



BC Transit HYBRID HYDROGEN FUEL CELL PROJECT

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National Fuel Cell Bus Workshop



PROJECT OVERVIEW

To advance the application of fuel cell bus and hydrogen fueling infrastructure technologies from a demonstration mode to a commercial mode by:

- Acquiring a 20 fuel cell bus fleet and associated fueling through a commercial tendering process
- Operating this fleet for a period of 5 years
- Evaluate bus and fueling performance, maintenance and service availability over this period
- Report on the applicability of these technologies

- FCB have been providing transit service in the Resort Municipality of Whistler since the 2010 Winter Olympic and Paralympic Games (February 2010)
- The fleet has logged approximately 1,300,000 km
 - » Maximum of 72,000km
 - » Minimum of 43,600km
- FCB are in the final commissioning stage
- BC Transit has not taken formal delivery of the buses



IMPLEMENTATION ISSUES

1. Very tight and defined (Olympics) implementation schedule
2. New supplier for the battery system after the prototype had been tested and accepted
3. ISE - the U.S. based system integration firm went bankrupt during the commissioning phase

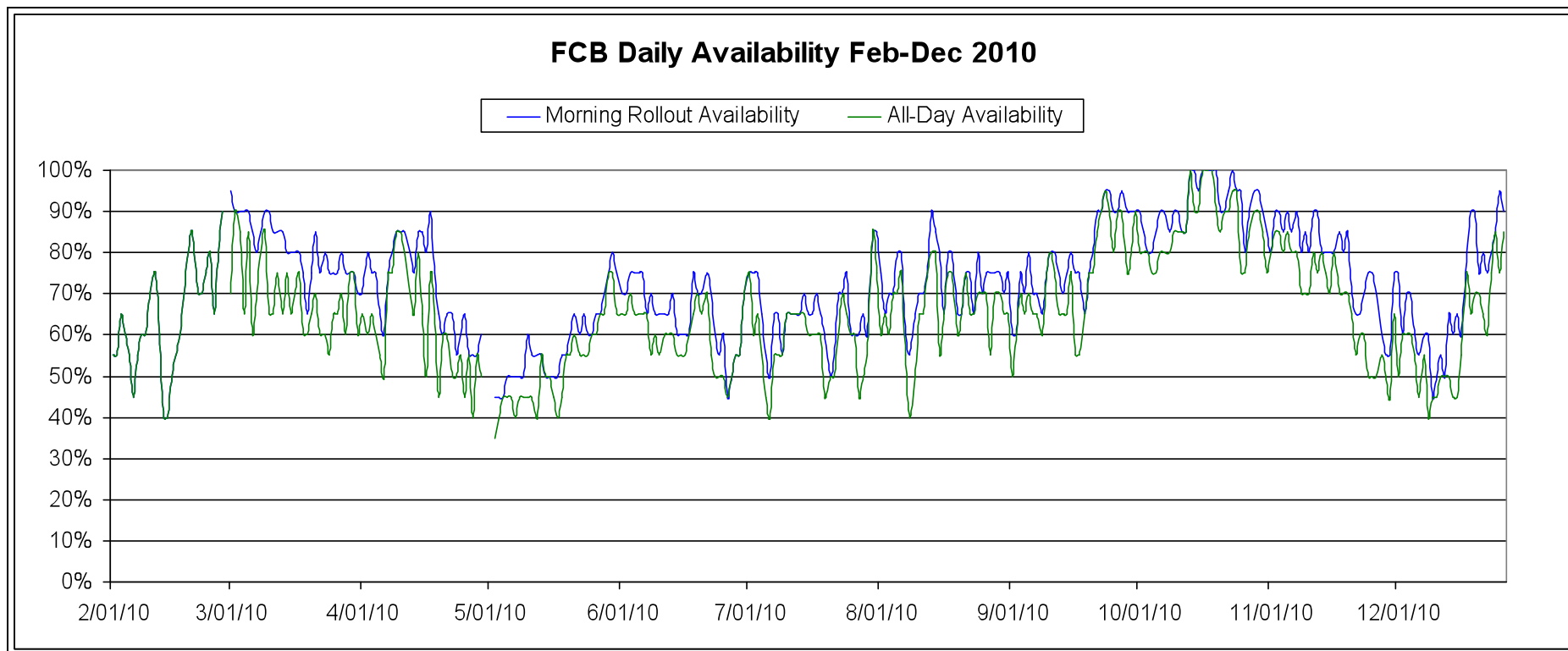
1. Performance
2. Reliability
3. Maintenance requirements
4. Range

Performance

- » Unable to maintain highway speed (80kmh) on long (greater than 1 km) steep grades (greater than 6%)
- » This has resulted in 3 of the Whistler routes being solely serviced by diesel buses
- » Significant impact on the scheduling and operation of the fleet
- » Performance on the remaining routes very positive
- » Driver and user support very high

First Year of Operations (Feb 2010 to Feb 2011)

- » Average daily roll-out availability - 72%
- » Average all day availability - 65%



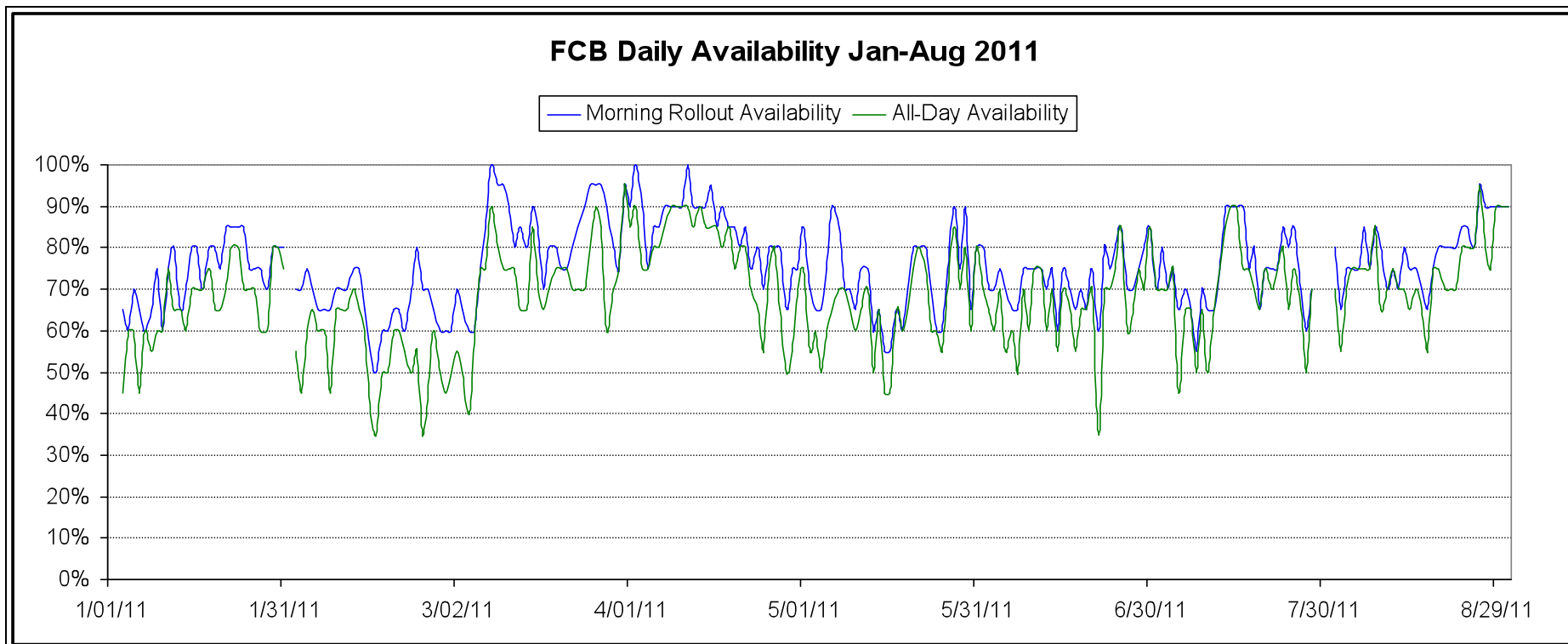


Reliability

Second Year of Operations

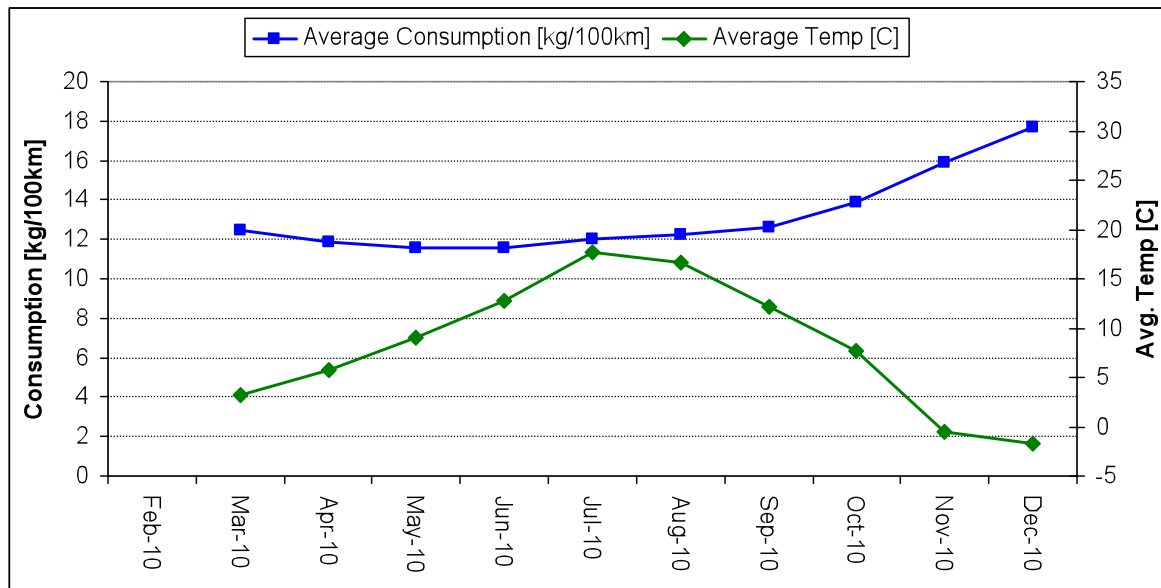
- » Average daily roll-out availability - 76%
- » Average all day availability - 68%

2011	Average Change-offs/day	Average Deployment	Failure Rate
May	1.45	8.71	16.7%
June	0.90	8.31	10.8%
July	0.64	13.07	4.9%
August	0.94	13.97	6.7%



Fuel Economy and Range

- Average fuel consumption 1st year (2010)
 - » 13.27kg/100km
 - » 317km range with 6 tanks
 - » Contractual requirement, 450km

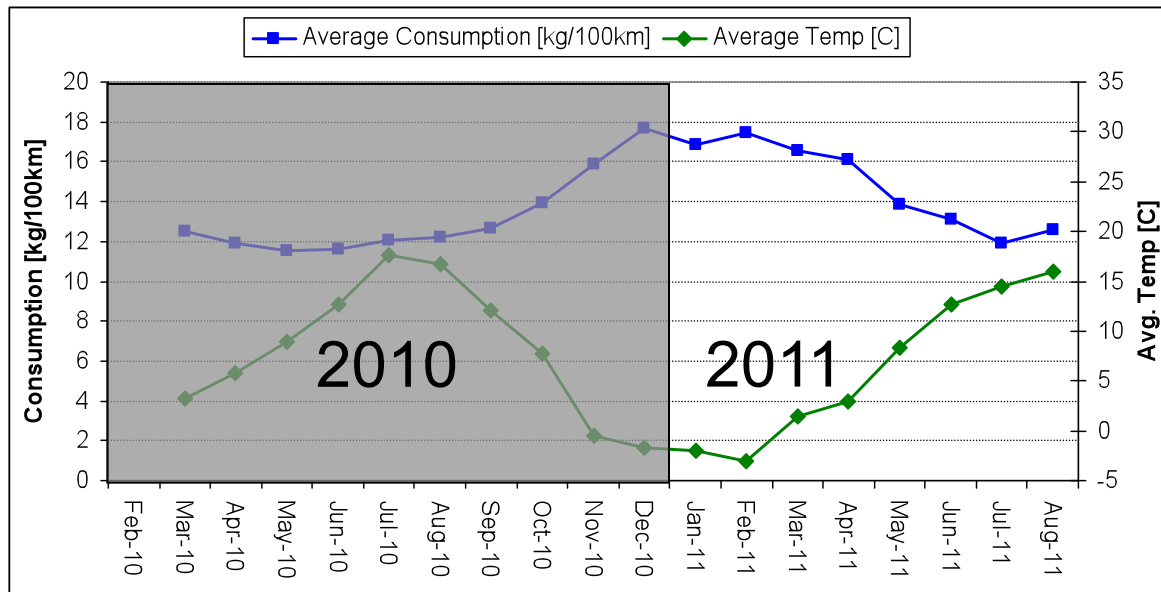


	Average Temp [C]	Average Consumption [kg/100km]	Range [km]
Jan-10	-	-	-
Feb-10	-	-	-
Mar-10	3.28	12.48	337
Apr-10	5.78	11.88	353
May-10	8.99	11.57	363
Jun-10	12.73	11.60	362
Jul-10	17.62	12.03	349
Aug-10	16.66	12.24	343
Sep-10	12.11	12.63	332
Oct-10	7.67	13.92	302
Nov-10	-0.5	15.90	264
Dec-10	-1.7	17.67	238



Fuel Economy and Range

- Average fuel consumption 2nd year (2011YTD)
 - » 14.3 kg/100 km
 - » 390km “scheduled” range with 8 tanks



	Average Temp [C]	Average Consumption [kg/100km]	Range with 8 tanks [km]
Jan-11	-2.03	16.87	332
Feb-11	-3	17.43	321
Mar-11	1.5	16.56	338
Apr-11	2.9	16.07	348
May-11	8.4	13.87	404
Jun-11	12.7	13.10	428
Jul-11	14.5	11.92	470
Aug-11	15.9	12.56	446

- Current preventative maintenance requirements are manpower intensive
 - .8hrs/1000km for diesel buses vs. 2.4hrs/1000km for fuel cell buses
- Batteries need to be balanced once a month, can take up to 8 hours
- Significant impact on scheduling

CORRECTIVE ACTION

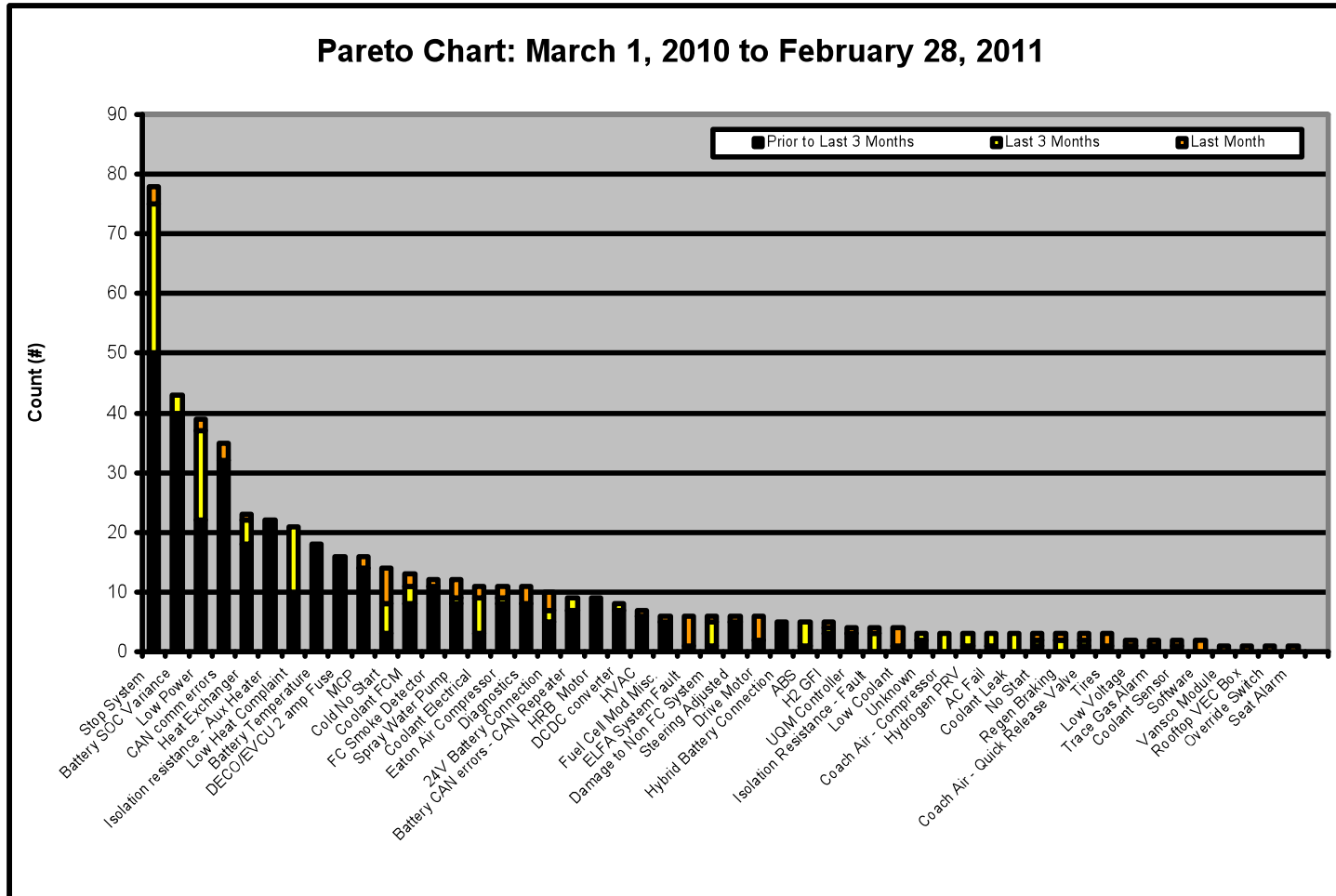
1. Contractual

- » Contractors (New Flyer and Ballard) commitment remains high
- » On site support very good
- » New Flyer has assumed all the contractual commitments of ISE
- » Contractor team is committed to developing a quality product

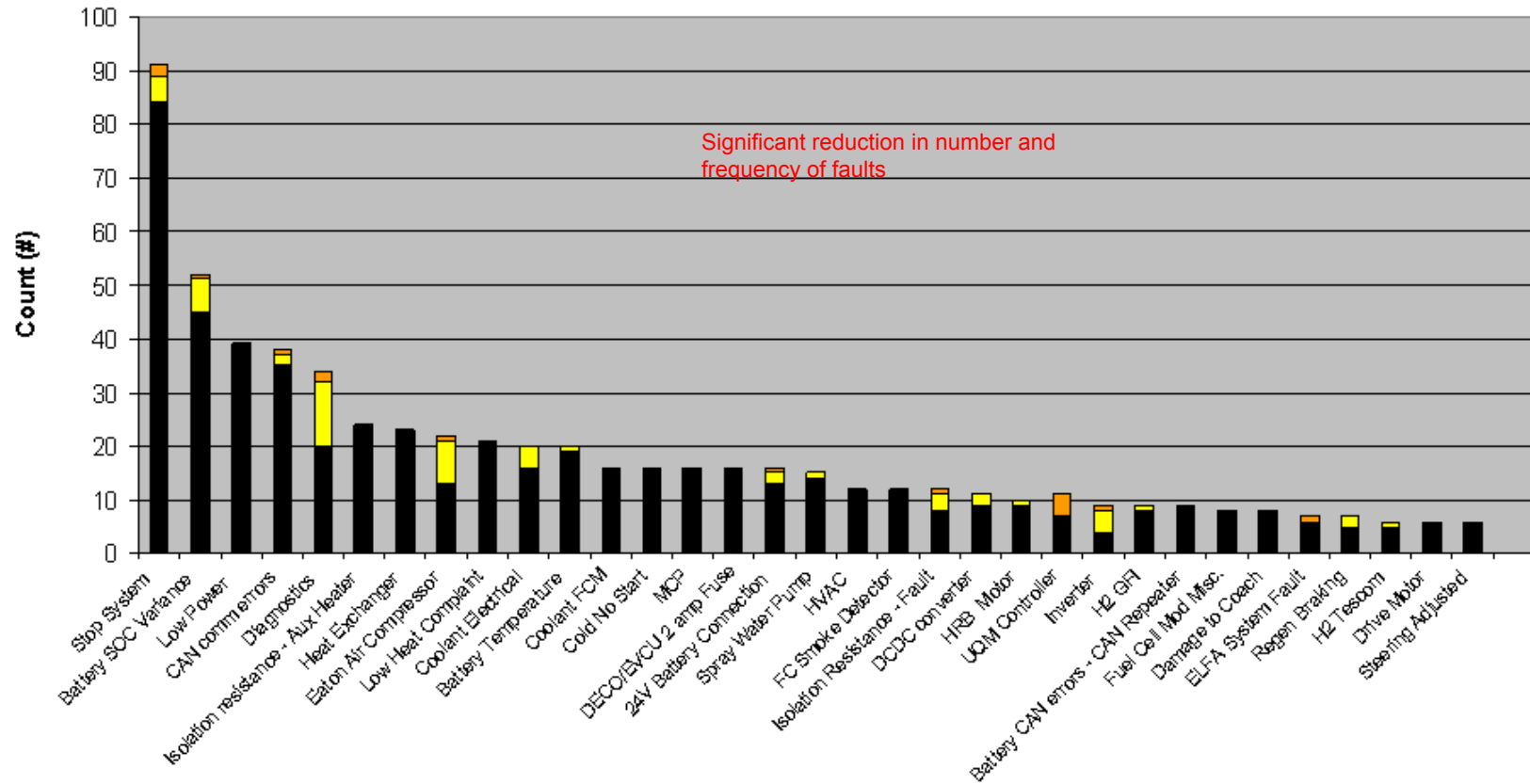
2. Availability

- » Performance
 - Contractor looking at software enhancements
 - Improvements will be incorporated into the Whistler fleet

- Reliability
 - » Contractor team initiated a program to replace key components with more robust components (almost completed, see chart)
 - » Contractor has brought together a team of experts from all the main suppliers
 - » Launching a “clean sweep” initiative aimed at eliminating all the “buried” software issues in the power management system
- Range
 - » Contractor has installed an additional 2 fuel tanks
 - » It is anticipated that software improvements will also improve range
- Maintenance
 - » Detailed review of PM program is being done
 - » Software revisions to reduce need for balancing of the batteries
 - » Additional training of maintenance staff



Reliability (currently)



- Procurement strategy will have a significant impact on the success of the project
- Pick your application carefully
- Involve your operations division early
- Plan on a long commissioning period
- Don't let the schedule drive the project