SAND2011-5385C

Poster Layout

Title - *Suggested Alternatives' For Navajo Tribal Utility Authority: Improving Customer Education and Utilizing Excess Power Generated by Off-grid Hybrid Units*

Objective – The objective of this paper is to suggest improvements to customer education in the use of off-grid solar hybrid systems and extend batteries life by offering alternative uses for excess power stored in the batteries.

Abstract –

The education of the customers is critical for awareness and knowledgeable on how to properly use solar hybrid systems and preventing overuse, which can harm and shorten the life of the batteries. Research includes suggesting alternative uses for the systems batteries while in the company yard awaiting the next customer, which could ensure that the batteries are working properly.

Some of the information gathered was on field visits to the Navajo Tribal Utility Authority's facilities and also observing the Operation & Maintenance procedures which includes how employees recorded the health of the batteries.

With only a couple of field visits, the NTUA Renewable Engineer provided more information about many solar hybrid units being used on the Navajo reservation. Units were being returned because of a recent extension of power lines to some of those hybrid system residences. Also noted was insufficient customer knowledgeable of the systems they were receiving and over loading the units, which caused harm to the batteries.

Background

The Navajo Tribal Utility Authority has served the Navajo people by providing electricity, water, and waste treatment. They have also taken advantage of the technology of harnessing the suns energy and giving it to residence in rural areas that are unable to connect to power lines.

For the systems that are still in operation and used daily, questioning how much the customer knows is crucial to know because the batteries could fail because of the continuous and complete discharge of the batteries.

Recently, the NTUA has received more funding and they have been expanding the number of units. With growth in customers, the stored units should perform well and be ready to be re-installed. By using the systems while they are stored, excess energy in the system's batteries could be used.

Methods

- Visited NTUA facilities on the Navajo Reservation
- Compiled short telephone interviews with NTUA that work with these systems on a daily basis. Retrieved existing information about system
- Applied academic learning from alternative energy classes

Results

The result from the research is a follows:

- Customer education is key
- Convey the generation and consumption limits of the off-grid hybrid units
- Battery life, when used properly, can be extended

Conclusion

The investment in customer knowledge is a preventive step that would benefit NTUA and the equipment involved from future failures due to the customers over use of the system. From the information gathered and the many questions asked, communication must be re-enforced to the customers and better educational tools must be developed for the customers' lack of knowledge of the solar systems.

Using the batteries that currently sit in the NTUA storage yard will have beneficial factors, such as making sure the system still operates correctly and satisfactory. Studying different resources on battery life cycles, a conclusion was reached that the customers' usage of the system played the primary factor for judging how long the batteries could last. Draining the batteries completely and continuously would drastically shorten the life cycle of any battery.

NTUA Hybrid Unit

Typical Wattage Requirements for Common Appliances

*These ratings are only estimates

General Household:	**Kitchen appliances**:	**Entertainment:**
Air Conditioner (room). 1000	Blender (electric) 300	CB radio 10
Air Conditioner (central). . .3,500	Can opener 100	CD player 35
Alarm/security system 3	Coffee grinder 100	Cell phone 24
Blow dryer. 1000	Coffee maker 800	Cell phone Charger 6-20
Ceiling fan 10-50	Dishwasher 1,500	Radio telephone 10
Vacuum (upright) 800	Exhaust fans (3) 144	Satellite system (12 ft dish) . . .45
Clock radio 2	Food dehydrator 600	Stereo 25-30
Clothes washer 1,450	Food processor 500	TV (19-inch color) 60
Dryer (electric) 4,000	Microwave (.5 ft3) 750	TV (25-inch color) 130
Dryer (gas) 300	Microwave (.8 to 1.5 ft3) . .1,400	TV (32-inch color) 300
Electric blanket 200	Mixer 120	VCR 20-50
Furnace fan 500	Popcorn popper 1,400	DVD. 11
Garage door opener 300	Range (large burner) 2,100	**Tools:**
Heater (portable) 1,500	Range (small burner) 1,250	Band saw (14”) 1,100
Iron (electric) 1,200	Trash compactor 1,500	Chain saw (12”) 1,100
Radio/phone transmit . . . 40-150	Toaster 800-1,500	Circular saw (7 ¼”) 1,400
Sewing machine 100		Disc sander (9”) 1,200
Table fan 10-25	**Lighting:**	Drill (1/4”) 300
	Incandescent (100W) 100	Drill (1/2”) 600
Refrigeration:	Incandescent light (60W) 60	Drill (1”) 1,000
Energy Star fridge/freezer . . .110 16 ft³ (10 hrs/day)	Compact fluorescent . . . . . .16 (60W equivalent)	Electric mower 1,500
Refridgerator/freezer . . . . . 475 16 ft³ (13 hrs/day)	Incandescent (40W) 40	Weed eater 500
Sun Frost refrigerator . . . . . 112 16 ft³ (7 hrs/day)	Compact fluorescent . . . . . 11 (40W equivalent)	**Office:**
		Computer (desktop) 80-450
Vestfrost fridge/freezer . . . . . .60 10.5 ft³	**Water Pumping:**	Computer (laptop) 20-140
	AC jet pump (1/4hp) . . . . . 500 165 gal per day, 20 ft. well	
Standard freezer . . . . . 440 14 ft³ (15 hrs/day)	DC pump for house . . . . . 60 Pressure system (1-2 hrs/day)	Printer (ink jet) 50-75
	DC submersible pump 50 (6hrs/day)	Printer (laser) 600-1,200
Sun Frost freezer . . . . . 112 19 ft³ (10 hrs/day)		Fax (stand-by) 15-45
		Fax (printing) 120-350

Source: Solar Energy International. “Typical Wattage Requirements for Common Appliances”. Photovoltaic: Design and Installation Manual. May 2007