Emergency Solutions for Powering Durable Medical Equipment and Assistive Technology

Introduction

Objectives:

- Provide planning resources for back up power during emergencies for up to 72 hours to support durable medical equipment (DME) and assistive technology (AT) for people with disabilities and those who are aging

Audience:

- People with disabilities and those who are aging
- Caregivers
- Service providers and emergency professionals

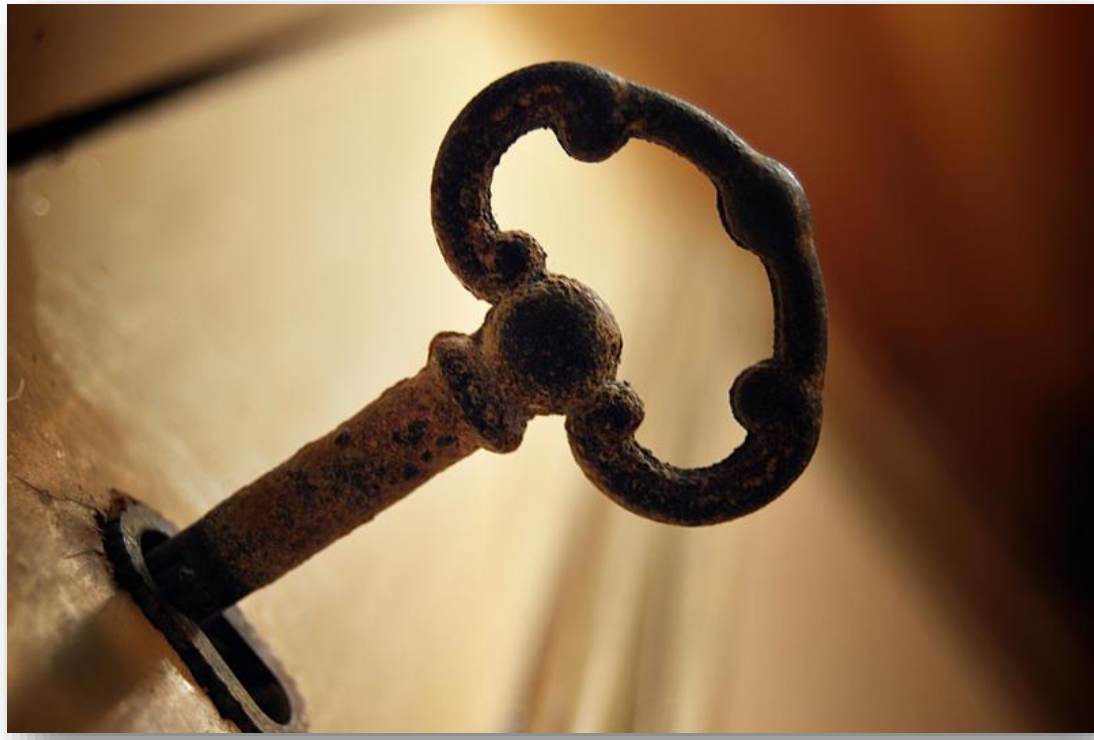
Disclaimer

- Always follow manufacturers' recommendations
- Using alternative and modified power sources inappropriately can risk of:
  - Fire
  - Electric shock
  - Acid burn (in the case of lead acid batteries)
  - Exposure to toxic and hazardous substances
  - Damage to the DME/AT equipment
  - Damage to the power source
  - Carbon monoxide poisoning (in the case of generators fueled with gasoline and diesel)

Why Prepare

Planning is the Key

Power Planning Checklist



Prepare for All Hazards: Natural Disasters and Man-Made Hazards

- **Make a Plan**
- General Preparedness
  - Ready.gov
    - Personal Kit- add items important to survival
    - Have a Plan- what concerns affect needs specifically
    - Power Outages- how to prepare
    - Alerts- Wireless Emergency Alerts (WEAs)
- TexasReady.gov
- Bookmark FEMA's Disaster.gov website for up-to-date current disaster information
- Download the FEMA app and add relevant zip codes for notifications
- Watch the FEMA Be Prepared video series on YouTube

General Back-up Power Needs

- Have back-up power for a minimum **72 hours** based on FEMA and American Red Cross individual preparedness recommendations
- What is needed that requires constant power or regular charging?
- Examples:
  - Lighting- flashlights and lanterns
  - Environmental warmth or cooling
  - Information and communications- radios, cell phones
  - Refrigeration
    - Perishable food
    - Specialized nutritional formulas
    - Medication(s)

Examples of Off-the-Shelf Options Communications

Examples of Off-the-Shelf Common Lighting Solutions (brightness measured in lumens)

Examples of Off-the-Shelf Battery Banks

Examples of Off-the-Shelf Options Adaptors and Cables

Disability Specific Power Needs

Definitions:

- **Durable Medical Equipment (DME)**- Equipment and supplies ordered by a health care provider for everyday or extended use such as wheelchairs, oxygen machines, lifts, suction machines, etc. DME may be life sustaining.
- **Assistive Technology (AT)**- Technology that enables a person with a disability or who is aging to access community, education, vocation, and/or independent function such as communication devices, computers and tablets, and smart technologies, etc.

Examples of Disability *Specific* Back-up Power Needs

- Life sustaining DME such as oxygen concentrators, feeding pumps, and suction machines, etc.
- Hearing aid batteries
- Telecommunications tools for the deaf and hard of hearing
- Power mobility such as wheelchairs, scooters, lifts, etc.
- Augmentative and Alternative Communication devices (AAC)
- Computers, tablets, cell phones, Braille note takers, AT software and apps
- Medications and nutrition that must be refrigerated

Example: Respironics Trilogy 100 Ventilator

The Trilogy 100 is a portable ventilation system that runs off of Low flow O2. The Respironics Trilogy 100 ventilator can control volume and pressure in the ventilation, making it easier for the patient to breath.

100-240 volts/50/60Hz/2.1 Amps/Max Use-504 Watts

Battery Life: Internal 3-4 hrs.., 8 hrs.. to fully charge

External 3-4 additional hrs., 8 hrs. to charge

Example: Standard Nebulizer

100-115 volts/1.5 Amps/Max Use-90-115 Watts

A nebulizer is a small machine that turns liquid medicine into a mist. You sit with the machine and breathe in through a connected mouthpiece. Medicine goes into your lungs as you take slow, deep breaths for 10 to 15 minutes. It is easy and pleasant to breathe the medicine into your lungs this way.

Wheelchairs and Mobility DME Concerns

Houston Chronicle
La Vita Bella nursing home in Dickinson were rescued after Timothy McIntosh tweeted the photo on Aug. 27, 2017. Photo by Timothy McIntosh

Wheelchairs and Mobility DME Concerns

- Plan to have at least one extra wheelchair/scooter battery
- Connect extra battery to trickle charger or battery maintainer
- Keep a manual wheelchair as a backup
- Monitor the life expectancy of your chair’s battery and plan for replacements
- Plan to evacuate with charging equipment, cables, batteries, manuals and wheel chair maintenance equipment

Plan for DME/AT Low Tech Alternatives

- Low-tech water-proof AAC systems
- Handheld optical low vision aids
- Dry Erase writing boards for communication
- Manual wheelchairs
- High efficiency ice chest coolers for medications

Electricity 101- it's like a water hose!

- Voltage is like the pressure that pushes water through the hose. It is measured in volts (V)
  - A watt is the common unit of measure for power (volts x amps) to perform work used by devices
  - Devices often describe the required electricity to charge the device in volts such as a 1.5V battery or a 6V AC wall charger
  - Direct Current (DC) from batteries powers many DME and AT devices
  - Alternating Current (AC) is accessed via outlets in the wall (60 Hz in the United States; 110/220v)

Electricity 101- more information

- DC batteries are often charged from AC outlets
  - Identify the DME and AT wattage from the manufacturer (sometimes listed on the power cord)
  - Know what charges the devices
  - Know how much power the devices pull (watts) Current is like the diameter of the hose. The wider it is, the more water will flow through. It is measured in amps (I or A).
- Amp Hours- a measure of time and power or how long will a battery source last with what voltage

How to figure power needs:

- Do the Math (Power=Current x Voltage, formula table on subsequent slide)
- Search the internet for a free power calculator
- Download a power calculator from an app store to a phone/tablet/computer
- Be aware that many devices have a higher **STARTING wattage**, and then a lower **RUNNING wattage** (For example, a refrigerator requires about 2200 watts to start and 700 watts to run after initial start). Refer to the owners manual!

Example with a Dell Laptop Charger and Online Calculator

Watts / Volts / Amps / Ohms calculator

Watts (W) - volts (V) - amps (A) - ohms (Ω) calculator.

Calculates dc power / voltage / current / resistance.

Enter **2 *values*** to get the other values and press the *Calculate* button:

Resistance (*R*)	886.153846	ohms (Ω)
Current (*I*)	0.270833333	amps (A)
Voltage (*V*)	240	volts (V)
Power (*P*)	65	watts (W)

= Calculate × Reset

Ohms Law Formulas for any Two Known Variables

Know Values	Resistance (R)	Current (I)	Voltage (V)	Power (P)
Current and Resistance	--	--	$V = IxR$	$P = I^2xR$
Voltage and Current	$R = V/I^2$	--	--	$P = VxI$
Power and Current	$R = P/I^2$	--	$V = P/I$	--
Voltage and Resistance	--	$I = V/R$	--	$P = V^2/R$
Power and Resistance	--	$I = \sqrt{P/R}$	$V= \sqrt{(PxR)}$	--
Voltage and Power	$R = V^2/P$	$I = P/V$	--	--

Batteries and Battery Back up

Some Battery Types

- Primary (non rechargeable or disposable)
  - Alkaline - AAAA, AAA, AA, C, D, 9V, button
  - Lithium - AAAA, AAA, AA, C, D, 9V, button
  - Mercury- button
  - Zinc- AAAA, AAA, AA, C, D, 9V, button
- Secondary (rechargeable)
  - Lithium (various)
  - Nickle (various)
  - Lead-acid
  - Glass

Batteries - more information

- Battery powered USB banks- best for small devices, various sizes/capacity and more affordable price ranges
- High-capacity USB Power solutions (~$100)
- High-capacity lithium-ion Battery Banks - (i.e. Goal Zero™), larger battery back up (~$1000 and up) with integrated power inverter and trickle charger
- Solar Power “Generators” back ups- how they really work

Battery Storage

- Check expiration dates regularly
- Avoid extreme temperatures
- Avoid extreme humidity
- Keep battery contacts from touching
  - Avoids leaking and corrosion
  - Use a Battery organizing box

Battery Storage - Helpful Hints

- Prepare a kit with devices that use the same type batteries such as all AA or AAA if possible
- Store devices and batteries separately in an emergency kit to avoid leaking and corrosion
- Check/recharge all batteries and devices every 6 months

Tips for Using a Car as a Generator

- Maintain vehicles
- Top off fuel tanks in preparation for a known disaster
- Utilize multiple adaptors for charging built in; USB, 110V power inverters in newer cars
- Check the owner’s manual to verify power (watts) these adaptors can deliver
- Connect a power inverter to the battery terminals of the engine to charge back up batteries or run higher rated power inverters

Warning:

When Using a Car as a Generator

- **<u>NEVER</u> run a vehicle inside an enclosed area** (like a garage) to power devices or run the car's heater or air conditioner
- This can result in carbon monoxide poisoning and possible death

What is a Portable Power Inverter and What does it Do?

- Converts DC Power from a battery into AC power that can power a wide range of household devices, assistive technology and DME
- Connects to a 12-volt battery
- Plug AC devices into the inverter
- Draws its power from a deep cycle or conventional car battery which will need to be recharged from another power source.
- Create a battery bank with more capacity by connecting multiple batteries together in parallel.

Inverter

[Cobra PRO 3000W]

Power Inverters: Direct Current to Alternate Current

- Use to power back up batteries, or run higher rated power inverter then charge/run devices
- Not all power inverters work for all things
- Peak/Start Up power and running power are different – check device manufacturers' information
- Must be clipped to a battery (a car's battery for example)
- Use an appropriately rated extension cord
- Ventilation may be required is using a car due to carbon monoxide

Example: A counter top ice maker - power inverter and car- can produce enough ice for an ice chest for a month on a single tank of gas

Choosing the Right DC/AC Power Inverter

- Choose a size based on the **watts (or amps)** required by device (refer to the specification plate on the device or appliance)
- Multiply the amps times the volts of the device to determine the amount of power in watts required by the device
- Add each device's power needs together if running them simultaneously and do NOT exceed the maximum power output of the inverter
- Make note of the peak power demand for the device(s) which is the power (in watts) required to start up the device (consult the owner's manual or the manufacturer's website)
- Acquire a larger model than needed (at least 10% to 20% more than largest load)

Common Power Inverter Features to Consider:

- Battery cables (ring type vs. alligator type)
- 12V cigarette adapter cable
- Number of 110V AC outlets
- Number of USB Type C outlets
- Includes an emergency light
- Produces pure sine wave (may be necessary for some computerized technology that requires more consistent 60Hz power vs. modified or square sine wave)
- Some **Medical** devices or devices with motors or digital clocks run better and more efficiently with a pure sine wave inverter but they cost more

Additional Power Inverter Tips

- Ring terminals work better than jumper cables for connecting the power inverter to the car battery.
- Keep the inverter close to the vehicle's battery and out of any rain or weather
- Run an extension cord from the inverter to the devices inside
- **Don't** ever run the car inside a garage or an enclosed (or even partially enclosed) area to avoid the risk of carbon monoxide poisoning
- Consult an electrician for assistance with home-sized Inverters and off-grid home inverter types

Build a Battery Back Up

- How to
  - DIY example
  - Lead acid battery - Battery on a cart- trickle charge; loose power-inverter- charge for 72 hrs.
  - Number of stored hours per “battery”
- Challenges

Image from https://www.instructables.com/How-to-Build-a-Battery-Backup-Generator

Generators


VOLTEC
POWER & LIGHTING
10
30
AMP
20
CONVERTS (1) TT-30 PLUG TO (3) LIGHTED 5-20 LOCKING RECEPTACLES
With
2'
Generator Adapter
RYOBI
2300
Bluetooth

Generators Overview

- Types - Gasoline, propane, and dual fuel
  - All are flammable
  - Take appropriate precautions for storage and handling
  - Gasoline
    - Cannot easily be stored for more than 6-12 months without additives
    - Easier to mange refilling from multiple smaller containers
  - Propane
    - Easier to store long-term and may be safer
    - Ensure propane tanks are full in preparation for a disaster

Generators Overview- more information

- Whole-house generators
  - Usually connects to natural gas lines only
  - Usually must be inspected by local officials
  - Must be professionally installed
  - Expensive ($10,000 or more)
- Has a large capacity and can power larger appliances
- Potential use beyond 72 hours

Example: Whole House Generator

Generator Safety Issues

- Read ALL the manufacturers' directions and warnings
- Electric shock hazards
  - Disconnect power from AC sources before connecting to a generator
  - Plug equipment into the generator using heavy duty outdoor rated extension cords
  - Make sure the generator is grounded per manufactures directions
- Fire hazards
  - Store fuel safely
    - Use approved canasters
    - Use fuel additives to maintain gasoline and diesel
  - Maintain fuel supply during use
  - Turn the generator off and let it cool before refueling
  - Use at least 15' away from structures

Generator Safety Issues- more information

- Do not store gasoline or diesel fuel in the generator
- Use outdoors
- Use in a dry location
- Provide adequate carbon monoxide ventilation
- Store and use in a secure location to prevent theft
- Using Generator Safely

Generators Issues & Challenges

- Secure storage when not in use and during use- threat of theft
- Lease agreements, local ordinances, and homeowner's association restrictions may limit the types of generators and where they can be stored/used
- Must be able to maintain and operate the generator with or without assistance including moving, starting, fueling and adding oil as needed
- Requires regular maintenance
- Acquiring additional fuel in a disaster or emergency

Getting Power Inside the Home Safely

- Plan ahead for using a portable generator outside the home by installing an inlet Power-Through-the-Wall Kit with interior 110V wall outlets
- Use appropriately rated extension cords
- This will secure the envelope of the home and keep out CO gas and weather.

Solar Generators

- Require a large and cumbersome lithium ion battery
- Require a large array of solar panels, and UV rays
- Solar panels and/or a large capacity battery may be the only viable option for apartment dwellers who cannot deploy a fuel generator 15 feet or more from their apartment
- Most roof top residential solar panels do NOT charge the house directly but feed into the public grid

Funding Back Up Power Options

- FEMA
  - Post Disaster
- State and local funding for people with disabilities and the aging
- Ask for back-up power solutions to be included with original funding source package (Insurance, Medicaid/Medicare, VA. TWC vocational rehabilitation).
- Payflex
- Able Accounts
- Texas Technology Access Program low interest loans

FEMA Generator Reimbursement

- FEMA *may* provide financial assistance for purchasing or renting up to a 5.5kw generator during a FEMA Qualifying Incident Period
- Applicants may be eligible to receive financial assistance for reimbursement as a Miscellaneous Other Needs Assistance (ONA) award under the Other Needs Assistance (ONA) provision of the Individuals and Households Program (IHP)
- To apply by phone, call the **FEMA Helpline**; phone numbers 1-800-621-3362 (711 or VRS available), TTY 1-800-462-7585, or click Apply Online
- Visit a local Disaster Recovery Center (DRC) for help (use the DRC Locator)

HHSC- Potential Medicaid Gas-powered Generator Funding for Medicaid managed care organizations (MCOs)

- A generator may be covered under a home and community-based services waiver for eligible members, or
- Provided as a case-by-case service for non-waiver members, or
- Members who are in a waiver that does not cover generators.
- MCOs may cover costs or partial costs above the cost limits in waiver programs through case-by-case as well.
- Generator Guidance

What if needs exceed 72 hours?

- Seek Assistance
  - Call 311 – (911 if an emergency) before back-up power is exhausted
  - Identify accessible local, state, federal government sponsored shelters Verify accessible safe transportation is available
- Plan for a network of supports with options for multiple alternative plans

Disability Specific Power Needs: Evacuating With Critical DME & AT

- Insure DME and AT is protected (dry bags, water proofing, etc.)
- Bring charging cables, extra batteries, and manuals
- Back up custom files, software, license keys and serial numbers to the cloud, or save the files and data on a secure, waterproof flash drive

What else can I do?

- Register with the local utility's **Critical Care Registry**
- Register with the **State of Texas Emergency Assistance Registry** (STEAR)
- Contact local Offices of Emergency Management and local fire station to notify them of medical power dependency

References and Resources

- Power Planning Checklist - Pacific ADA Center
- Power Outages (Ready.gov)
- Be Prepared for A Power Outage (FEMA)
- Be Informed (FEMA)
- Going to a Public Shelter During the COVID-19 Pandemic (CDC)
- Children in Disasters (CDC)
- Disaster Preparedness and Recovery (Disability Rights Texas)
- Individuals with Disabilities (Ready.gov)
- DIY Battery Inverter
- Generator Guidance