SUSTAINABLE TECHNICAL BULLETINS

Contents

* Definition can be found in Glossary

Bulletin 101: **Haddad's Basecamp Battery**

Summary:
Haddad's Basecamp Battery is a cutting-edge B.E.S.S.* solution designed for efficient energy storage and reliable output. Designed with the unique demands of film industry transportation departments in mind. With a 198kWh storage capacity and a 36kW output (42kW peak), it provides a sustainable alternative to traditional generators. Equipped with lithium-ion* batteries, Bluetooth capabilities, and pass-through connections, this battery ensures seamless operation, making it ideal for various applications.

The Facts:

Battery Type: Lithium-Ion*

- Uses advanced lithium-ion* technology for higher efficiency, longer lifespan, and faster charging compared to traditional lead-acid batteries.

Storage Capacity: 198kWh

- Provides a large energy reserve capable of sustaining extended operations without the need for frequent recharges.

Output Power*: 36kW Continuous (42kW Peak) - 150 amps per leg, 300 amp total

- Delivers consistent 36kW power for various electrical loads.
- Peak output of 42kW allows handling of short-term high-power demands without interruptions.

Voltage: 120/240V Single-Phase Output*

- Compatible with standard electrical systems, making it easy to integrate into existing infrastructure.
- Provides stable power for sensitive electronics, lighting, and heavy equipment.

Run Time:

- 16-18 hours at 100 amps – Suitable for long-duration operations requiring steady power.
- 6 hours at 300 amps (maximum load) – Supports high-demand applications with power-intensive equipment.

Charge Time: Can Be Recharged in 2-6 Hours

- A fast-charging system ensures minimal downtime, allowing for quick turnaround between uses.

Connections: Camlock In/Out* for Easy Integration

- Equipped with standard camlock connectors for quick, secure, and flexible power distribution.
- Plug-and-play compatibility makes it simple to set up at various locations.

Monitoring: Digital LED Display & Bluetooth Telematics*

- LED status indicator provides real-time feedback on power levels and battery performance.
- Bluetooth telematics* enables remote monitoring of battery status, performance metrics, and operational diagnostics.
- Enhances predictive maintenance and reduces downtime with early issue detection.

* Definition can be found in Glossary

Additional Feature: Pass-Through Capability

- Allows the battery to be charged while still supplying power to, ensuring continuous operation.

The Basecamp Battery offers **cleaner, quieter, and more efficient** power compared to traditional generators, making it ideal for various applications.

* Definition can be found in Glossary

Bulletin 102: **Haddad's Hybrid Basecamp Battery**

Summary:
Haddad's Hybrid Basecamp Battery is a cutting-edge power solution that combines a B.E.S.S.* with a Tier 4 diesel generator, ensuring continuous, efficient, and low-emission power. This system provides quiet, clean energy while the generator acts as a backup and recharging source, making it ideal for film production.

The Facts:

Battery Features:

- 198kWh lithium-ion* battery for long-lasting power.
- Run Time:
  - 16-18 hours @ 100 amps (continuous use).
  - 6 hours @ 300 amps (maximum load).
- Fast Recharge: Can be recharged in 6 hours.
- 36kW continuous output, 42kW peak power. 150 amps per leg, 300 amps total
- 120/240V single-phase output*, compatible with most electrical systems.
- Telematic monitoring via Bluetooth for local tracking.
- Pass-through capabilities allow power flow while charging.

Generator Features:

- 1400-amp generator with Tier 4 diesel engine.
- Super quiet operation at 55 decibels* from 23 feet.
- Capable of using renewable diesel*, reducing emissions.
- Truck mounted for easy mobility.

How the Generator Complements the Battery

- The generator can recharge the battery ensuring minimal downtime and continuous operation when battery power is low.
- Backup Power for High-Demand Loads: If power demands exceed the battery's output capacity, the generator provides an additional energy source.
- Pass-Through Capabilities for Uninterrupted Operation: The battery can supply power while charging from the generator, preventing downtime.
- Quiet, Clean Power with Reduced Emissions: The battery provides silent operation, while the generator runs at just 55 decibels*, making it quieter and more eco-friendly than traditional generators.
- Mobility and Versatility: The truck-mounted system is easily transportable for splinter job sites, remote locations, and mobile power needs.

Why This Matters

The Hybrid Basecamp Battery delivers clean, silent energy while the generator provides reliability and recharging power, making it a sustainable, high-performance alternative to traditional power sources.

* Definition can be found in Glossary

Bulletin 103: **Haddad's Basecamp Battery – 7 Layers of Safety**

At Haddad's, safety isn't a feature — it's a foundation. Our Basecamp Batteries are engineered with a multi-layered approach to ensure dependable, high-performance power with industry-leading protection.

The 7 Layers of Safety

1. High-Integrity Battery Cells*

We start with advanced lithium-ion* cells that meet strict global safety and performance standards.

- Tested for shock, impact, heat, vibration, overcharging, and more
- Proven across millions of real-world* miles

2. Sealed & Durable Modules*

Cells are assembled into rugged, aluminum-encased modules* with built-in fuses and sealed in a proprietary compound to block out moisture and oxygen.

- IP67* rated for water and dust protection
- Internally fused* for added resilience

3. Smart Battery Management System (BMS)*

Each battery includes onboard hardware and software that continuously monitors charge, temperature, voltage, and system health.

- Real-time cell balancing*
- Overcurrent* and over/under-voltage protection*
- Built-in warnings and automatic shutoffs*

4. Heavy-Duty Pack Housing*

Our packs are enclosed in precision-milled steel for protection against harsh environments.

- Weather-resistant (IP66/67)*
- Includes advanced venting and secure mounting options
- Tested to rigorous safety standards (ANSI/CAN/UL1973)*

5. Contactors* & Disconnects

Powerful, high-current switches ensure the system can safely disconnect under any condition.

- Designed to handle heavy electrical loads
- Includes arc suppression* and secondary safety contacts

6. Integrated Safety Architecture*

Our batteries are designed as a full system — not just a collection of parts — with every layer working in sync to ensure protection and performance.

- Built to meet automotive safety expectations
- Minimizes the risk of single-point failures*

7. Built on Real-World* Collaboration

Each system is designed with real use cases in mind, based on how our teams work in the field. Our approach prioritizes reliability, ease of use, and peace of mind — no surprises, no compromises.

* Definition can be found in Glossary

Bulletin 104: **Haddad's 36kWh Batteries**

Summary:
Lithium-ion* NMC (Nickel Manganese Cobalt) batteries are among the most advanced and widely used energy storage solutions today. They offer high energy density, long cycle life, and excellent efficiency, making them the preferred choice for electric vehicles (EVs), renewable energy storage, and portable electronics. Their superior performance, reliability, lightweight design, and safety features make them an outstanding option for both commercial and consumer applications.

Key Facts About Haddad's Lithium-Ion* NMC* Batteries:

1. **UL Certified**
   - All components of our batteries are UL Certified and passed all UN38.3, BG/T 31482, 38031:20 cell tests*
2. **Built for All Climates**
   - The system is built to perform reliably across a broad range of temperatures, with a proven track record of operating effectively in colder conditions thanks to its integrated heating system.
3. **High Energy Density**
   - Provide an excellent balance between energy storage and weight, making them ideal for applications where space and weight constraints matter.
4. **Lightweight Design**
   - Designed to be lightweight, enhancing their efficiency and making them an optimal choice for applications that require mobility.
5. **Long Cycle Life**
   - Can last for thousands of charge cycles with minimal capacity loss, ensuring long-term performance and reliability.
6. **High Efficiency**
   - Exhibit high charge and discharge efficiency (typically above 90%), reducing energy loss and improving overall system efficiency.
7. **Fast Charging Capability**
   - Can be charged quickly without significantly impacting lifespan, making them ideal for fast-charging applications.
8. **Enhanced Thermal Stability**
   - Feature advanced thermal management systems that regulate temperature during operation, reducing the risk of overheating and enhancing safety. This stability helps prevent thermal runaway, ensuring reliable performance even in demanding applications. Additionally, innovations in electrolyte formulation and electrode design further improve thermal resistance and operational safety.

* Definition can be found in Glossary

9. **Eco-Friendly and Recyclable**
    - Offer improved sustainability and recyclability, contributing to greener energy solutions.

* Definition can be found in Glossary

Bulletin 105: **Haddad's Solar Panels**

Summary:
Haddad's equips state-of-the-art off-grid solar power solution engineered for high efficiency, durability, and real-world* performance. Designed with military/aerospace-grade* materials, these panels provide reliable, lightweight, and efficient solar energy for sustained power needs.

The Facts:

Real World Data: Haddad's advertises real-world* data rather than standard laboratory test conditions.

Wattage per Panel: 425 watts

Premium Monocrystalline Panels*: Engineered for high efficiency* and superior energy conversion.

Extreme Durability: Built to withstand harsh weather conditions and road vibrations. Superior Low-Sun Angle Performance: Optimized for all lighting conditions, ensuring maximum energy capture even in low-light environments.

80% Lighter Than Traditional Glass Panels: Weighing 19.77lbs (8.96kg), making them ideal for mobile applications.

More Break-Resistant: Unlike traditional glass panels, these are highly durable and resistant to damage.

The chart below shows the average hourly solar power output (Wh) over the year in Chicago, IL.
Each month's totals represent the average daily watt hours harvested per kW of solar array based on the given month.

For example:

- 8 solar panels at 425w/panel = 3,400w of solar array
- 3,400w ÷ 1000 = 3.4kW of solar array.
- 3.4 kW of solar array X 4,875Wh per solar array (June) = 16,575Wh
- 16,575Wh ÷ 1000 = **16.58kWh harvested**

Source: globalsolaratlas.info

Average hourly profiles

Total photovoltaic power output [Wh]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0 - 1												
1 - 2												
2 - 3												
3 - 4												
4 - 5						4						
5 - 6				11	56	71	53	18	0			
6 - 7			22	104	166	184	168	119	67	17		
7 - 8	9	42	126	227	280	303	291	243	188	112	42	9
8 - 9	77	144	237	332	376	406	398	352	303	215	131	72
9 - 10	160	245	337	421	449	478	481	437	399	301	216	147
10 - 11	227	322	414	478	503	537	534	496	461	349	270	200
11 - 12	255	358	446	506	523	557	551	520	482	364	284	220
12 - 13	247	347	436	493	507	549	532	515	463	341	263	210
13 - 14	210	304	391	446	475	520	521	480	418	292	214	174
14 - 15	158	250	328	381	415	458	457	416	349	224	147	117
15 - 16	78	158	234	287	327	368	374	323	247	128	58	40
16 - 17	10	55	120	175	217	256	262	211	124	30	2	
17 - 18			21	64	108	141	141	90	20			
18 - 19				1	20	42	39	10				
19 - 20												
20 - 21												
21 - 22												
22 - 23												
23 - 24												
Sum	1,430	2,225	3,113	3,927	4,422	4,875	4,833	4,232	3,521	2,374	1,627	1,187

* Definition can be found in Glossary

In summary, in 1 day during the month of June, in Chicago, IL, you could harvest 16.58kWh* of solar energy. Assuming average performance ratio*, efficiency*, cloud cover, and weather conditions.

* Definition can be found in Glossary

Bulletin 106: **Haddad's Tier 4 Generators**

Summary:
The transition to sustainable power solutions is critical for reducing operational CO_2* emissions and fuel dependency. This bulletin outlines the benefits of integrating **Tier 4-compliant generators** to create an optimized, low-carbon power solution.

The Facts:
Emissions for Tier 3 vs. Tier 4 1400AMP diesel generator running at 300AMPS

	Tier 3	Tier 4
NOx – nitrogen oxides*	4.00 g/kWh	0.40 g/kWh
PM – particulate matter*	0.20 g/kWh	0.02 g/kWh
CO – carbon monoxide*	3.50 g/kWh	3.50 g/kWh
HC – hydrocarbons*	0.19 g/kWh	0.19 g/kWh

g/kWh = grams per kilowatt-hour*
Tier 4 generators reduce **Nox emissions by 90%** compared to Tier 3
Tier 4 technology cuts **particulate matter* emissions by 90%**

Advanced Emission Control Technology
- Utilizes Selective Catalytic Reduction (SCR)* and Diesel Particulate Filters (DPF)* to reduce harmful emissions.
- Reduces nitrogen oxides* (NO_x) and particulate matter* to near-zero levels.

Lower Carbon Footprint*
- Burns fuel more efficiently, reducing overall fuel consumption and greenhouse gas emissions.
- Helps meet strict Environmental Protection Agency (EPA) emission standards.

Cleaner Fuel Combustion
- Equipped with high-pressure common rail (HPCR)* fuel systems that optimize combustion for cleaner operation.
- Reduces unburned hydrocarbons* and soot production.

Reduced Noise Pollution
- Designed with advanced soundproofing and quieter engine operation.
- Minimizes environmental disturbance in noise-sensitive areas.

Eco-Friendly Materials
- Engine components are often made from recyclable or environmentally friendly materials.

Smart Load Management
- Incorporates load-sensing technology to adjust power output based on demand, conserving fuel.
- Reduces idling time and fuel waste.

* Definition can be found in Glossary

Bulletin 107: **Calculating Environmental Impacts of CO_2 Emissions from a Tier 4 Generator using Petroleum-Based Diesel**

Understanding the environmental impact of CO_2* emissions from a Tier 4 generator* is essential for improving efficiency and reducing your carbon footprint*. Here's how to calculate emissions based on a generator running at **100 amps** for **12 hours** per day, **5 days** a week:

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1. Source of Emissions

- **Equipment:** Tier 4 Generator*
- **Fuel Type:** Petroleum Diesel*

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2. Gather Data

- **Load:** 100 amps
- **Operation:** 12 hours per day, 5 days per week = **60 hours/week**
- **Diesel Consumption Rate:** The generator burns **3.4 gallons of diesel per hour**
  60 hours/week × 3.4 gal/hour = 204 gallons/week

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3. Apply the Emission Factor

- **Diesel Emission Factor:** ~22.4 lbs CO_2 per gallon
  204 gallons/week × 22.4 lbs/gal = 4,569.6 lbs CO_2/week
  Convert to metric tons* (1 metric ton = 2,204.62 lbs):
  4,569.6 ÷ 2,204.62 = 2.07 metric tons of CO_2/week

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4. Estimate the Annual Impact

Multiply by 52 weeks to get the annual total:
2.07 × 52 = 107.64 metric tons of CO_2/year

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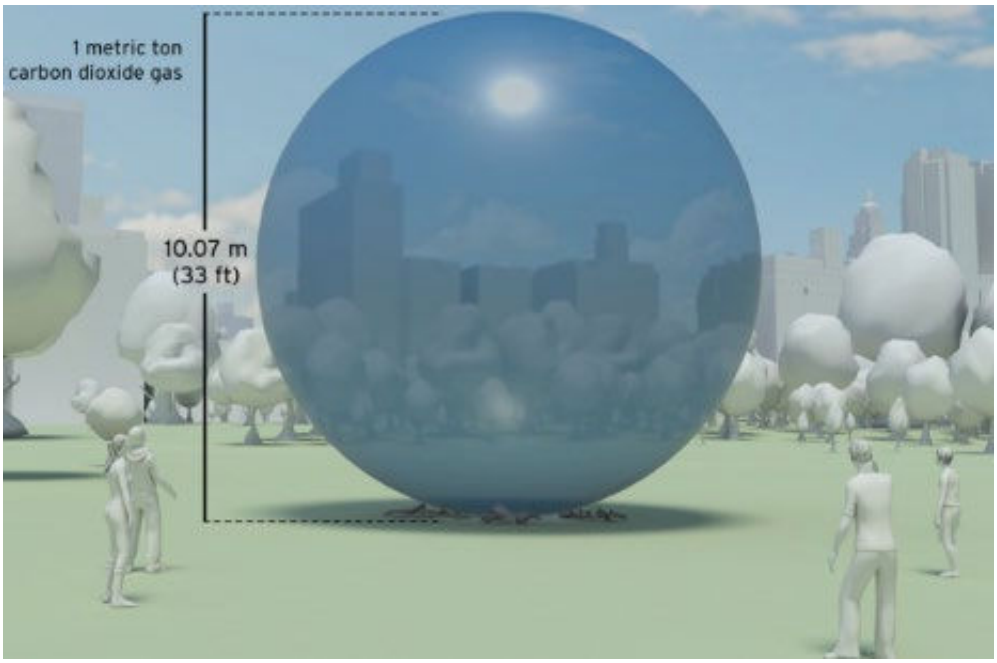
5. Environmental Impact

- **Tree Offset:** A mature tree absorbs ~22 kg (~0.022 metric tons) of CO_2 per year
- To offset 107.64 metric tons of CO_2 per year, you'd need:
  107.64 ÷ 0.022 ≈ 4,893 trees used to clean the CO_2 emissions from the Tier 4 generator in this example

* Definition can be found in Glossary

What does one metric ton* of CO2 look like:



* Definition can be found in Glossary

Bulletin 108: **Calculating Environmental Impacts of CO_2 Emissions from a Tier 4 Generator Using Renewable Diesel**

Switching to **renewable diesel*** is an effective way to reduce the environmental impact of CO_2* emissions from your Tier 4 generator*. Haddad's Tier 4 generators are fully compatible with renewable diesel. Here's how to calculate emissions based on a generator running at **100 amps** for **12 hours** per day, **5 days** a week, using **renewable diesel*** instead of traditional diesel:

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1. Identify the Source of Emissions

- **Equipment:** Tier 4 Generator*
- **Fuel Type:** Renewable Diesel*

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2. Gather Data

- **Load:** 100 amps
- **Operation:** 12 hours per day, 5 days per week = **60 hours/week**
- **Fuel Consumption Rate:** The generator burns **3.4 gallons of renewable diesel per hour**
  60 hours/week × 3.4 gal/hour = 204 gallons/week

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3. Apply the Renewable Diesel Emission Factor

- **Renewable Diesel Emission Factor:** ~13 lbs CO_2 per gallon
  204 gallons/week × 13 lbs/gal = 2,652 lbs CO_2/week
  Convert to metric tons (1 metric ton = 2,204.62 lbs):
  2,652 ÷ 2,204.62 ≈ 1.2 metric tons of CO_2/week

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4. Estimate the Annual Impact

Multiply by 52 weeks to get the annual total:
1.2 × 52 = 62.4 metric tons of CO_2/year

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5. Environmental Impact

- **Tree Offset:** A mature tree absorbs ~22 kg (~0.022 metric tons) of CO_2 per year
- To offset 62.4 metric tons of CO_2 per year, you'd need:
  62.4 ÷ 0.022 ≈ 2,836 trees used to clean the CO_2 emissions from the Tier 4 generator in this example
  That's **2,057 fewer trees** compared to using petroleum diesel (which required 4,893 trees)!

* Definition can be found in Glossary

Bulletin 109: **Calculating Environmental Impacts of CO_2 Emissions from a 198 kWh Lithium-Ion NMC Battery**

Switching from a Tier 4 generator* to a **198 kWh lithium-ion NMC battery** is a strategic way to reduce CO_2* emissions and improve environmental sustainability. Here's how to calculate emissions based on a battery system supplying power equivalent to a generator running at **100 amps** for **12 hours** per day, **5 days** a week:

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1. Identify the Source of Emissions

- **Equipment:** 198 kWh Lithium-Ion* NMC Battery
- **Energy Source:** Electricity (Assuming grid-based charging)

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2. Gather Data

- **Load:** 100 amps
- **Operation:** 12 hours per day, 5 days per week = **60 hours/week**
- **Power Draw:** At 100 amps and 120V, the generator would consume approximately **12 kW** of power:
  100 amps × 120V = 12 kW
  12 kW × 12 hours/day × 5 days/week = 720 kWh/week
  To cover this load using a 198 kWh battery, you would need to **recharge it approximately 3.6 times per week**:
  720 ÷ 198 ≈ 3.6 charges/week

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3. Apply the Grid Electricity Emission Factor

- **Average U.S. Grid Emission Factor:** ~0.85 lbs CO_2 per kWh (varies by region)
  720 kWh/week × 0.85 lbs CO_2/kWh = 612 lbs CO_2/week
  Convert to metric tons:
  612 ÷ 2,204.62 ≈ 0.28 metric tons of CO_2/week

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4. Estimate the Annual Impact

Multiply by 52 weeks to get the annual total:
0.28 × 52 ≈ 14.6 metric tons of CO_2/year

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5. Environmental Impact

- **Tree Offset:** A mature tree absorbs ~22 kg (~0.022 metric tons) of CO_2 per year
- To offset 14.6 metric tons of CO_2 per year, you'd need:
  14.6 ÷ 0.022 ≈ 664 trees
  That's **4,229 fewer trees** compared to using a Tier 4 generator with petroleum diesel and **2,172 fewer trees** than with renewable diesel!

* Definition can be found in Glossary

Bulletin 110: **Understanding Scope 1, 2, and 3 Emissions in the Transportation Department**

The Transportation Department plays a central role in film production emissions due to its management of vehicles, trailers, and mobile power. Accurately categorizing emissions into Scope 1, 2, and 3 helps productions reduce their carbon footprint* and meet sustainability goals.

SCOPE 1 – DIRECT EMISSIONS (OWNED VEHICLES, GENERATORS, TRAILERS)

These are emissions from fuel combustion in vehicles and equipment under the production's direct control.

Examples in Production:

- Diesel burned in:
  - Stakebeds, cube trucks, and grip trucks
  - Picture vehicles driven by the transportation team
  - Tow vehicles for cast trailers
- Fuel used in generators powering:
  - **Cast trailers**
  - **Wardrobe trailers**
  - **Hair and makeup trailers**
- Mobile HVAC units powered by diesel or propane

Responsibility: These emissions are directly controlled by the transportation department and are included in Scope 1.

SCOPE 2 – INDIRECT EMISSIONS FROM PURCHASED ENERGY

Emissions from electricity used to power transportation-adjacent infrastructure or equipment.

Examples in Production:

- Electricity drawn from grid to:
  - Charge **battery-electric vehicles**
  - Run **trailers connected to shore power** at stages or lots
  - Power **charging depots** or **garages** operated by the production

Responsibility: While the emissions happen off-site at a power plant, they are the result of the production's energy use.

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* Definition can be found in Glossary

SCOPE 3 – INDIRECT EMISSIONS FROM VALUE CHAIN ACTIVITIES

These are upstream or downstream emissions not directly controlled by the production but still attributable to its activities.

Examples in Production:

- Talent and crew flights to and from production
- Cast and crew commuting in personal vehicles
- Use of:
    - Rideshare apps or black car services
    - Freight services transporting trailers or equipment
    - Generator fuel supplied and operated by third-party vendors

Responsibility: Though indirect, these emissions must be accounted for to get a full picture of production impact.

CLEAN ENERGY ALTERNATIVES – BATTERY ENERGY STORAGE SYSTEMS (BESS)

To reduce Scope 1 emissions, productions can integrate **Battery Energy Storage Systems (B.E.S.S)** to power trailers and support equipment instead of diesel generators.

Examples of Emission Reduction via B.E.S.S:

- Swapping out diesel gensets with **lithium-ion* battery packs** to run:
    - **Cast trailers overnight**
    - **Hair/makeup and wardrobe units during prep hours**
- Charging BESS units using **solar arrays** or off-peak grid power
- Combining BESS with a hybrid generator to reduce fuel use and runtime

Benefits:

- Cuts on-site fuel consumption (Scope 1)
- Reduces noise and air pollution on set
- May allow trailer power to shift into Scope 2 if charged via grid

* Definition can be found in Glossary

Bulletin 111: **B.E.S.S (Battery Energy Storage System)**

In the fast-paced world of film production, reliable and sustainable power is essential. **Battery Energy Storage Systems (B.E.S.S.)** offer a clean, efficient, and portable energy solution, reducing reliance on noisy and polluting diesel generators. Whether on remote sets, in studios, or during live productions, B.E.S.S. ensures uninterrupted power supply while supporting sustainability efforts.

Key Benefits of B.E.S.S. in the Film Industry

✓ **Quiet Operation:** Eliminates noise pollution, improving on-set audio recording.
✓ **Eco-Friendly:** Reduces carbon footprint* by replacing diesel generators with clean energy.
✓ **Reliable Power Supply:** Ensures consistent power for lighting, cameras, and production equipment.
✓ **Cost-Effective:** Lowers fuel and maintenance costs over time.
✓ **Portable & Scalable:** Adaptable for small shoots to large-scale productions.

Applications of B.E.S.S. in Film Production

On-Location Filming: Provides power in remote areas where grid access is limited.
Studio Productions: Supports lighting, cameras, and equipment with stable energy.
Live Broadcasts & Events: Ensures uninterrupted power for seamless transmission.

Why Transition to a B.E.S.S.?

- **Regulatory Compliance:** Meets growing sustainability mandates in the entertainment industry.
- **Hybrid Integration:** Works alongside solar panels and generators for maximum efficiency.
- **Improved Logistics:** Reduces fuel transport needs, making remote shoots easier.

Conclusion

The future of film production is **clean, quiet, and efficient.** By integrating **B.E.S.S.,** studios and filmmakers can enhance operational efficiency, reduce environmental impact, and ensure a seamless production experience.

For more information on B.E.S.S. solutions for the film industry, contact [Your Contact Information].

Powering Creativity, Sustainably!

* Definition can be found in Glossary

Bulletin 112: **Haddad's Unmatched Attention to Detail**

When you choose Haddad's, you're choosing certainty. You're choosing a team that's at your beck and call 24 hours a day. Whether it's 2 AM or 2 PM, you'll always get a real person on the other end of the line, ready to assist.

At Haddad's, our commitment to quality starts with what we call the defining moment—when a unit returns from rental. This is when our triple-check system begins, ensuring every truck, trailer, water truck, or fuel truck is fully inspected and ready for the road.

Our 100-point checklist covers every detail, with a dedicated team of 2 to 5 professionals thoroughly inspecting the unit. From top to bottom and front to back, no aspect is overlooked. A manager is always on-site to determine if the unit needs bodywork or outside services, ensuring that every repair decision is made efficiently and effectively.

Safety is our top priority. We don't just check the basics—we get under the trailer, inspecting the frame, mechanics, and all safety components to ensure 100% road readiness. Every unit is road-tested for no less than 30 miles before being cleared for rental.

At Haddad's, we don't just rent equipment—we deliver confidence. When you choose us, you can trust that every piece of equipment is meticulously checked, expertly maintained, and always ready to perform.

* Definition can be found in Glossary

Bulletin 113: **Continuing Education**

Bulletin 113a: Sustainable Production for Entertainment Certification (SPEC)

The SPEC certification is an excellent foundational program focused specifically on the entertainment, film, and sports industry with continuing education and networking opportunities.

5-hour seminar - $350

Follow the link below to sign up:

https://usgbc-ca.org/sustainable-production/

USGBC California has partnered with industry and technical experts **Green Spark Group** and **Ereth Environmental**, along with a range of industry advisors across film, TV, music, and live sports to develop a Sustainable Production for Entertainment Certification (SPEC).

This foundational certification is worker-centered for a wide range of individuals across the entertainment industry – from executives to operations crew, tentpole producers to music engineers, art directors to live event personnel, and many more. This is an industry-first and exciting opportunity to advance professional development! This training applies cross-functionally as an industry standard, allowing learners to recognize the sustainable opportunities in their job function and in connection with other roles and responsibilities.

This foundational certification is for all who work in the entertainment industry value chain, including all positions, roles, responsibilities, and affiliations.

This training applies cross-functionally as an industry standard, allowing learners to recognize the sustainable opportunities in their job function and in connection with other roles and responsibilities.

The Key Messages in the certification are:

- Environmental impacts of entertainment are known; solutions are available in the marketplace now to reduce these impacts.
- Sustainable, cost-effective strategies are available.
- Planning is critical and preferred with early decisions to institute sustainable actions.
- Communication and leadership connects needs in and among departments, assigns regular duties, and holds the production accountable.
- Professional associations will deepen your impact, understanding, and leadership in the industry.

* Definition can be found in Glossary

Bulletin 113b: Penn State University World Campus (Online)

Graduate Certificate in Sustainability Management and Policy

This graduate certificate is an excellent pathway for those who already have a bachelor's degree and wish to transition into a sustainable focused career.

4 classes – 12 credits – Tuition $1,027 per credit - $12,324 Total cost

Follow the link below to sign up:

https://www.worldcampus.psu.edu/degrees-and-certificates/penn-state-online-sustainability-management-and-policy-graduate-certificate#costs

You can prepare to lead sustainability projects in both corporate settings and within government entities by studying such topics as:

The evaluation of energy policy challenges and the crafting of policy alternatives to meet economic, environmental, and social goals

Energy resource availability, including current energy markets and forecast scenarios, and the technology processes used for conversion

The identification and characterization of leading stakeholders, including energy producers, professional associations, and interest groups across different energy sectors

The technical and economic understanding of sustainability technologies and systems, and the assessment of their impacts using social, environmental, and economic metrics

Required Courses:

BA 850 Sustainability-Driven Innovation 3 credits

This course explores sustainability as a business opportunity for developing innovative products and services. It will focus on consumer needs related to sustainability, willingness to pay for these needs, and the innovative processes necessary to create sustainable solutions.

EME 803 Applied Energy Policy 3 credits

Provides in-depth exploration of energy policy development, implementation, and assessment at multiple governmental and corporate scales, with emphasis on energy markets.

EME 805 Renewable Energy and Nonmarket Enterprise 3 credits

Industry perspective on resources, technologies, engineering approaches, and externalities involved in deploying renewable energy businesses profitably and sustainably.

EME 807 Technologies for Sustainability Systems 3 credits

This course examines strategies and applications of sustainable technologies in manufacturing, energy, water, transportation, food, and building systems.

* Definition can be found in Glossary

Bulletin 113c: New York SUNY ESF (ONLINE)

Sustainability Management B.S. 2 year program (60 Credits)

New York State Resident Students - $3,535 per semester - $14,140 total cost

Out of state students - $10,015 per semester - $40,060 total cost

https://online.esf.edu/sustainability-management/info

Analyze the complex interactions among and between the three pillars of sustainability: the environment, the economy, and society, with a focus on identifying areas of potential conflict/opportunity.

Apply qualitative and quantitative skills appropriate to the sustainability field

Develop solutions that balance the priorities of sustainable development, social equity, and human/nature interaction.

Analyze data and develop reports and presentations relevant to sustainability and its implementation

Work independently and collaboratively for effective and successful project and people management, communication, and institutionalize sustainable practices.

Classes

SUS 300	Sustainable Systems Thinking: Ecology, Economics, & Society
SUS 310	Human & Social Dimensions of Sustainability
SUS 320	Ecological Dimensions of Sustainability
SUS 330	Introduction to Sustainability Data Analysis
SUS 340	Principles of Sustainable Development
SUS 350	Introduction to Spatial Analysis & Geographic Information Systems
SUS 360	Climate Change & Sustainability
SUS 400	Analysis of Sustainable Systems
SUS 410	Sustainable Urbanism
SUS 420	Sustainable Energy: Technology, Systems & Policy
SUS 430	Managerial Economics for Sustainability
SUS 440	Environmental Justice: Policy, Law, & Society
SUS 450	Civic Engagement & Participatory Planning
SUS 480	Sustainability Management Capstone

* Definition can be found in Glossary

Bulletin 113d: Montclair State University (New Jersey)

Sustainability Science B.S. 4 year program (120 credits)

New Jersey State Resident Student Tuition - $7,956.00 per semester - $63,648 total

Out of state students - $13,011.00 per semester - $104,088 total cost

https://www.montclair.edu/academics/sustainability-science/

Montclair State University sustainability programs lead the way in New Jersey in integrating natural and physical science with social science, economics, policy and project management to prepare sustainability professionals and managers to tackle society's most complex and pressing environmental problems.

Sample of courses

AES 101	Planet Earth
EAES 160	The Human Environment
EAES 202	Introduction to Sustainability Science
EAES 370	World Resources and Industries
EAES 402	Sustainability Science Seminar
EAES 201	Understanding Weather and Climate
EAES 210	Introduction to GIS and Remote Sensing
EAES 361	Environmental Policy
EAES 460	Environmental Law
ANTH 422	Environment and Community

Disclaimer:

The sustainability certification and degree program recommendations provided above are for informational purposes only. We do not endorse, sponsor, or have any affiliation with the institutions or programs listed. Prospective students and professionals should conduct their own research to determine which program best meets their needs, including verifying costs, curriculum, accreditation status, and potential financial aid options. Completion of any program does not guarantee job placement, career advancement, or employer recognition. Prices, course offerings, and availability are subject to change by the respective institutions. Always consult official school websites or contact program administrators for the most up-to-date information.

* Definition can be found in Glossary

Glossary

A

- **Amps × Volts = Watts → Watts / 1000 = Kilowatts (kW) → kW × Hours = Kilowatt-Hours (kWh)**: A fundamental electrical formula used to calculate power and energy consumption. **Amps** (A) represent electrical current, **Volts** (V) indicate electrical potential, and their product gives **Watts** (W), which measures total power. Watts divided by 1,000 converts to **Kilowatts** (kW), and multiplying by time (hours) results in **Kilowatt-Hours** (kWh), the standard unit of energy measurement.
- **Arc Suppression**: A technology that prevents electrical sparks (arcs) when switching power on or off — important for high-power systems.
- **ANSI Certification (ANSI 1973):** A safety standard set by the American National Standards Institute (ANSI) that ensures the safe design, operation, and performance of energy storage systems, including batteries, to prevent hazards like fire or electric shock.
- **Automatic Shutoffs**: If something goes wrong (like a temperature spike or short circuit), the system turns off power automatically to protect the user and equipment.

B

- **B.E.S.S.**: **Battery Energy Storage System**. It is a system that stores electrical energy in batteries for later use, commonly used in renewable energy integration, backup power, and grid stability applications.
- **Battery Cells**: The individual units inside a battery that store and release energy. Multiple cells are combined to create more powerful modules.
- **Battery Management System (BMS)**: The onboard system that acts like the battery's brain — monitoring temperature, charge level, voltage, and system health to keep everything safe and balanced.
- **BG/T 31482 Certification:** A Chinese national standard that sets safety and performance requirements for lithium-ion battery cells, ensuring protection against issues such as overheating, overcharging, and short circuits.
- **BG/T 38031 Certification:** A Chinese national standard focused on the safety and performance of battery packs used in electric vehicles, including tests for thermal stability, electrical safety, and mechanical integrity.

C

- **Camlock In/Out**: A quick-connect electrical connector used for fast, secure power distribution in generators and battery systems. "In" receives power, while "Out" supplies power to equipment. Common in industrial, event, and temporary power setups for high-current loads.
- **Carbon Dioxide (CO_2)**: A colorless, odorless gas produced by burning fossil fuels, respiration, and other natural processes. It is a greenhouse gas that contributes to global warming.

* Definition can be found in Glossary

- **Carbon Footprint:** The total amount of greenhouse gases, primarily carbon dioxide (CO_2), emitted directly or indirectly by an individual, organization, event, or product, typically measured in metric tons of CO_2 equivalent.
- **Carbon Monoxide (CO)**: A colorless, odorless, and toxic gas produced by incomplete combustion of fossil fuels. It can be harmful when inhaled, as it reduces the blood's ability to carry oxygen, leading to potential health risks such as dizziness, unconsciousness, and even death in high concentrations.
- **Cell Balancing**: The process of making sure each **cell** in a battery holds an equal charge. This improves safety, performance, and battery lifespan.
- **Contactor**: A heavy-duty switch that connects or disconnects the **battery's power** — especially useful during startup, shutdown, or emergency stops.

D

- **Decibels (dB)**: A unit of measurement used to express the intensity or loudness of sound. The higher the decibel level, the louder the sound. For reference:
  • 30 dB – Whisper
  • 55 dB – Typical conversation or a quiet generator
  • 70 dB – Vacuum cleaner
  • 100 dB – Chainsaw
  • 120 dB+ – Jet engine at takeoff (pain threshold)
- **Diesel Particulate Filter (DPF)**: A device that captures and stores exhaust soot to reduce emissions from diesel engines.

E

- **Efficiency (Solar Panels):** The ratio of the amount of sunlight that a solar panel can convert into usable electrical energy compared to the total amount of sunlight that hits the panel. Higher efficiency means more energy is generated from a given amount of sunlight.

G

- **g/kWh (grams per kilowatt-hour)**: A unit of measurement that represents the amount of a substance (such as emissions or fuel consumption) produced or consumed per kilowatt-hour (kWh) of energy generated. It is commonly used to quantify pollutant emissions (e.g., NOx, CO_2, PM) from power generation sources like engines and generators. Lower g/kWh values indicate higher efficiency and cleaner energy production.

H

- **High-Pressure Common Rail (HPCR):** A fuel injection system in diesel engines that uses a high-pressure pump to deliver fuel to a shared rail, which then supplies precisely metered fuel to electronically controlled injectors for improved combustion efficiency and reduced emissions.
- **Hydrocarbons (HC)**: Organic compounds made up of hydrogen and carbon atoms, commonly found in fuels like gasoline and diesel. When released into the air from combustion processes, **hydrocarbons** contribute to air pollution and the formation of smog. Some **hydrocarbons** are also hazardous to human health and the environment.

* Definition can be found in Glossary

I

- **Internally Fused**: Each module has built-in fuses that shut off power if there's a problem, helping prevent damage or accidents.
- **IP67 / IP66 Rated**: International standards for how well something is sealed.
  - **IP67**: Protected from dust and can survive being submerged in water temporarily.
  - **IP66**: Protected from dust and strong water jets.

K

- **kWh (Kilowatt-Hour)**: A unit of energy measurement that represents the amount of electricity consumed or produced over time. One **kilowatt-hour** equals the energy used by a 1,000-watt (1 kW) device running for one hour. In emissions measurement (g/kWh), it is used to quantify pollutants released per unit of energy generated, where lower values indicate higher efficiency and cleaner energy production.

L

- **Lithium-Ion (Li-Ion)**: A type of rechargeable battery known for its high energy density, long lifespan, and fast charging capabilities. **Lithium-ion** batteries are commonly used in electric vehicles, portable electronics, and energy storage systems due to their lightweight design, efficiency, and low maintenance requirements. Compared to traditional lead-acid batteries, **lithium-ion** batteries offer greater durability, higher power output, and improved environmental sustainability.

M

- **Metric Ton (tonne):** A unit of mass equivalent to 1,000 kilograms, or approximately 2,204.62 pounds. It is commonly used in most countries around the world for measuring weight, especially for large quantities, and is part of the International System of Units (SI). The metric ton is different from the U.S. ton (short ton), which is approximately 907.1847 kilograms.
- **Military/Aerospace-Grade Materials**: Materials that meet the stringent performance, durability, and safety standards required for military and aerospace applications, ensuring reliability under extreme conditions such as high altitudes, intense temperatures, vibrations, and pressure.
- **Modules**: Groups of **battery cells** packaged together with added protection and monitoring — like building blocks for the full **battery system**.

N

- **Nitrogen Oxides (NOx)**: A group of highly reactive gases, primarily nitric oxide (NO) and nitrogen dioxide (NO_2), produced from fuel combustion in vehicles, power plants, and industrial processes. **NOx** contributes to air pollution, smog, and acid rain, and plays a key role in the formation of ground-level ozone, which can harm respiratory health.
- **NMC (Nickel Manganese Cobalt):** A type of lithium-ion battery chemistry that combines nickel, manganese, and cobalt in varying proportions to form the cathode material. NMC batteries are known for their high energy density, long lifespan, and improved thermal stability, commonly used in electric vehicles and energy storage systems.

* Definition can be found in Glossary

O

- **Output Power**: The total amount of electrical power a device, generator, or **battery system** can deliver to a load. It is typically measured in watts (W) or kilowatts (kW) and calculated using the formula:
  Output Power = Voltage (V) × Amps (A): Output power determines the capacity and performance of electrical systems, affecting how much energy can be supplied to equipment, appliances, or industrial applications.
- **Over/Under-Voltage Protection**: Stops the **battery** from charging too much or draining too low, which helps prevent damage and overheating.
- **Overcurrent Protection**: A built-in safety feature that prevents too much electricity from flowing through the system at once.

P

- **Pack Housing**: The tough outer shell that protects the **battery system**. In this case, it's made of strong, milled steel and is built to handle tough conditions.
- **Particulate Matter (PM)**: A mixture of tiny solid particles and liquid droplets suspended in the air, produced by sources like combustion engines, industrial processes, and natural events. **PM** can be harmful to health, affecting the respiratory system and contributing to air pollution.
- **Performance Ratio (PR):** A metric used to evaluate the efficiency of a solar power system, comparing its actual energy output to the theoretical maximum output under ideal conditions. It accounts for factors like weather, system losses, and inefficiencies, with higher PR indicating better system performance.
- **Petroleum Diesel:** A type of diesel fuel derived from crude oil through a refining process. It is commonly used in internal combustion engines, particularly in heavy-duty vehicles, trucks, and machinery. Petroleum diesel is composed of hydrocarbons and contains impurities that can contribute to air pollution when burned.
- **Premium Monocrystalline Panels**: High-efficiency solar panels made from a single silicon crystal, offering superior energy conversion, durability, and performance in all light conditions.

R

- **Real-World Use Cases**: Practical, everyday environments and conditions where the **batteries** are actually used — like film sets, vehicles, or mobile units.
- **Renewable Diesel**: A clean-burning, petroleum-free fuel made from vegetable oils, animal fats, and waste grease. It is chemically similar to petroleum diesel, fully compatible with diesel engines, and reduces emissions.

* Definition can be found in Glossary

S

- **Selective Catalytic Reduction (SCR):** An emissions control technology that reduces nitrogen oxides (NO_x) in diesel exhaust by injecting a urea-based solution (Diesel Exhaust Fluid) into the exhaust stream, where it reacts with a catalyst to convert NO_x into nitrogen and water.
- **Single-Phase Output**: A type of electrical power distribution where a single alternating current (AC) waveform is used to deliver voltage. It is commonly used in residential, commercial, and light industrial applications due to its simplicity, efficiency, and compatibility with most household and small business electrical devices.
- **Single-Point Failure**: When one small part of a system failing causes the whole thing to stop working. Haddad's **battery systems** are designed to avoid this risk.
- **System Architecture**: The overall design and layout of the **battery system** — how all parts work together to deliver safe and reliable energy.

T

- **Telematics**: A technology that combines telecommunications and data monitoring to track and manage equipment performance remotely. In power systems, **telematics** allows for real-time monitoring of **battery status**, energy usage, and diagnostics via Bluetooth or wireless networks, improving efficiency, maintenance, and performance tracking.
- **Tier 4 Generator**: A diesel generator that meets the **EPA Tier 4 emissions standards**, which are the most stringent regulations for reducing harmful pollutants like **nitrogen oxides (NOx)** and **particulate matter (PM)**.

U

- **UL Certification:** A safety certification issued by Underwriters Laboratories (UL) that verifies a product meets specific safety and performance standards for electrical, mechanical, and environmental safety.
- **UL 1973 Certification:** A safety standard established by Underwriters Laboratories (UL) for batteries and energy storage systems used in stationary applications, electric vehicles, and other devices, ensuring they meet safety, reliability, and performance standards.
- **UN38.3 Certification:** A certification that confirms batteries meet international transport safety standards, including tests for altitude simulation, thermal variation, vibration, shock, overcharge, and short circuit resistance.

* Definition can be found in Glossary