

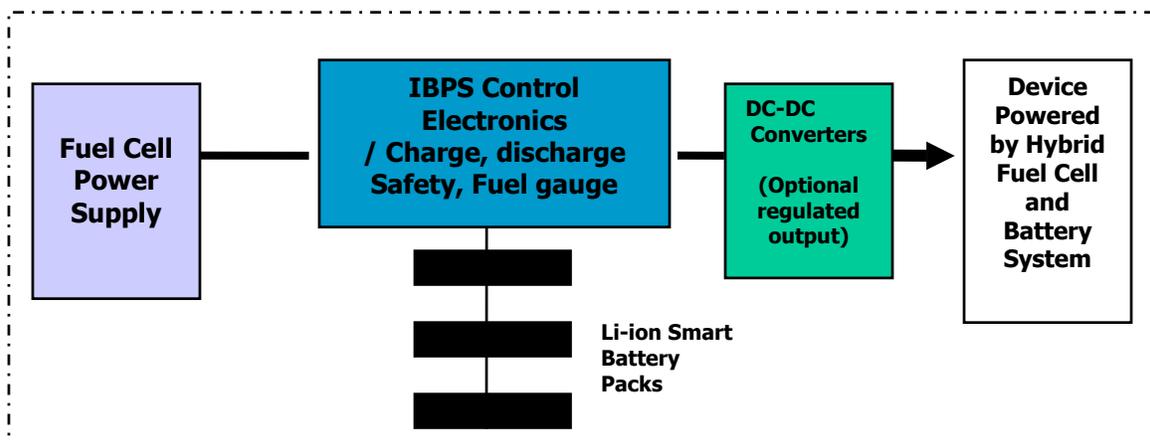
Intelligent Battery and Power System – Efficient Storage and Utilization of Fuel Cell Energy

Technical Summary

Nov 2005

The need for a reliable and clean DC energy source to power portable electronic devices is real today and growing fast. Until recently, converted AC or battery –sourced DC have been the only affordable approaches. The continuing development of Fuel Cell technology is now yielding a technically viable and increasingly affordable alternative to these traditional DC power sources. Many potential applications, however, have low *average power needs* combined with much higher *peak power needs*, which would logically necessitate a much larger and more expensive fuel cell system than the average power consumption would indicate. One potential solution that minimizes the fuel cell size requirement, is to integrate a battery sub-system that will serve as a ‘reservoir’ for the fuel cell electric output not consumed during the average state, and supplement the fuel cell electric output when required to satisfy the peak power state demand.

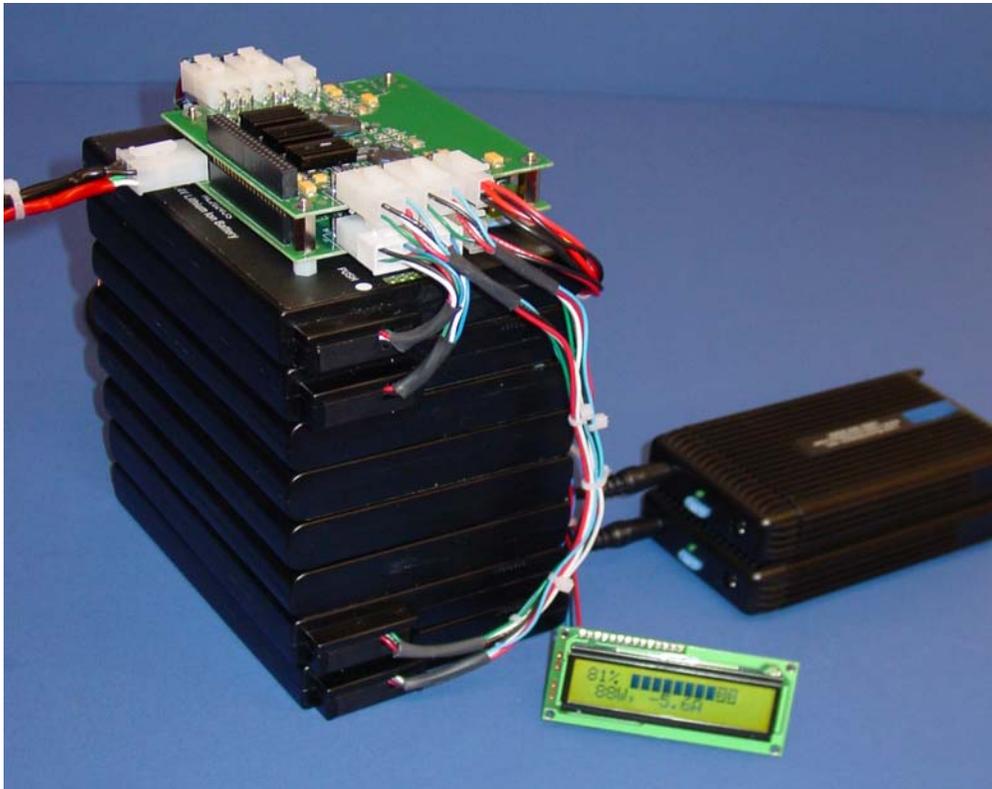
The Intelligent Battery and Power Systems (IBPS) from OceanServer Technology allows fuel cell users to integrate a highly efficient (95%) method of capturing and storing the fuel cell’s electric output. The IBPS consists of modular components that manage the charge and discharge functions needed to safely manage a scalable array of high performance rechargeable Lithium-Ion battery Smart Packs. The IBPS serves as a complete power subsystem that can be easily coupled with a fuel cell and integrated into a system application to provide regulated DC output over a wide range of voltages and current levels. The IBPS will use all of the fuel cell’s output by first sourcing the load, and then recharging the attached batteries as required. When the power requirements of the systems under load exceed the output level of the fuel cell, the IBPS sources supplemental power from the batteries to satisfy the load demands. The IBPS switches between external power sources (fuel cell output, batteries, vehicle DC, converted wall outlet AC, etc.) seamlessly and quickly (approximately 10 uSeconds).



OceanServer offers a variety of IBPS controller cards to meet your fuel cell battery requirement. Clustering together multiple controllers enables users to develop very large battery arrays beyond 760 Watts.

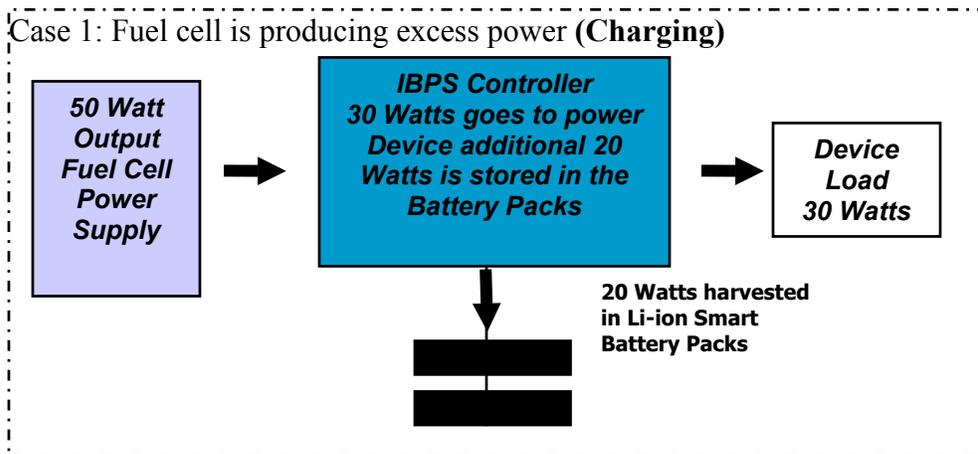
IBPS Controller	95 Watt Hour Battery Packs	Input Power (Charge)	Output Power (Discharge)	Capacity (Fully Charged)
MP-04	4	128 Watts	192 Watts	380 W/hrs
XP-04	4	128 Watts	320 Watts	380 W/hrs
MP-08	8	256 Watts	312 Watts	760 W/hrs
XP-08	8	256 Watts	640 Watts	760 W/hrs

Controller Summary: Specifications for controllers with a full set of battery packs

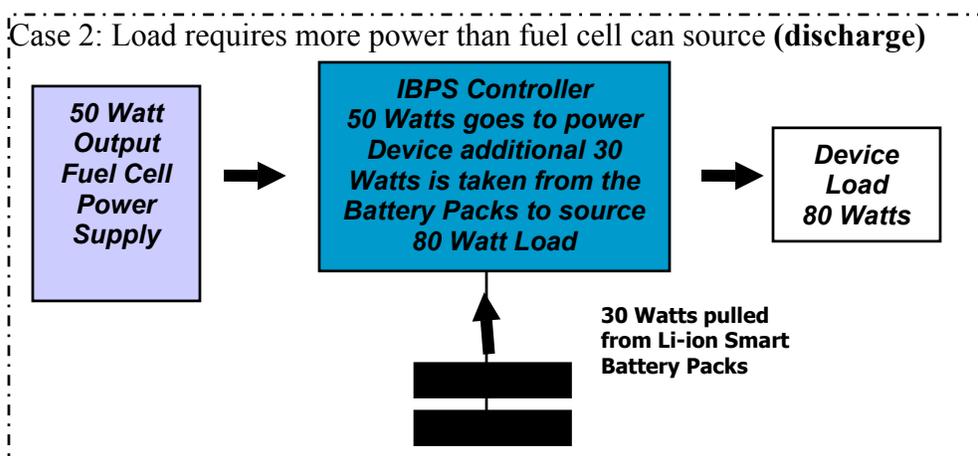


Example: Complete System, MP-08 with 760 Watt-hours of Li-Ion Smart Packs

The load of a given device is intelligently managed by the OceanServer battery system. The fuel cell's output is dynamically directed in two directions. The electric output goes to source the load and excess power is simultaneously captured in the Lithium-Ion battery Smart packs (50 Watt Output Fuel Cell example below).

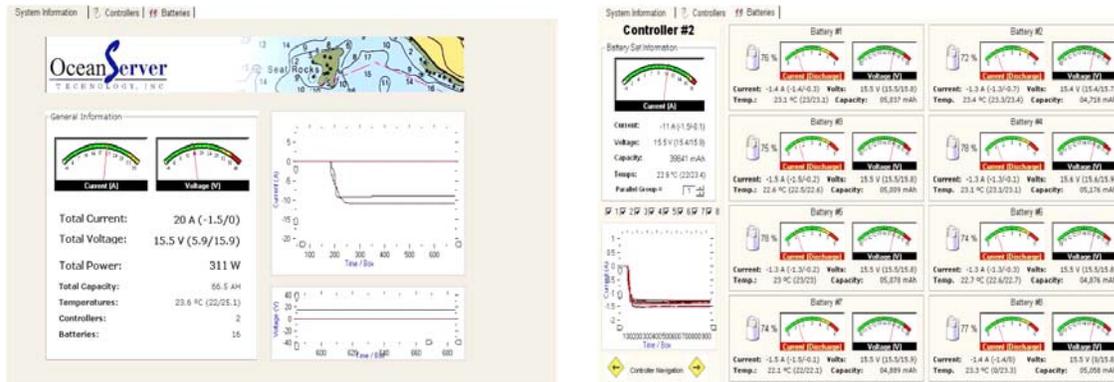


The energy stored in the battery packs can also be used to supplement a load that may exceed the Fuel Cell power output. The IBPS provides instantaneous switching from harvesting to supplying additional power if required. Below is an example of a device that requires an 80-Watt load with only a 50-Watt Fuel Cell.



The IBPS provides detailed system status, fuel gauge, charge current, discharge current, voltage, power, runtime to empty, charge time to full, percent of remaining capacity, Amp

hours, etc. User devices can integrate this information to improve system operation and to enhance monitoring status. The hardware is provided with two Windows™ GUI applications, **MiniBats™** and **FullBats™**, that let the user monitor and graphically present the status of the battery system. This GUI-based aid is viewable from a host system, or can be displayed in configurable, abbreviated form on an optional LCD display.



The IBPS consists of modular ‘building blocks’ that enable a system designer to scale the total amount of power as needed. The standard OceanServer Lithium-Ion battery packs are 95-Watt hours each and can be easily and safely clustered together to create a single large DC source. This flexible model allows fuel cell users to build a battery system to match their fuel cell design. All IBPS components are fully engineered to work out of the box and leverage the same battery cells and electronic components used in today’s most popular notebook computers. Typical system sizes range between 95 Watt-hours and 20,000 Watt-hours of battery energy.

For Additional Information

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