Beacon Power -Flywheel Energy Storage System Case Study

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Application and Case History of Flywheel Systems for Commercial Sites

New Technology to Replace Batteries in Telecommunications Systems

Beacon Power of Woburn, Massachusetts, produces an advanced high speed flywheel system for reliable power applications. Currently, Beacon Power is selling their product, the "20C1000 Cable/Telecom Flywheel System" to the telecommunications market as a substitute for battery back-up power. This application brief presents a discussion of the application of this system for power quality and reliability, along with a case study of the Beacon Power Flywheel Energy System.

The Problem

As the telecommunications industry grows with ever-increasing service and product offerings, and as competition within the industry becomes fiercer, providers of cable, telephony, and other products will look to reliability and cost-effectiveness to distinguish themselves from one another. Reliability for telecommunications and cable equipment has traditionally been provided through the use of lead-acid batteries. These, however, have significant disadvantages of high maintenance, short lifetimes, and disposal problems because of the lead component. Telecommunications operators are ripe for alternative power quality and reliability solutions for their systems.

The Solution

The Beacon Power Flywheel Energy System was designed to serve the power quality market, especially as a replacement for lead-acid batteries in telecommunications systems. The response time, power level, and discharge time are all suited to this application. In addition, it is nearly maintenance-free, has a long life, and is environmentally friendly. In fact, one of the most significant benefits is avoidance of frequent disposal and replacement of lead-containing batteries.

The Beacon product has been in testing for the past year with six systems installed at four established customers. Eight more are scheduled for installations at commercial sites in late1999 or early 2000. EPRI-sponsored projects will place 2 or 3 more units in the field in 2000. This experience is discussed in more detail later. The system is shown schematically in Figure 1 below. The system has been designed to simply substitute into a conventional dc back-up circuit, as shown in Figure 2 below.

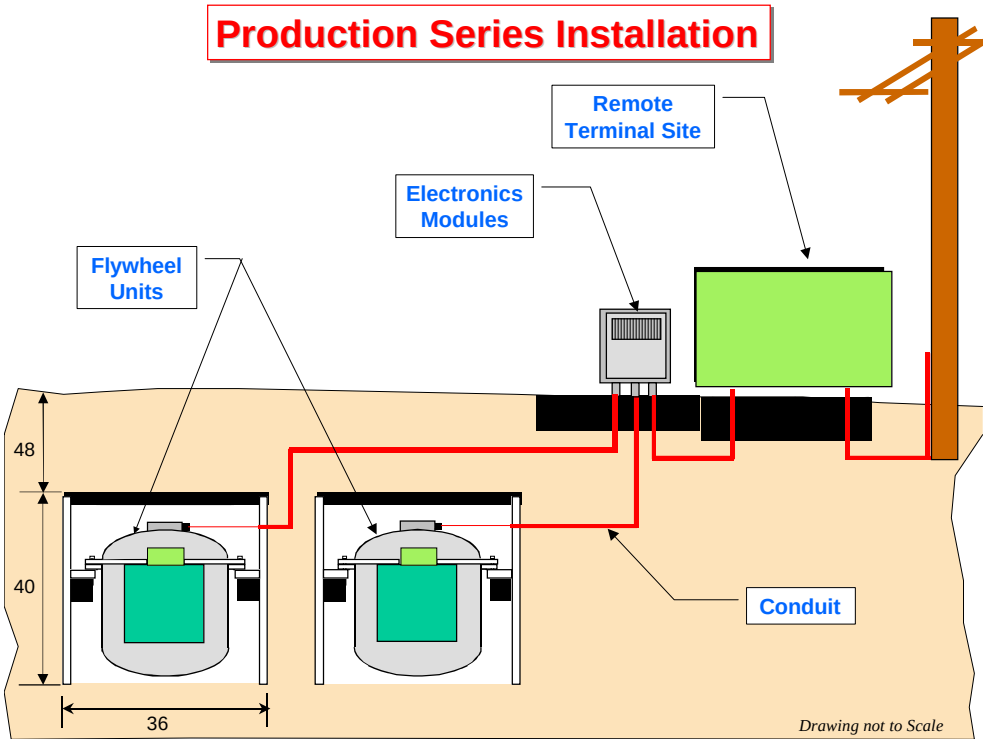

Figure 1 Flywheel System Installation Drawing

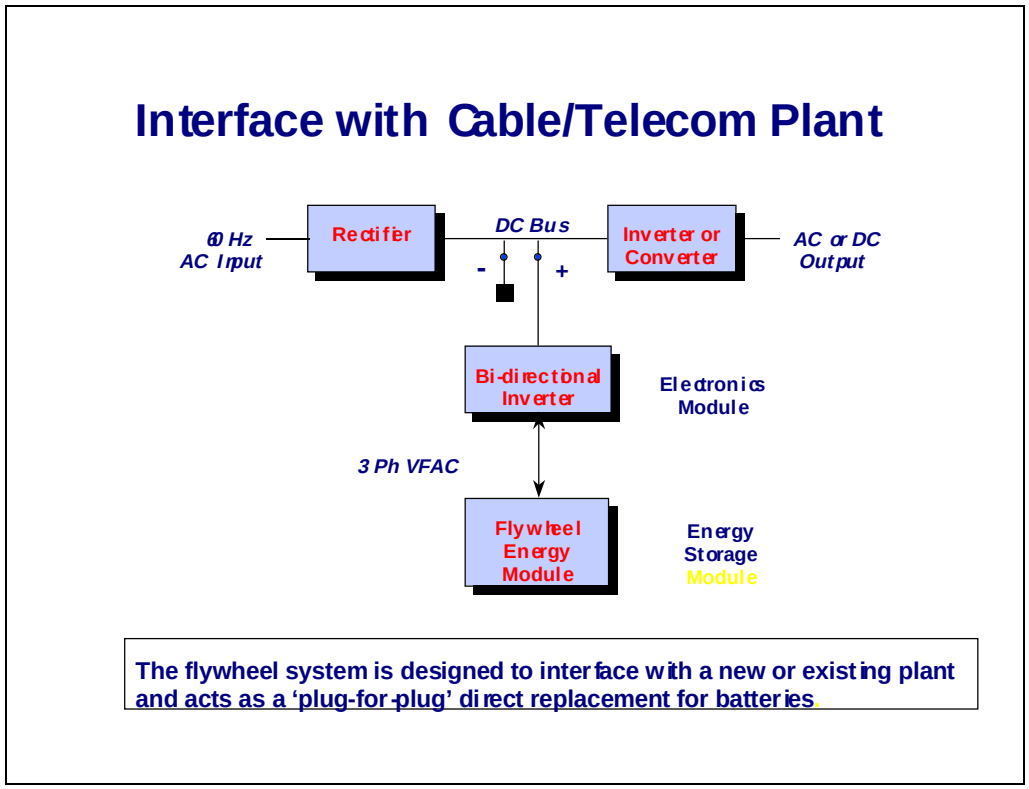

Figure 2 Flywheel System Circuit Diagram

Advanced Technology at Work
The Beacon Power Flywheel Energy Storage System is a back-up power supply based on state-of-the-art composite flywheel technology. The advanced kinetic energy device is extremely compact. Spinning at 30,000 rpm, it has a specific energy of 8 Wh/lb, more than ten times that of conventional batteries. Remote control and monitoring are provided by RS-232 standard serial interface, and communication is via standard telephone or high speed cable modem with internet connection.

Product Spec: 20C1000 Cable/Telecom Flywheel System

Power:	1 kW
Discharge duration:	2 hr
Usable energy:	2 kWh
Output voltage:	36V or 48V dc
Recharge time:	5 hr
Weight:	260 lb

Installation

Installation of the flywheel systems is currently underground to take advantage of earthen containment.

Cost
The 20C1000 Cable/Telecom system is available for about $5000 per unit for a standard installation.

Applications and Advantages
The initial target market is for telecommunications and cable TV back-up power. Other power quality and reliability applications are also possible and are being pursued in conjunction with the EPRI Power Quality program. Compared with conventional battery-based back-up systems, the flywheel has many advantages, as listed in Table 1 below.

Other applications of the Beacon Power Flywheel System include power quality for other types of stationary loads, such as industrial processing equipment or for residential units in locations with less reliable grid power. A future product will have higher output power (4 kW) with shorter discharge duration (1/2 hr).

Table 1 A Comparison of Flywheel and Battery Characteristics

The Flywheel Advantage

	Battery	*Flywheel*
Maintenance	**3-6 months**	**7 years**
Life	**1-5 years**	**> 20 years**
Temperature Effect	**> 77 F**	**140 F max**
Environmental	✓	✓✓
Cost of Ownership	✓	✓✓
Monitoring	✓	✓✓

Application History

The Beacon Power Flywheel Energy Storage System has a good track record, with 6 flywheels having been tested in four different customer sites over the past year. Table 2 below indicates the present experience. Table 3 lists the currently planned installations. Production shipments are scheduled to begin in March 2000.

Table 2 Current Beacon Flywheel Installations

Customer	Location	Installa-tion Date	Batteries replaced	Operation to date	Comments
Wind Break Cable	Harrison, Nebraska	9-98	Two 36V strings	>20 events	Steel sleeve, in-ground configuration
Cox Communica-tions / San Diego Gas and Electric	Anaheim, CA	12-98	Two 36V strings	1 month demo	Remote control via Internet
Bellcore	Chester, NJ	12-98	Test cell	1 month demo	Laboratory environment
Bell Atlantic	Exton, PA	1-99	One 48V string	Load testing	Dual flywheel, plastic sleeve

Table 3 Planned Beacon Flywheel Installations

Customers	**Number of units to be installed**
Media One	1
Comcast	1
Buford Television	1
Jones Intercable	1
GTE	3
ABB	1
Duke Power (EPRI sponsored)	1
EPRI customer (TBD)	1 or more

Resources:
The Beacon Power Web page address is: http://www.satcon.com/sub/beacon/index.html
The EPRI Contact for power quality applications is: Ben Banerjee (650)855-7925.

About EPRI

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