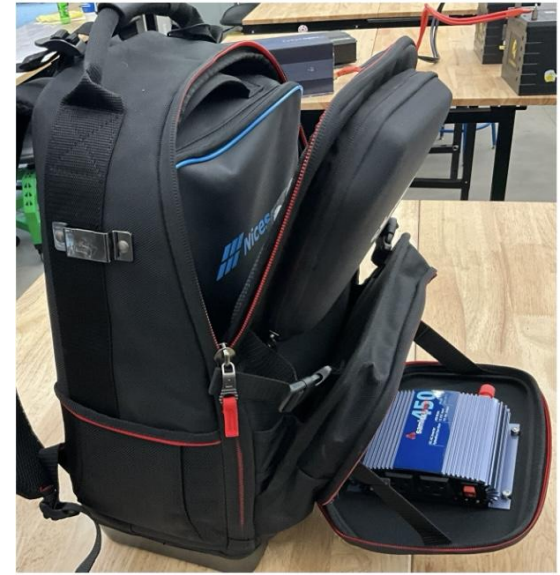
Refining Battery Storage To Increase Power Availability.



1st Prototype: Solar Suitcase  
Suitcase lacked durability.  
Dual lead-acid batteries were heavy with low capacity.  
PWM charge controller proved inefficient.  
Inverter underperformed and overheated.



2nd Prototype: Solar Backpack  
Steel cables added excessive weight to the tool backpack, even with the switch to a lighter lithium battery.



3rd Prototype: Solar Backpack  
(Production Model)  
: Lightweight, durable backpack design.  
: Upgraded to a larger 20Ah lithium battery with capacity for future expansion.  
: Equipped with a high-efficiency 10A, 12V MPPT charge controller.  
: Features a lighter, more durable Samlex inverter available in both U.S. and European versions.



# Project Performance, Outreach , and Recognition

Ivy's Next Generation Sustainable Living (NGSL) program was honored with an invitation to present their Solar Backpack Project at the National Career & Technical Education Conference in December 2024. The trip was fully funded by Harbor Freight Tools for Schools, whose generous support covered all associated expenses.

The NGSL Solar Backpack Project was also recognized as the Tennessee Charter Schools Community Impact Project of the Year, celebrating its innovation and meaningful contribution to both education and global outreach.



Ivy Academy's NGSL Solar Backpack Project Was Featured On Channel 9 abc News <https://newschannel9.com/news/local/ivy-academy-teacher-students-design-solar-powered-backpacks-for-war-torn-ukraine>

Ivy Academy's NGSL Solar Backpack Project Was Featured On Channel 12 wdef News. <https://www.wdef.com/whats-right-with-our-schools-ivy-academy-helping-ukrainian-students/>



# Submission & Next Steps

Finalizing Documentation: Create Video.

Expanding The Project: More Units, Improved Design, Wider Distribution.

Exploring New Applications: Refugee Camps, Emergency Response Teams.



## Conclusion & Acknowledgments



WattCycle and Ivy Academy's Next Generation Sustainable Living Program Are Shaping a Sustainable Future Through Innovation and Education.



Thank you to NEED, Harbor Freight Tools For Schools, WattCycle Batteries, Samlex America Power Inverters, And Home Depot.

Future Goal: Improving Renewable Energy Solutions for Disaster Relief Worldwide..



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