ASK AN AIRSTREAMER

EVERYTHING YOU NEED TO KNOW ABOUT YOUR AIRSTREAM'S POWER SYSTEM

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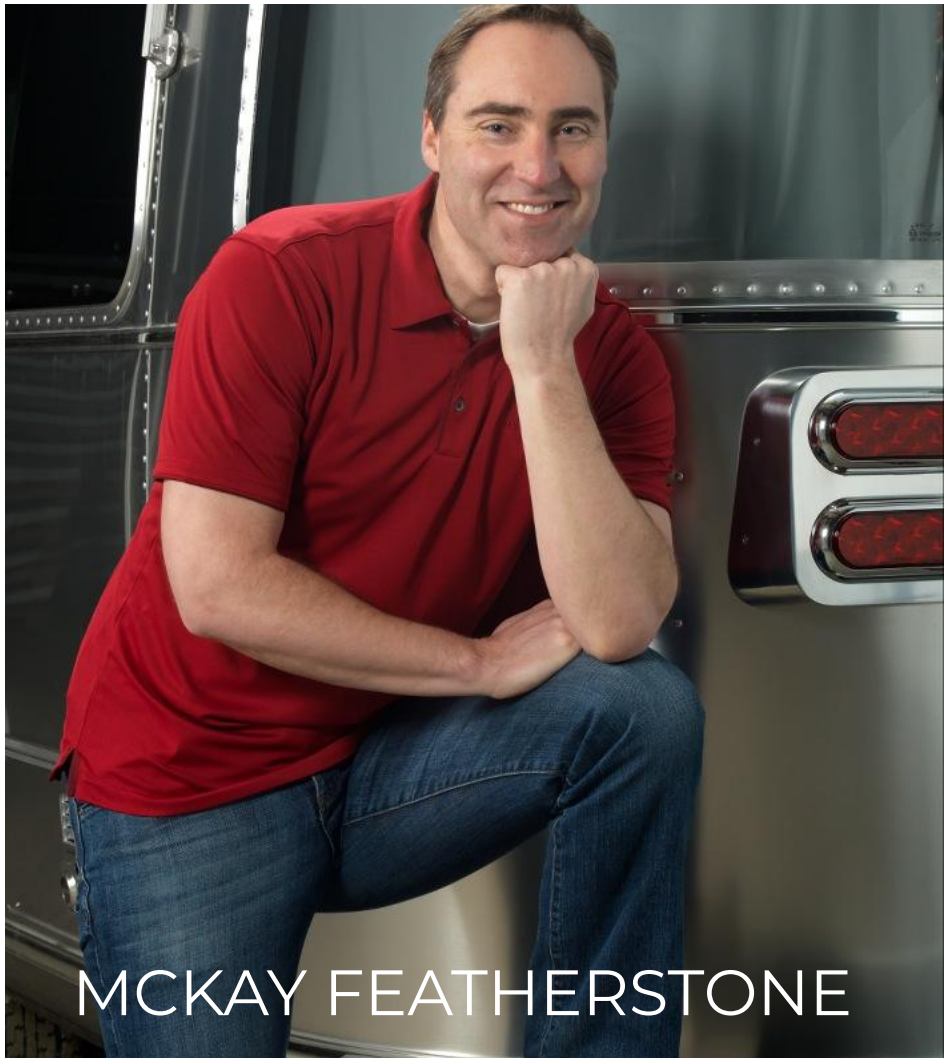
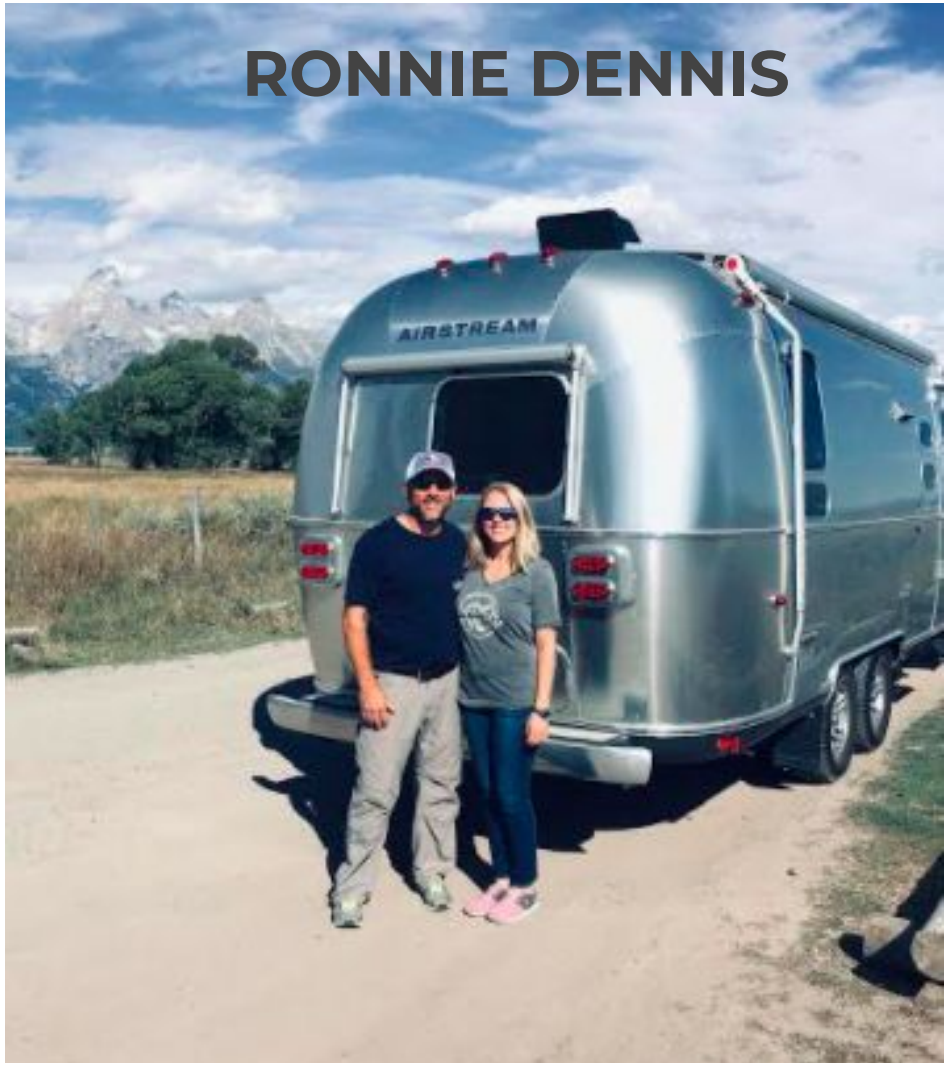
WHAT WE'LL DISCUSS TODAY

1. History of power in Airstreams
2. Overview of DC & AC electrical systems
3. Power generation, power storage, power conversion, power consumption
4. Future of Airstream electrification
5. Q & A


MCKAY FEATHERSTONE


RONNIE DENNIS
AIRSTREAM

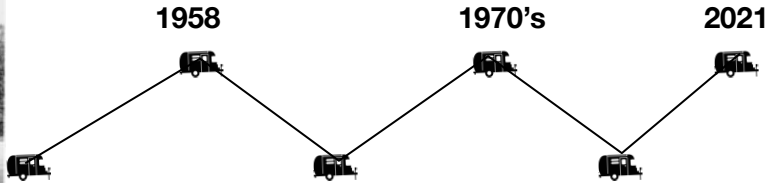
MCKAY

VICE PRESIDENT
PRODUCT DEVELOPMENT
& ENGINEERING


CAUTION
12VDC PANEL


100 Amp Hour 12 Volt
LiFePO4 Battery
RONNIE

HISTORY OF PORTABLE POWER IN AIRSTREAMS



1951-52: Wally Byam leads the first Airstream Caravan to Mexico and Central America. Assuming that most places along the way would not have water or electricity available, he purchased generators, an army surplus water purifier, and spare parts and equipment.

1958: Airstream introduced the International line, the first ever self-contained travel trailers with battery power and tanks that allowed people to stay comfortable while boondocking.

1960's: The Uni-Volt electrical system is developed capable of converting 110-volt power from an outside source into several different types used in a trailer, such as 12-volt DC power for light fixtures.

1970's: Excella 500-recognizable by the blue stripe on its body, ushered Airstream into 1970s style, with affordable and accessible luxury. Featured new conveniences like vista view windows, an appliance center, a bar, a telephone jack, and air conditioning

2018: Introduction of Airstream Airstream Smart Control Technology

2020: Airstream Power Plus

THE CURRENT WAR

THE TALE OF AN EARLY TECH RIVALRY

DC

DIRECT CURRENT

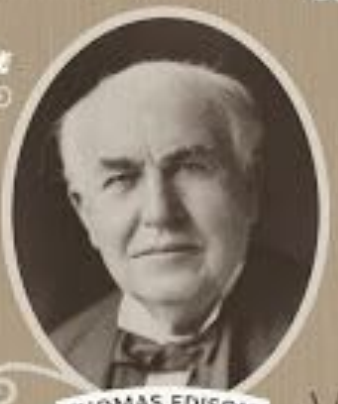
The flow of electricity is in one direction only. The system operates at the same voltage level throughout and is not as efficient for high voltage, long distance transmission.

Direct current runs through:

- Battery-Powered Devices
- Fuel and Solar Cells
- Light Emitting Diodes

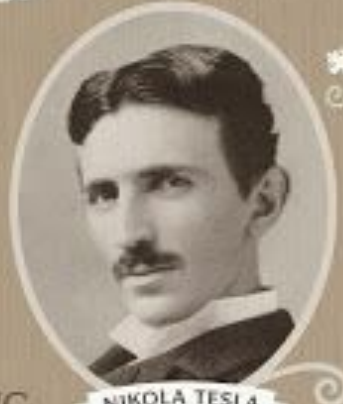
"[TESLA'S] IDEAS ARE SPLENDID, BUT THEY ARE UTTERLY IMPRACTICAL."

- THOMAS EDISON



THOMAS EDISON

VS.



NIKOLA TESLA

You would have never found two geniuses so spiteful of each other beyond turn-of-the-century inventors Nikola Tesla and Thomas Edison. They worked together—and hated each other. Let's compare their life, achievements, and embittered battles.

AC

ALTERNATING CURRENT

Electric charge periodically reverses direction and is transmitted to customers by a transformer that could handle much higher voltages.

Alternating current runs through:

- Car Motors
- Radio Signals
- Appliances

"IF EDISON HAD A NEEDLE TO FIND IN A HAYSTACK, HE WOULD PROCEED AT ONCE... UNTIL HE FOUND THE OBJECT OF HIS SEARCH. I WAS A SORRY WITNESS OF SUCH DOINGS, KNOWING THAT A LITTLE THEORY AND CALCULATION WOULD HAVE SAVED HIM 90 PERCENT OF HIS LABOR."

NIKOLA TESLA

1847	BORN	1856
Milan, Ohio	BIRTHPLACE	Smiljan, Croatia
Wizard of Menlo Park	NICKNAME	Wizard of the West
Home-schooled and self-taught	EDUCATION	Studied math, physics, and mechanics at The Polytechnic Institute at Graz
Mass communication and business	FORTE	Electromagnetism and electromechanical engineering
Trial and error	METHOD	Getting inspired and seeing the invention in his mind is certain before fully constructing it
DC (Direct Current)	WAR OF CURRENTS: ELECTRICAL TRANSMISSION IDEA	AC (Alternating Current)
Incandescent light bulb; phonograph; camera; making technology; motion picture camera; DC motors and electric power	NOTABLE INVENTIONS	Tesla coil; rotating magnetic field principle; transformer circuit; radio transmitter; fluorescent light; AC motors and electric power generation system
1,093	NUMBER OF US PATENTS	112
0	NUMBER OF NOBEL PRIZES WON	0
1	NUMBER OF ELEPHANTS ELECTROCUTED	6
1931—Passed away peacefully in his New Jersey home, surrounded by friends and family	DEATH	1943—Died lonely and in debt in Room 3327 at the New Yorker Hotel

"Genius is one percent inspiration and ninety-nine percent perspiration."

Thomas Edison

LATE BLOOMER

Thomas Edison, the youngest in his family, didn't learn to talk until he was almost 4 years old.

FALLING OUT

Edison promised Tesla a generous reward if he could smooth out his direct current system. The young engineer took on the assignment and ended up saving Edison more than $100,000 (millions of dollars by today's standards). When Tesla asked for his rightful compensation, Edison declined to pay him. Tesla resigned shortly after, and the elder inventor spent the rest of his life campaigning to discredit his counterpart.

EDISON FRIES AN ELEPHANT

In order to prove the dangers of Tesla's alternating current, Thomas Edison staged a highly publicized electrocution of the three-ton elephant known as "Topsy." She died instantly after being shocked with a 6,600-volt AC charge.

WAR OF CURRENTS OFFICIALLY SETTLED

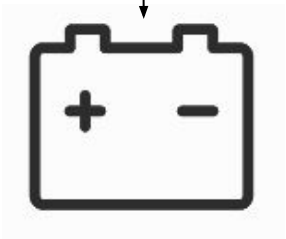
In 2007, Con Edison ended 125 years of direct current electricity service that began when Thomas Edison opened his power station in 1882. It changed to only provide alternating current.

NOBEL PRIZE CONTROVERSY

In 1915, both Edison and Tesla were to receive Nobel Prizes for their strides in physics, but unfortunately, neither won. It is rumored to have been caused by their animosity towards each other and refusal to share the coveted award.

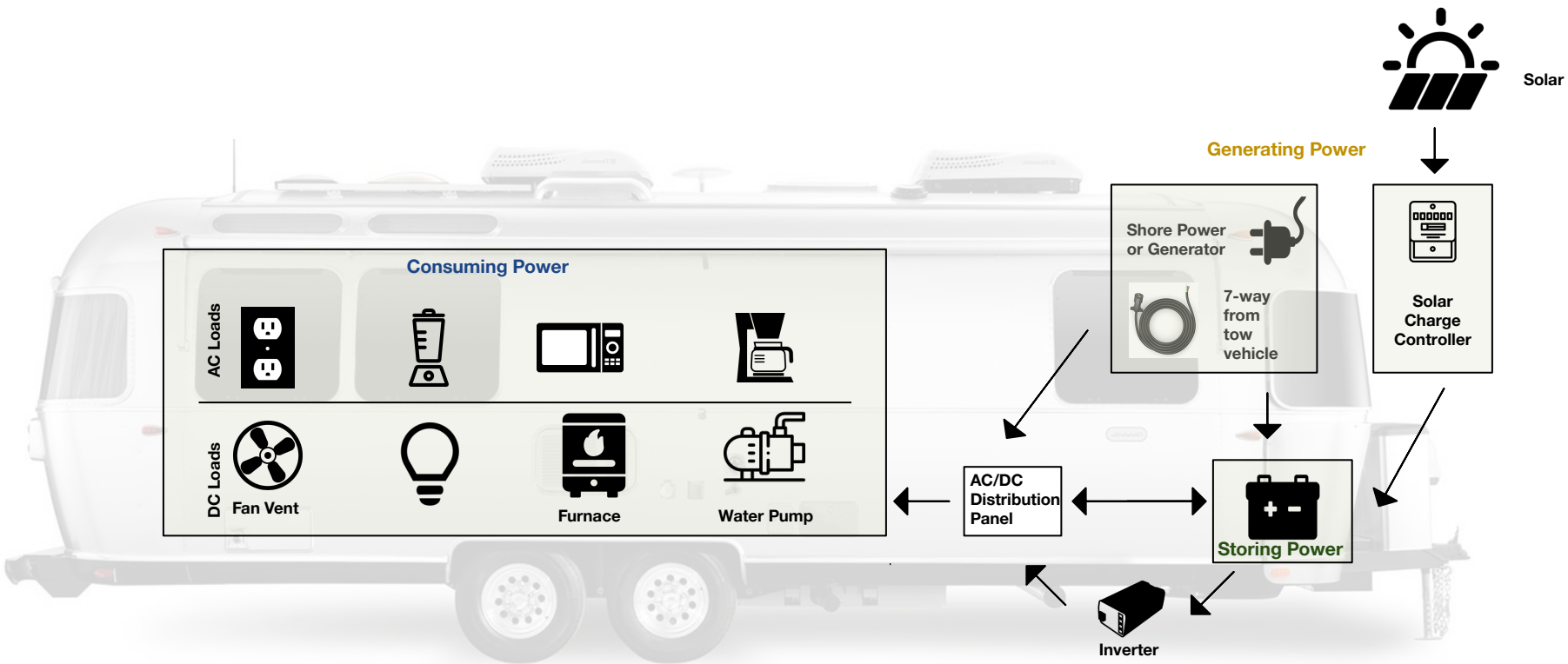
ONE AIRSTREAM, TWO ELECTRICAL SYSTEMS

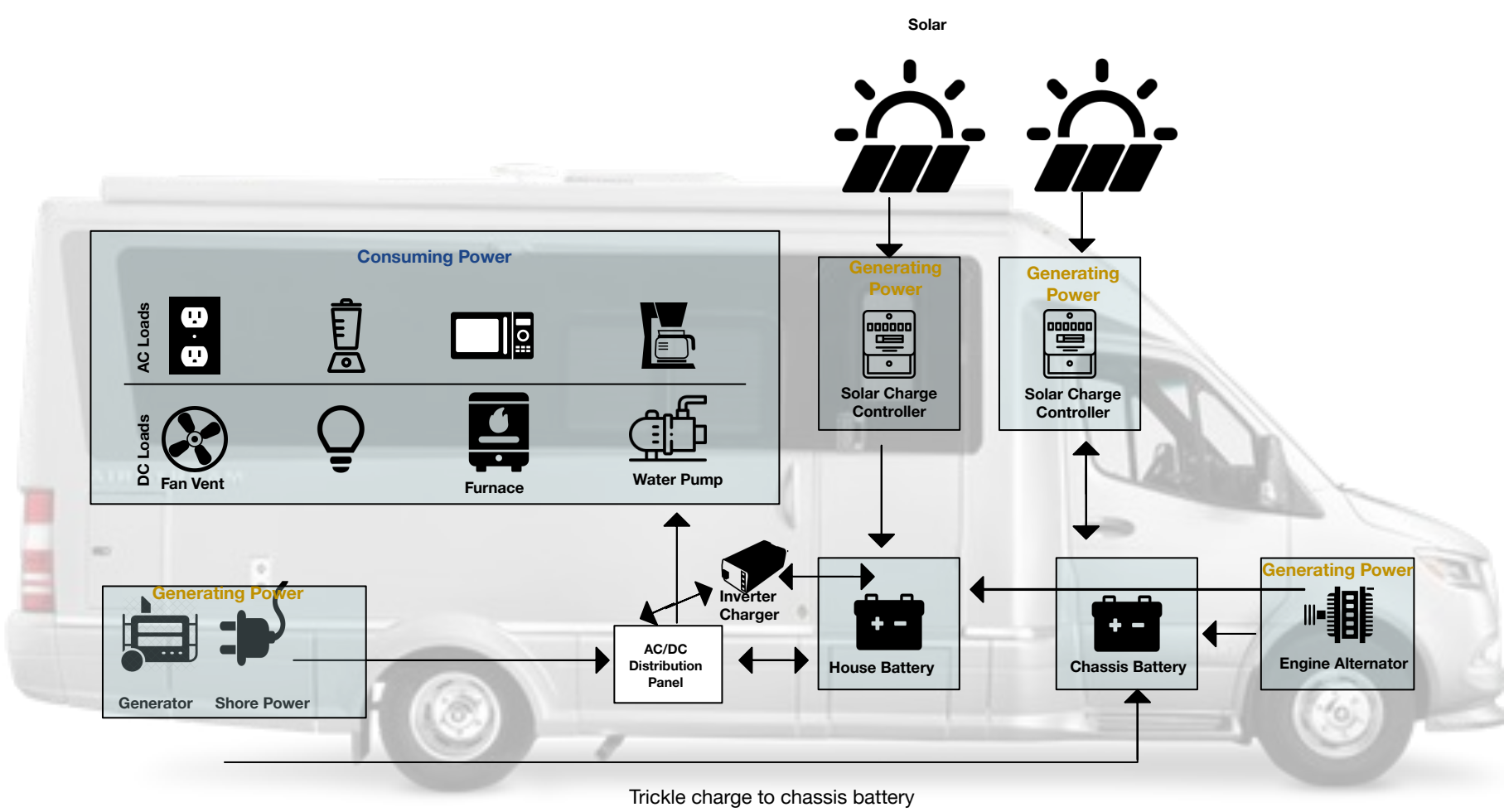
12-VOLT DC ELECTRICAL SYSTEM



120-VOLT AC ELECTRICAL SYSTEM

HOW DOES ELECTRICITY WORK IN AN AIRSTREAM?


Solar
Generating Power
Shore Power or Generator
7-way from tow vehicle
Solar Charge Controller
Consuming Power
AC Loads
DC Loads
Fan Vent
Furnace
Water Pump
AC/DC Distribution Panel
Storing Power
Inverter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Generating Power
Generator
Shore Power
Inverter Charger
AC/DC Distribution Panel
House Battery
Chassis Battery
Generating Power
Engine Alternator
Trickle charge to chassis battery

POWER GENERATION

DIFFERENT WAYS TO STAY POWERED

Solar
As much as you can fit/carry (only when it's sunny)

Portable/Onboard Generators
Starting at 10 amps AC

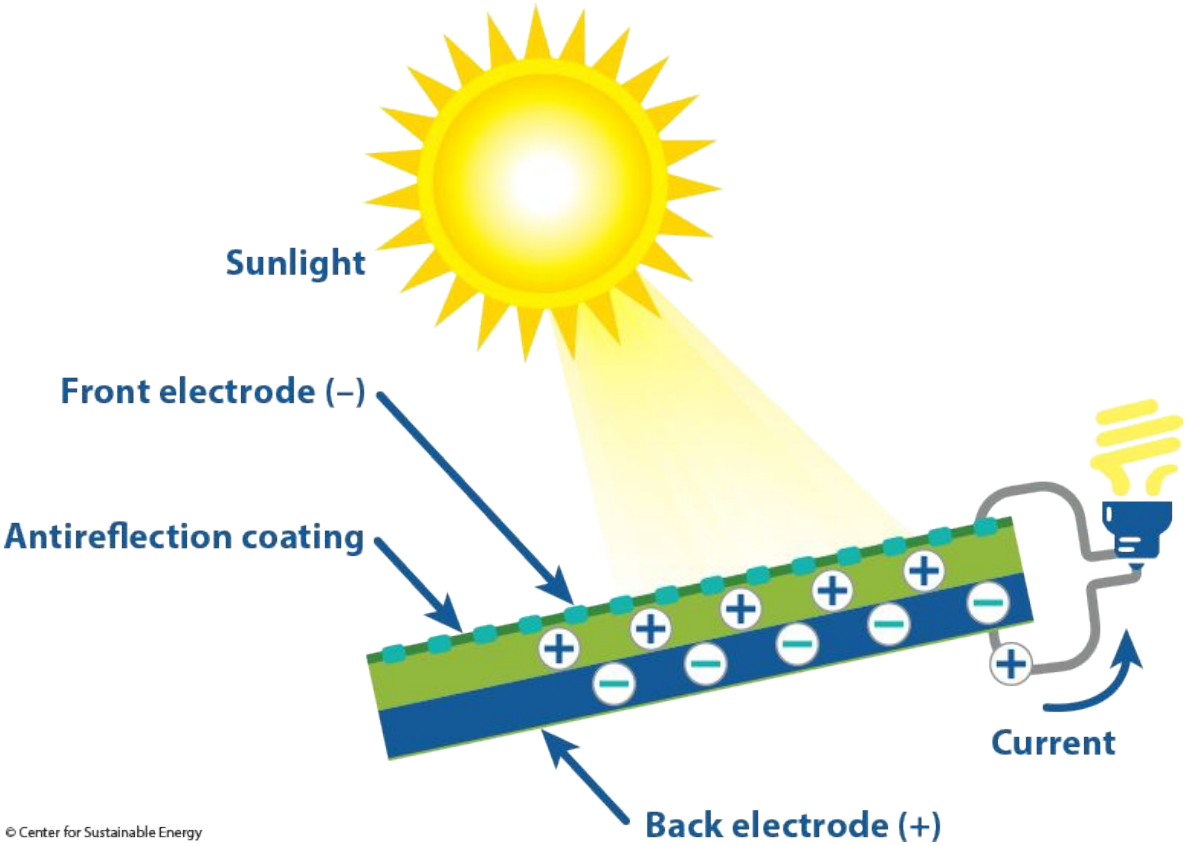
Vehicle Alternator
Only when vehicle is running (limited to 7 amps DC in Travel Trailer and 40 amps DC in Touring Coach)

Power Pedestal
Virtually unlimited power

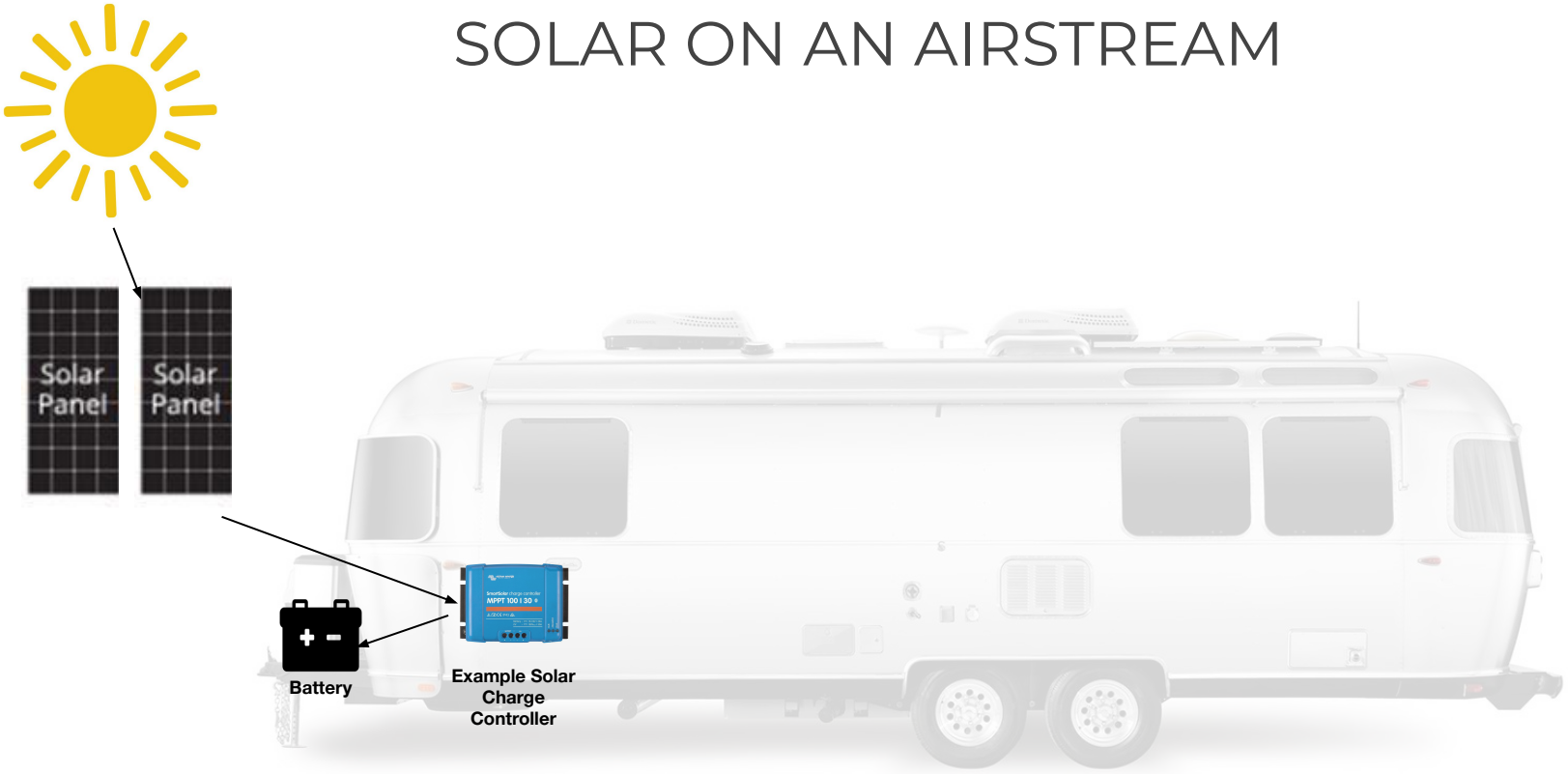
(GENERALLY) LESS POWER

(GENERALLY) MORE POWER

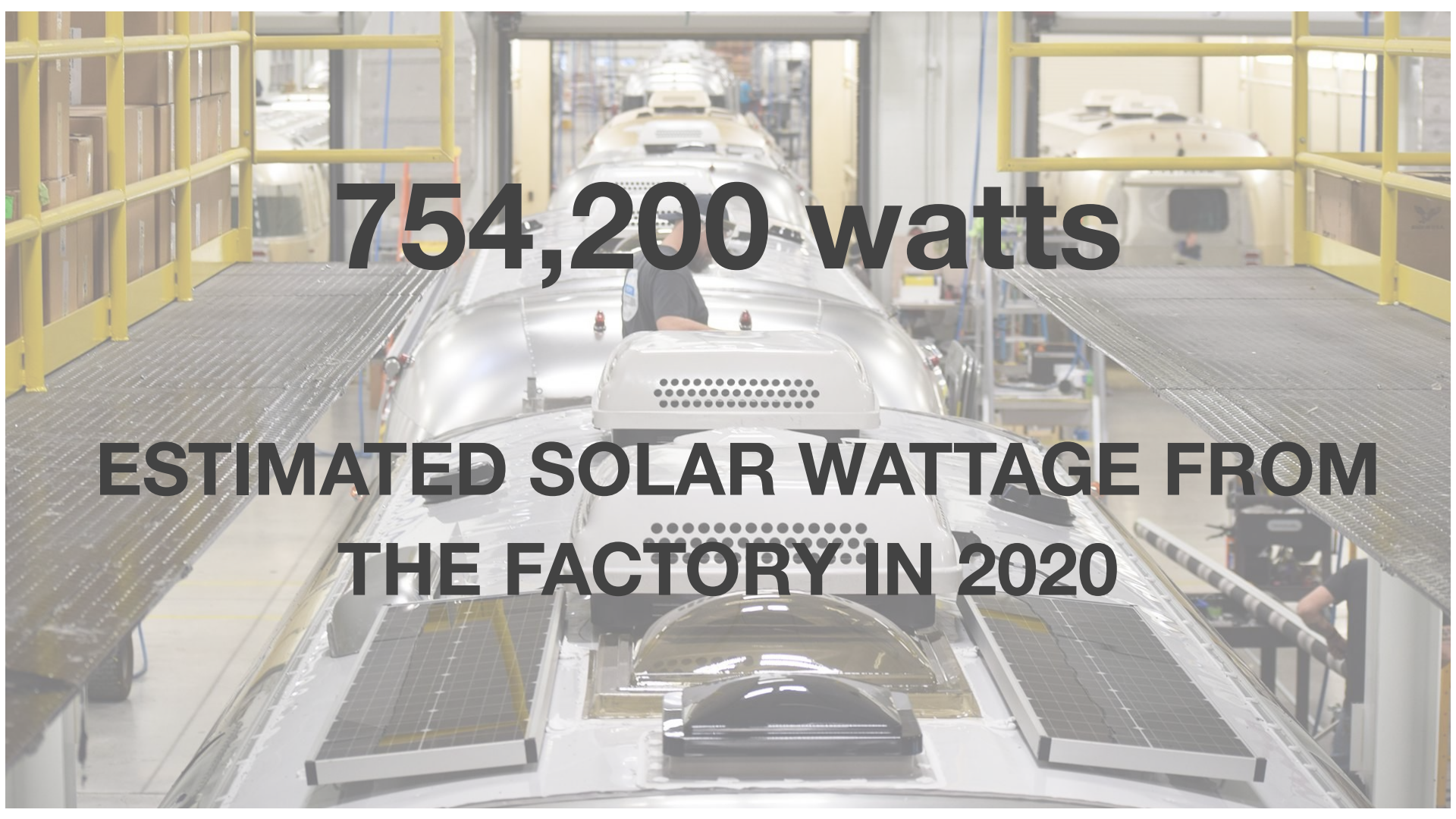
HOW DO SOLAR PANELS WORK?



SOLAR ON AN AIRSTREAM



- Charging when there's sun and when the batteries need power
- The solar charge controller regulates power between solar panels and batteries


754,200 watts
ESTIMATED SOLAR WATTAGE FROM THE FACTORY IN 2020

AIRSTREAM SOLAR OVERVIEW

TRAVEL TRAILER

- 270 watts of solar is standard on Airstream Classic
- All travel trailers come pre-wired with solar on the roof
- All travel trailers include a Zamp solar power plug near the hitch (pictured below)

TOURING COACH

(as of July 2020)

- Interstate 19
  - Chassis 50 watts and House 200 watts
- Interstate EXT
  - Chassis 100 watts and House 300 watts
- Atlas
  - Chassis 100 watts and House 300 watts

MONITORING SOLAR POWER

Previous Models

2021 Models

Charge controller performs these basic functions:

- It senses when the battery is fully charged and disconnects the charge current to avoid overcharging the battery

- It resumes charging the battery when the battery voltage has dropped sufficiently to accept additional charge current

- It checks the availability of charge current, by cycling the relay every 4 minutes. If there is insufficient charge current available, it's internal relay will disconnect the battery to prevent discharge through the solar panels at night

HOW TO CHOOSE THE RIGHT GENERATOR

EU1000i

EU2200i

EU3000iS

EU7000iS

Run-time	Run-time @ 25% load-8 hrs	Run-time @ 25% load-8.1 hrs	Run-time @ 25% load-8 hrs	Run-time @ 25% load-18hrs
Cost (MSRP)	$979	$1,100	$2,419	$5,059
Wattage	1,000 peak watts 900 watts	2,200 peak watts 1,800 watts	3,000 peak watts 2,800 rated watts	7,000 peak watts 5,000 rated watts
Weight	29lbs	47lbs	130lbs	265 lbs
Noise	42 to 50 dBA @ 23’	48 to 57 dBA @ 23’	50-57 dBA @ 23’	52-58 dBA @ 23’

- How much power do you need?
- How much does it weigh?
- Where will you store it?

- How long will it run?
- Can you easily remove fuel from the carburetor for easy storage?
- How loud is it?

*All Airstream Touring Coaches have generators included

SHORE POWER & ACCESSORIES

30 amp
to 50 amp

50 amp
to 30 amp

50 amp
to 15 amp

Internal

External

Adapters

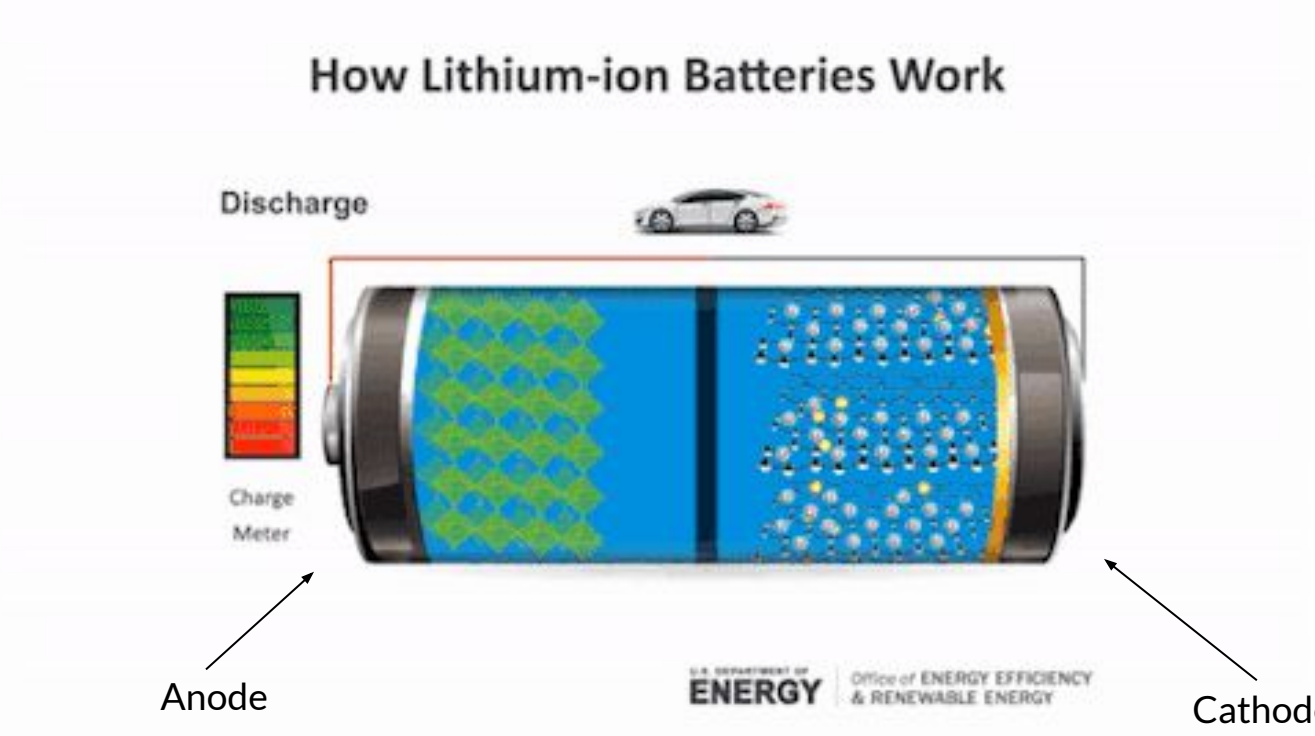
Power adapters help to convert the cord connections to give you more flexibility

Surge protectors

A surge protector is designed to protect an Airstream's electronics from issues that stem from the outlet you plug into

POWER STORAGE

HOW DOES A BATTERY WORK?

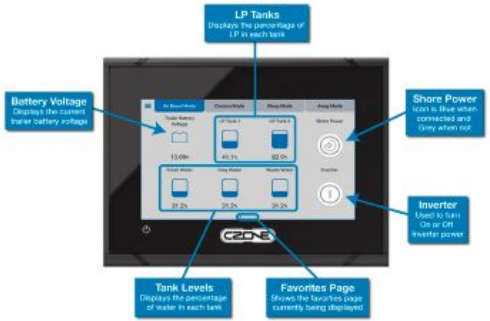


WHAT'S IN A BATTERY NAME?

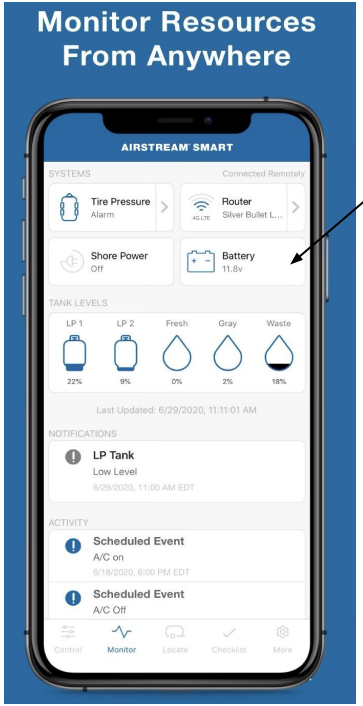
	LEAD ACID	LITHIUM-ION
Chemistry	Lead Acid	Varies, but most common is LiFePO4 for drop-in replacements for lead acid
Estimated Number of Charges/ Cycles	400-500	3000-5000
Estimated Useable Power	~50%	~80-90%
Weight	Heavy	On average, 55% lighter than lead acid
Temperature Considerations	Generally not as sensitive	Can be sensitive
Fast Charging	Can be slow	~Four times faster than lead acid
Maintenance Considerations	Check/clean terminals AND check water level if not sealed	Check/clean terminals

HOW MUCH BATTERY POWER DO YOU HAVE (LEAD ACID ONLY)?

Globetrotter, International, Caravel, Basecamp, Bambi, Flying Cloud, Atlas



Classic, Interstate

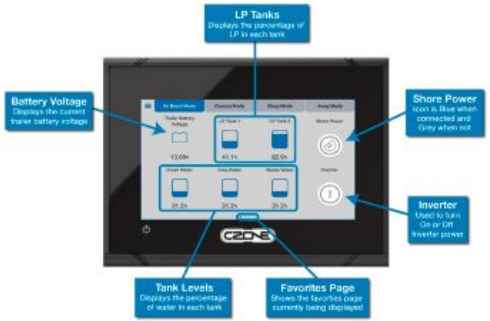


Classic Only

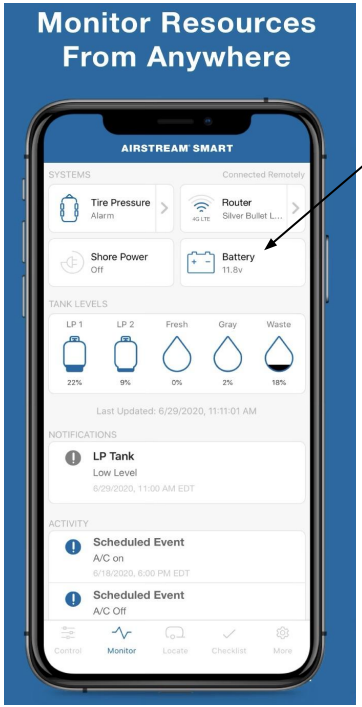
Voltage	State of Charge
13.0	100%
12.7	90%
12.5	80%
12.3	70%
12.1	60%
12.0	50%
11.9	40%
11.8	30%
11.6	20%
11.5	10%
10.5	0%

HOW MUCH BATTERY POWER DO YOU HAVE (LITHIUM ONLY)?

Globetrotter, International, Caravel, Basecamp, Bambi, Flying Cloud, Atlas



Classic, Interstate



Classic Only

Voltage	State of Charge
13.4	100%
13.3	90%
13.2	80%
13.2	70%
13.1	60%
13.0	50%
12.9	40%
12.8	30%
12.7	20%
12.0	10%
9.6	0%

DISCONNECT SWITCHES

Atlas

Interstate

Basecamp & Bambi

Travel Trailer
(except Classic)

Classic

- Disconnects house battery from the vehicle and in Touring Coach, disconnects the inverter
- Disconnects most DC loads except for safety equipment
- Solar stays connected and is able to charge if needed
- Use these when storing your vehicle

The Upgrade to Lithium Batteries with Airstream Power Plus

Oct 02, 2020

Upgrade option: 2 AGM batteries with 2 LiFePO4 lithium batteries and upgraded power converter

Average charge rate: Up to 5 times faster than lead acid

Durability and longevity: 10 times longer than lead acid

Depth of discharge: 2 to 3 times more usable power and 100% discharge

Weight savings: ~55% less

Cost: Consult your dealer to find out what you need and what it will cost

POWER CONVERSION

CHARGERS/CONVERTERS

Electrical devices that convert voltage from 110vAC to 12vDC in your Airstream

- Automatic
- Charges your batteries using generator or shore power

INVERTERS

Electrical devices that convert voltage from 12vDC to 110vAC

- Must be turned on
- Converts stored DC power in batteries to 110vAC
- Lose some power when from DC to AC

USING YOUR INVERTER

- Almost all Airstream travel trailers (not available with Bambi and Basecamp) offer a 1,000 watt pure sine wave power inverter as a standard feature
- Know the wattage of the device you're plugging in before you turn the inverter on

Inverter outlet

Inverter control example in Travel Trailers

Inverter control example in Touring Coach

POWER CONSUMPTION

WATT CAN I RUN?

Watt = measure of work and the universal energy comparison

Conversion Formulas:

Watts = Volts x Amps
Volts = Watts / Amps
Amps = Watts / Volts

Examples

Alternating Current (AC)	Direct Current (DC)
Using a 120 volt / 1 amp TV for one hour *120 volts X 1 amp = 120 watt hours* *(run for two hours = 240 watts)*	Using a 12 volt / 7 amp gas furnace for one hour *12 volts X 7 amps = 84 watt hours* *(run for two hours = 168 watts)*
Using a 120 volt / 10 amp coffee maker for 10 minutes *120 volts X 10 amps = 1,200 watt hours* *(Using for 10 minutes, so divide by 6)* *1,200/6 = 200 watts*	Using a 12 volt / 1.8 amp fantastic fan for 8 hours on low speed *12 volts X 1.8 amps = 21.6 watt hours* *(Using for 8 hours, so multiply by 8)* *21.6*8 = 172.8 watts*

COMMON AIRSTREAM LOADS

RV Loads	Watts	Owner Devices	Watts	Owner Devices	Watts	Owner Devices	Watts	Owner Devices	Watts
Dometic AC's	Start-up watts: 3,500 Running watts: 1,500	Electric Weber Grill	1,800	Iron	1,000	Air Fryer	1,500	Dehumidifier	350
Refrigerator	440	2 Slice Toaster	800	Amazon Alexa	3	Blender	300	Outdoor LED String Lights	50
Microwave	1,000	Coffee Machine	1,200	Phone/Tablet	12	Hair Dryer	1,200	Portable Fan	115
Heating	3,150	Laptop	85	Computer (Monitor/Printer)	200	Curling Iron	35		
Smart Television (32")	145	Coffee Machine	1,200	Electric Blanket	125	Hand-held Vacuum	106		
Lights (LED)	~150	Slow Cooker (Instapot)	700	Electric Kettle	1,500	Nest Camera	8		

POWER MANAGEMENT

OFF GRID

What do you need to do?

- Closely manage power consumption
- Manage inverter capacity
- More solar is better if you can store the energy

ON GRID

What do you need to do?

- Don’t trip breaker at the power pedestal
- Closer to almost “unlimited” power in a traditional home


ELECTRIFICATION