

# High Power Primary

*It just might last longer than you think!*



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# Agenda

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- **RBC Technologies**
- **Context**
  - High Power Device Growth
  - Business Perspectives
- **High Power Primary Products**
  - Standard Alkaline Benchmark
  - High Power Alkaline
  - Nickel Oxy-hydroxide
  - Lithium Iron Disulfide
  - RBC HRB Design
- **Conclusion**



# RBC Technologies Profile

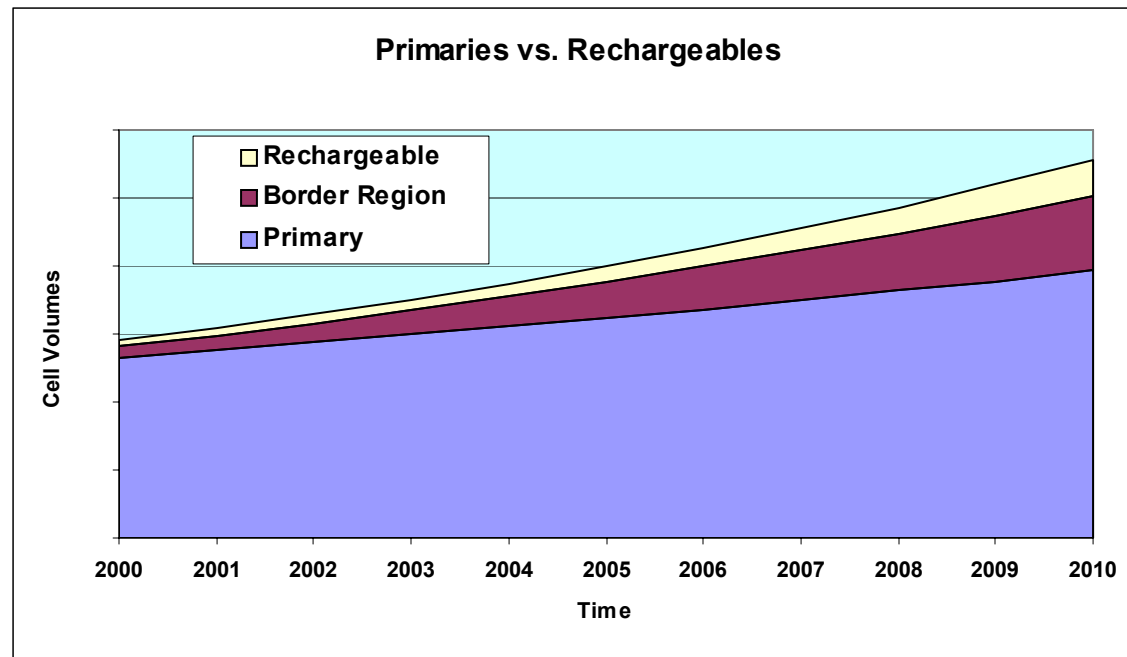
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- **R&D company, focusing on advanced battery technologies**
- **RBC commercializes technologies through licensing and joint venture partnerships**
- **RBC is currently concentrating on innovative, patent pending and patentable, high power cylindrical alkaline technology**



# High Power Device Explosion

- Growth of high power devices has been driving rechargeable cell volume growth
- Primary is at risk of losing the border region, e.g. digital cameras, MP3 players, PDAs, or other new high power devices
- Primary batteries can grow in the range of 3-4% or 6-8% depending on how well primary developers respond to the high power challenge



# Business Perspectives

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## Consumer

- Consumers do prefer the convenience and low entry cost for disposables
  - The consumer is making a rational decision, based on a 6 month payout requirement for investing in higher cost rechargeables and a recharging system

## The Primary Battery Company Business Model

- Why not just add rechargeables to the line or...?
  - Adding rechargeables, with more OEM and less replacement has serious financial downside
- Can primaries be improved enough to make a difference?

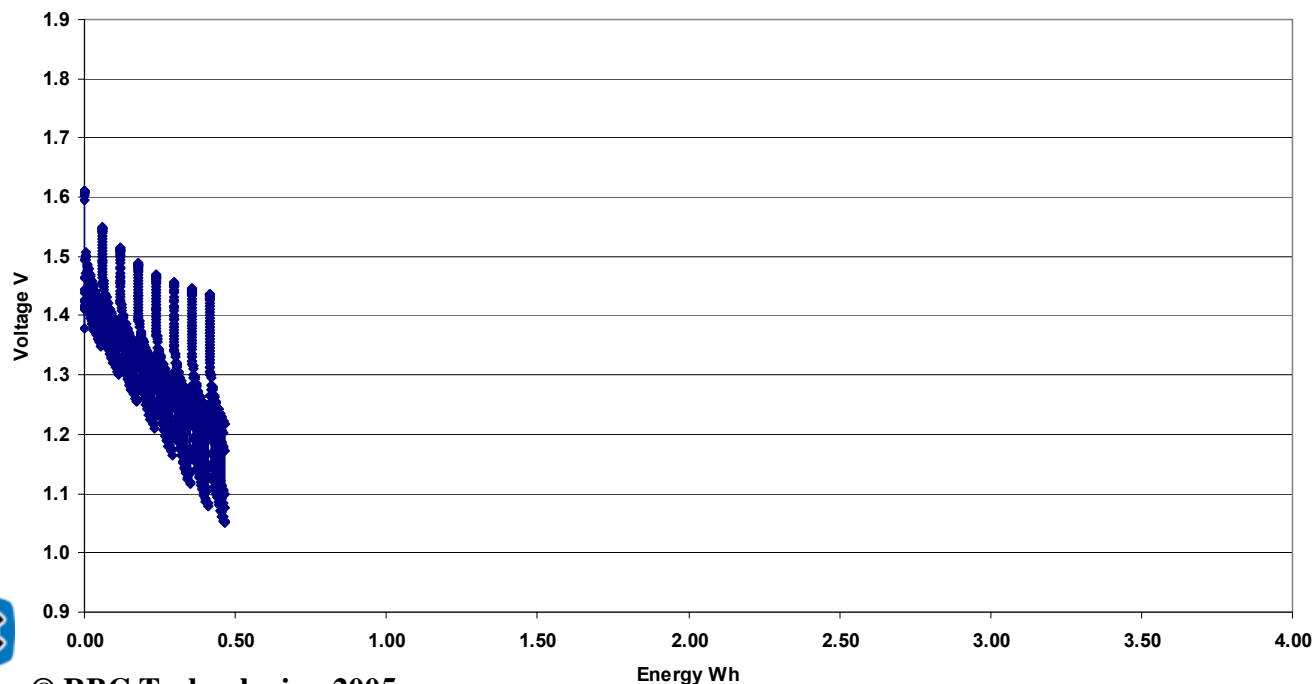
*Primary developers are responding to the challenge!*



# Standard Alkaline

- Standard alkaline is our benchmark
- Zeroing in on the most demanding high power test, digital camera pulse
- Highlighting AA performance
- While standard alkaline has seen considerable improvement, it still has limitations in high power applications
- 80 pulses, .5Wh

Standard Alkaline  
AA Digital Camera Pulse Test  
1.5 W 2s, .65W 28s, 10x/hr, Rest 55min, 1.05V

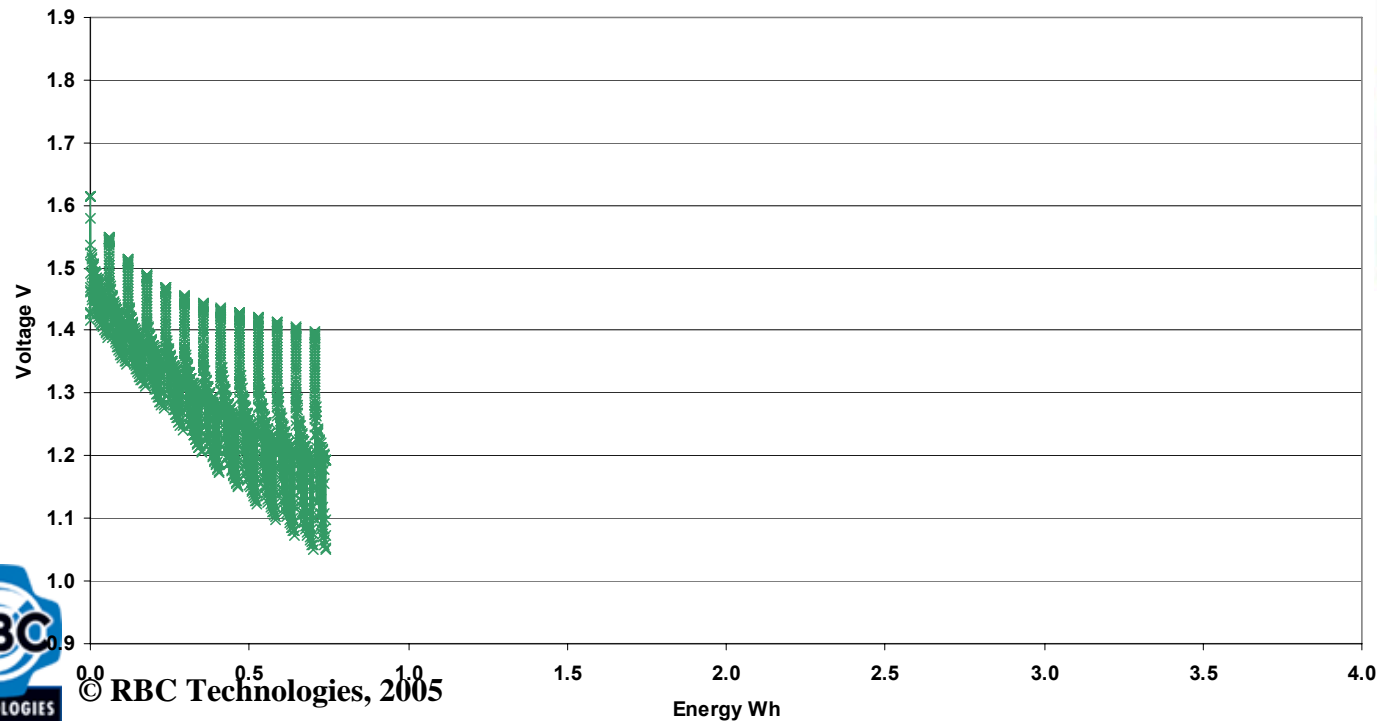


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# High Power Alkaline Manganese

- Launched by Duracell in 1998
  - Followed by Energizer in 2000
  - 1.6X performance vs. standard alkaline
- 125 pulses, .7 Wh, 10 to 15% improvements still possible

High Power Alkaline  
AA Digital Camera Pulse Test  
1.5 W 2s, .65W 28s, 10x/hr, Rest 55min, 1.05V



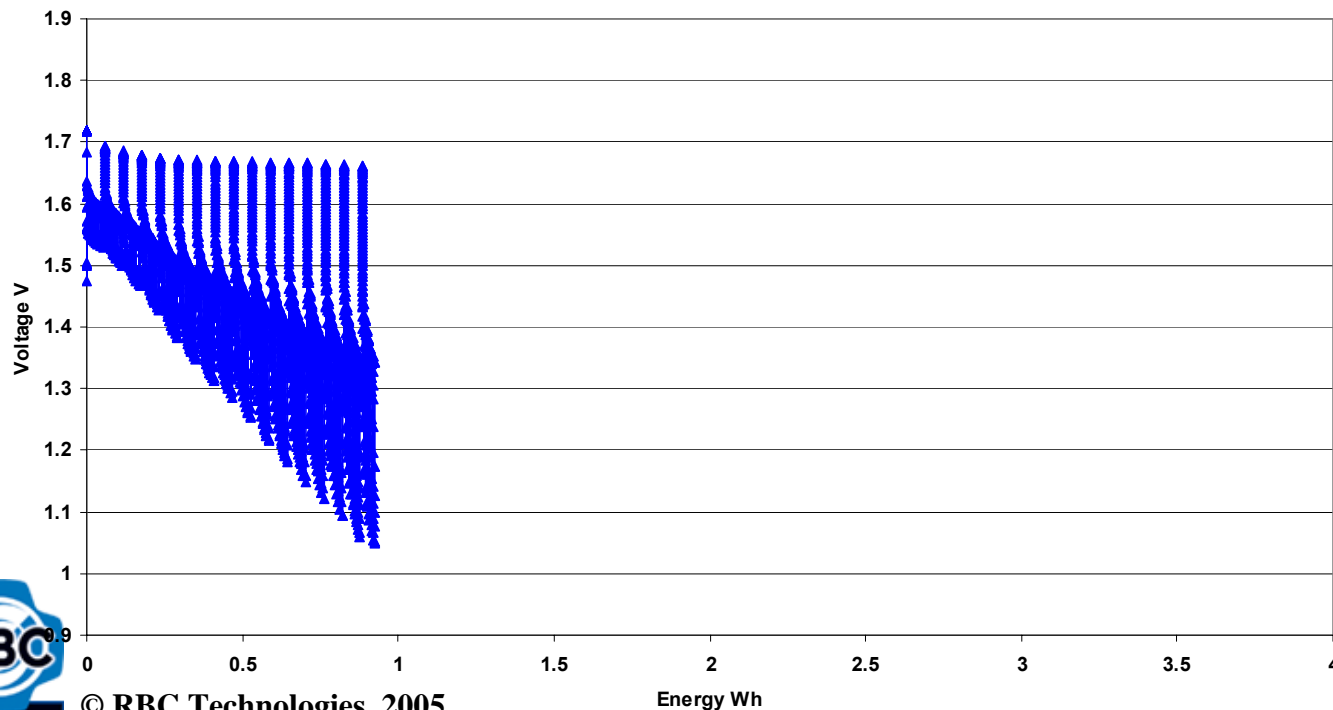
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Energy Wh

# Nickel Oxy-hydroxide

- **Panasonic & Toshiba launched in 2002**
  - Panasonic Oxyride 2004-5
  - Nickel and manganese cathode
  - 2.0X performance vs. standard alkaline
- **160 pulses, .9 Wh, 20 to 40% improvement possible**

Nickel Oxy-Hydroxide  
AA Digital Camera Pulse Test  
1.5 W 2s, .65W 28s, 10x/hr, Rest 55min, 1.05V



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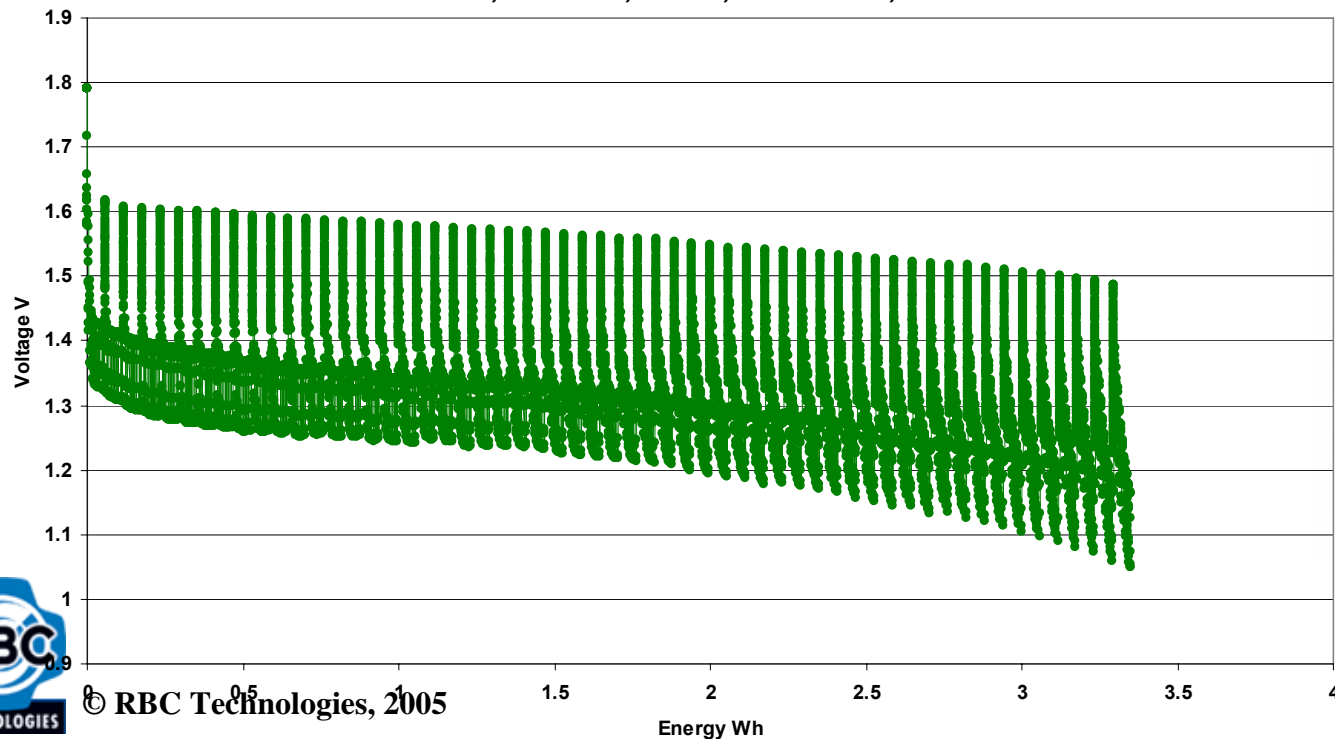
# Lithium Iron Disulfide

- **Energizer launched in 1992**
  - Recent sales growth driven by digital camera
  - 7.2X performance vs. standard alkaline
  - Lithium chemistry with a wound anode design
- **570 pulses, 3.4 Wh today, 10 to 15% improvements still possible**

## Lithium Iron Disulfide

AA Digital Camera Pulse Test

1.5 W 2s, .65W 28s, 10x/hr, Rest 55min, 1.05V

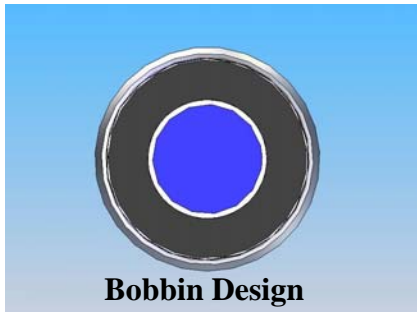


# RBC HRB Products

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- RBC's High Rate Bobbin (HRB) cell design is a hybrid between wound and bobbin cells

Top View of AA Cylindrical Cells

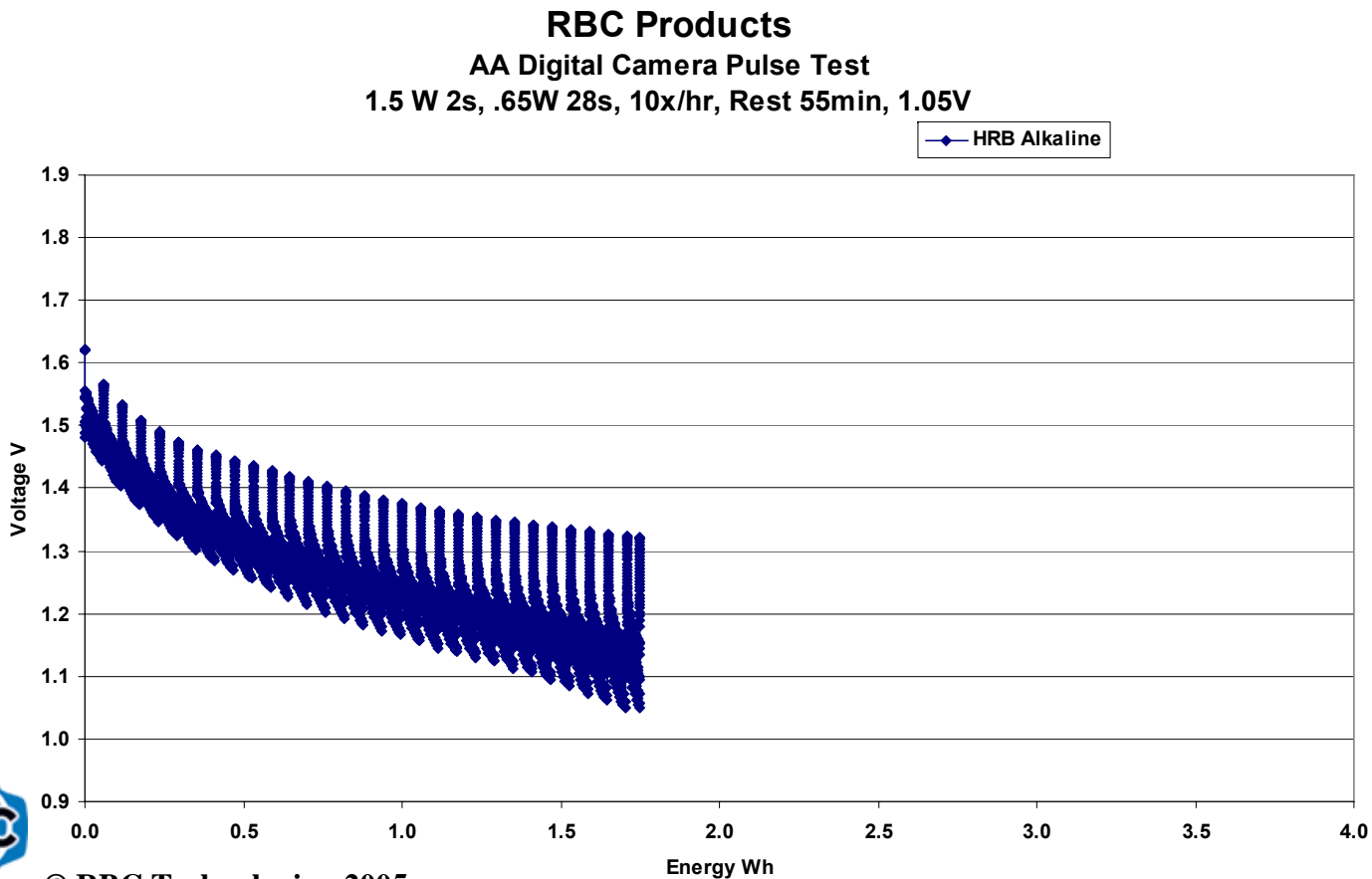


- **Intermediate in:**
  - Surface area between anode and cathode
  - Power
  - The manufacturing ease of bobbin and the complexity of wound
- Innovative manufacturing process closely based on conventional alkaline with similar low productions costs
- Pilot line in place to demonstrate high speed manufacturability



# RBC Performance

- HRB Alkaline:
  - 290 pulses, 1.7 Wh, 3.7X performance vs. standard alkaline

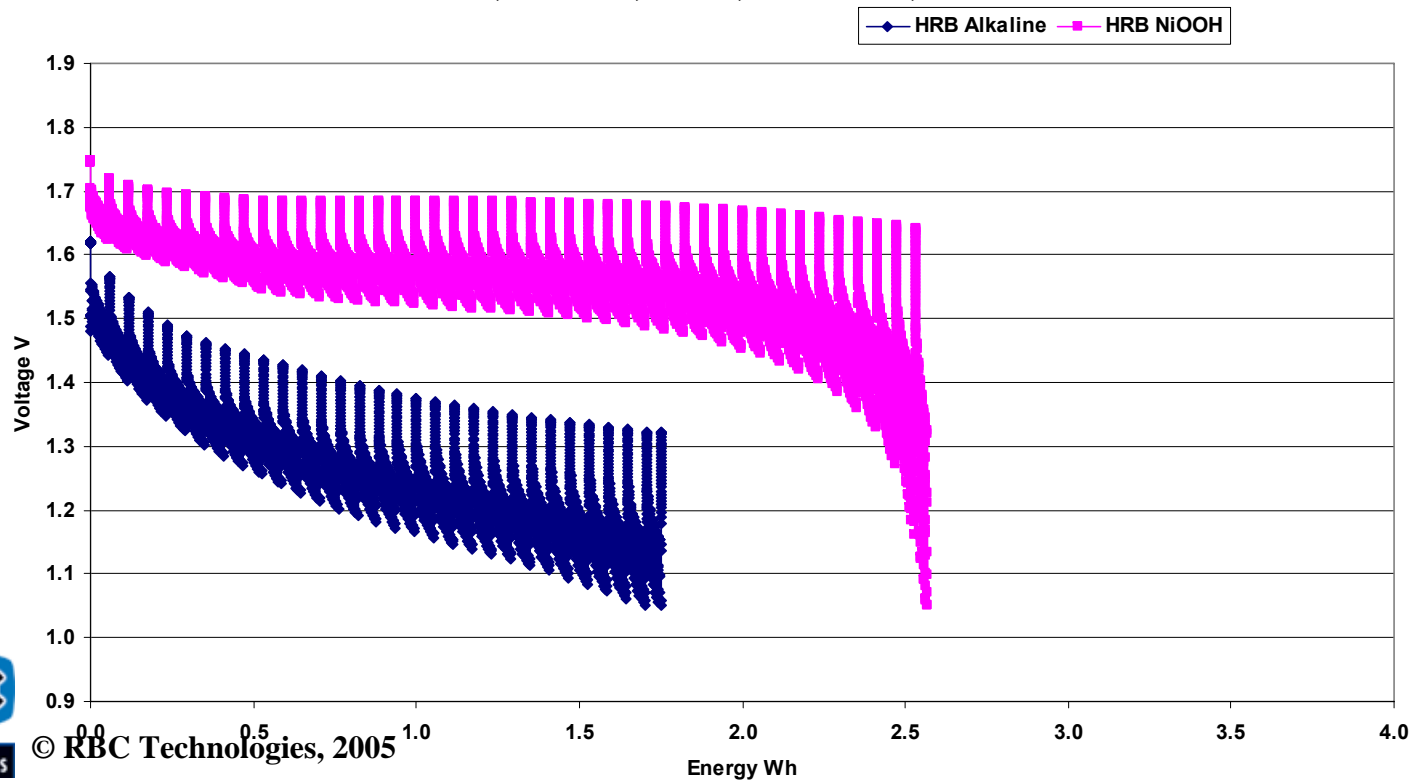


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# RBC Performance

- **HRB Alkaline:**
  - 290 pulses, 1.7 Wh, 3.7X performance vs. standard alkaline
- **HRB Nickel Oxy-hydroxide:**
  - 430 pulses, 2.6 Wh, 5.5X performance vs. standard alkaline

**RBC Products**  
AA Digital Camera Pulse Test  
1.5 W 2s, .65W 28s, 10x/hr, Rest 55min, 1.05V

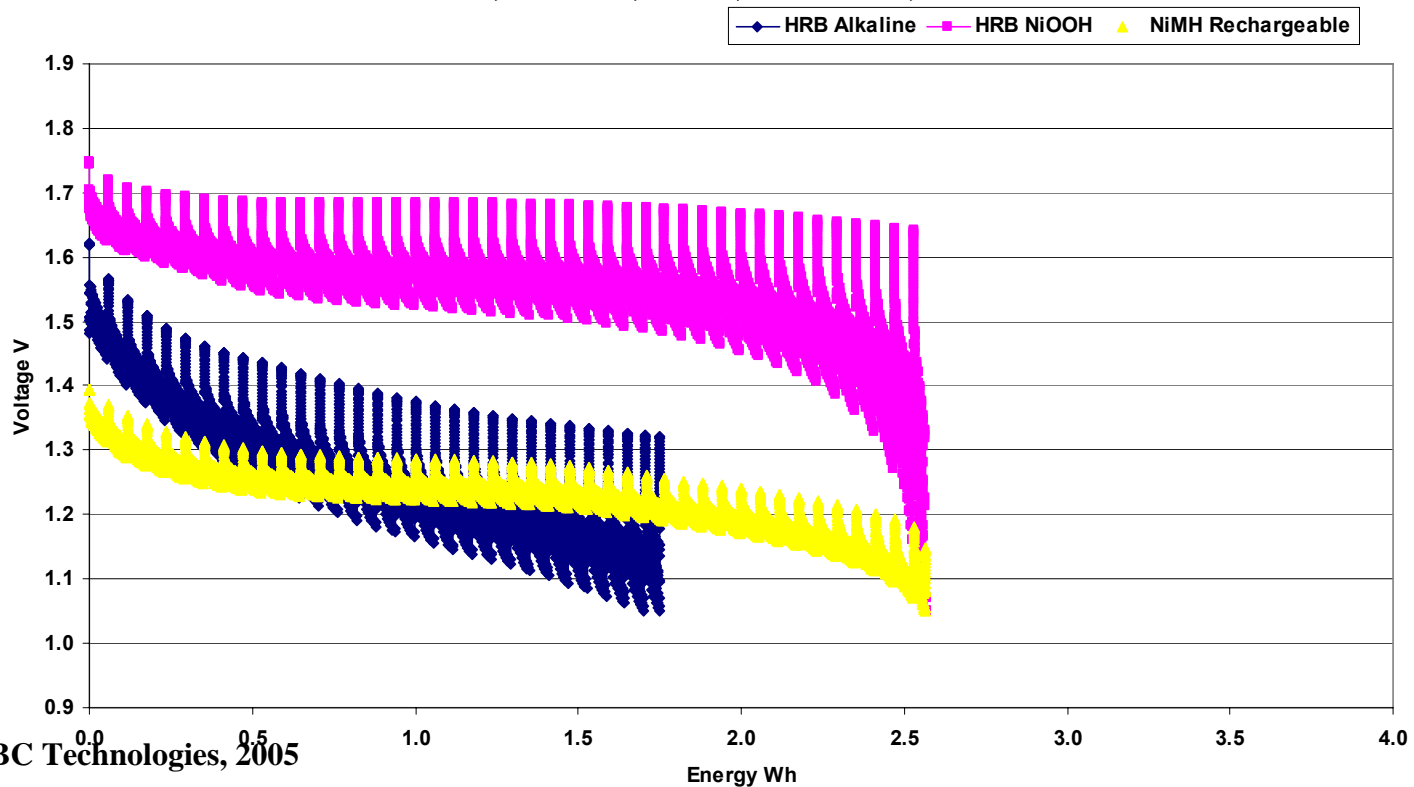


# RBC Performance

- **HRB Alkaline:**
  - 290 pulses, 1.7 Wh, 3.7X performance vs. standard alkaline
- **HRB Nickel Oxy-hydroxide:**
  - 430 pulses, 2.6 Wh, 5.5X performance vs. standard alkaline
- **NiMH Rechargeable**
  - 430 pulses, 2.6 Wh, 5.5X performance vs. standard alkaline

## RBC Products

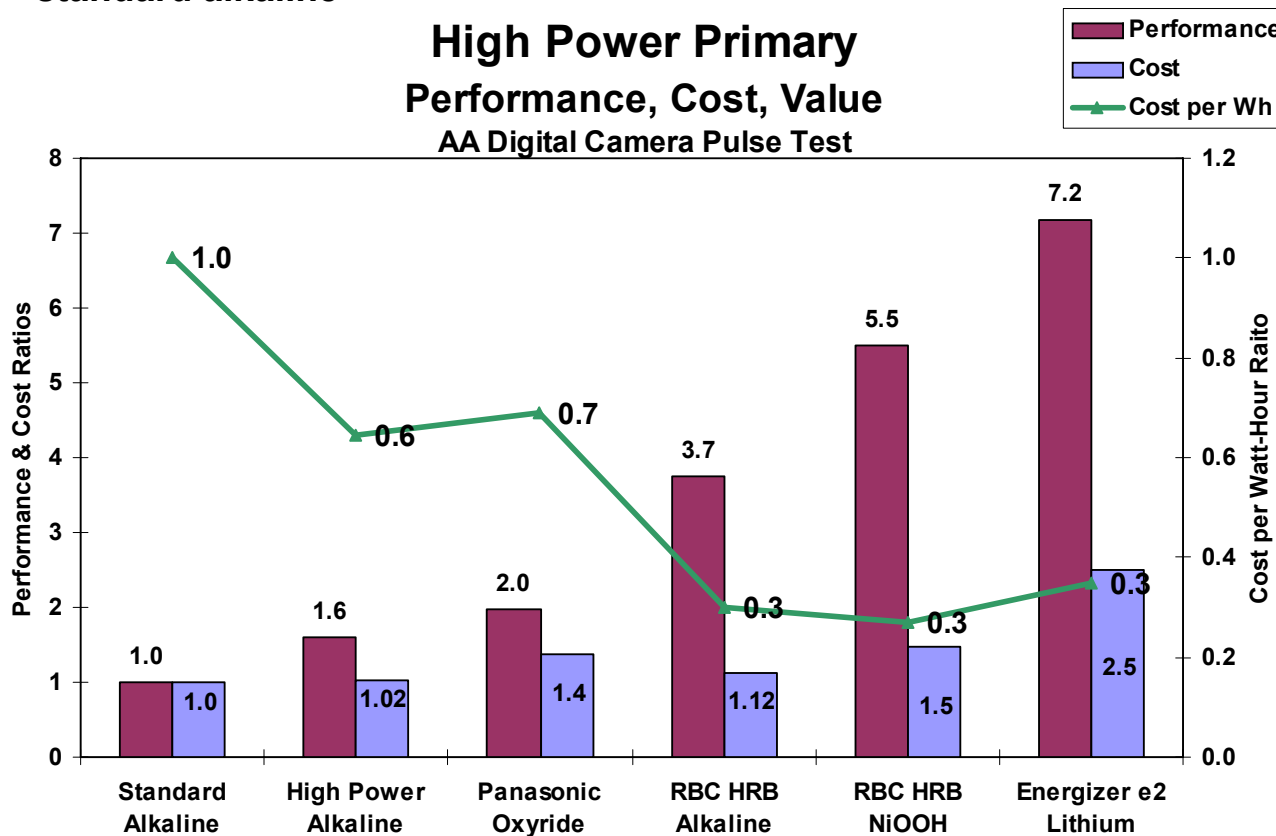
AA Digital Camera Pulse Test  
1.5 W 2s, .65W 28s, 10x/hr, Rest 55min, 1.05V



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# Cost & Value

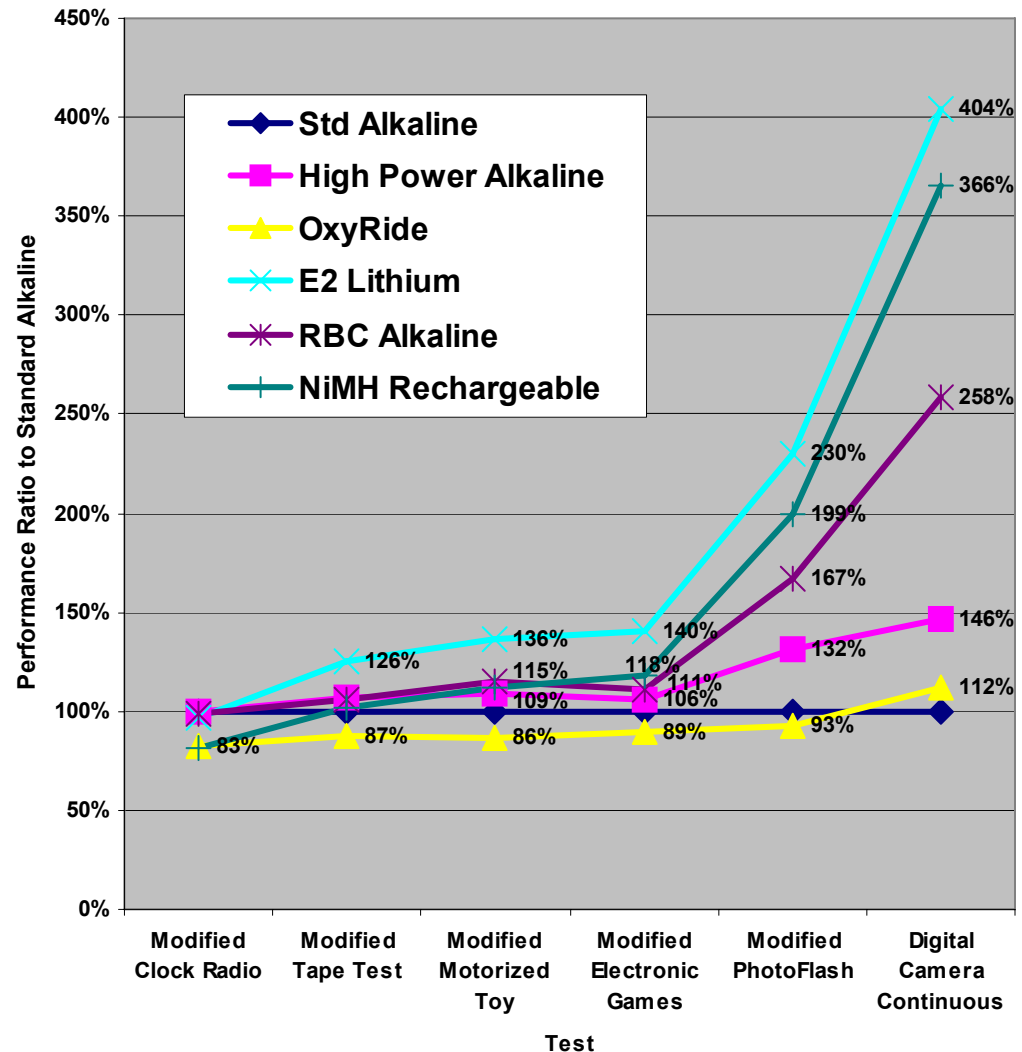
- High power alkaline bobbin products and Oxyride deliver comparable values vs. standard alkaline
- E2 lithium and both RBC products deliver superior values
  - The RBC products will be able to deliver that value at price points closer to standard alkaline



# Other Application Test Results

- Benchmarked to standard alkaline as 100%
- Lithium and RBC Alkaline are superior products in all test ranges
- Nickel products provide good high power performance but sacrifice performance at lower power
- No lower rate tests yet for RBC NiOOH; expectations that it will sacrifice in the lower range as do other Nickel products

ANSI/IEC Test Results



# Conclusion

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## Primary batteries...

- **...have more life in them!**
  - Are increasingly capable of high power performance that had required rechargeables
  - Continued developments in design, chemistry and manufacturing processes are improving performance and values
- **...deliver consumer convenience, avoiding the investment cost in rechargeables**
- **...deliver design options for OEMs**
  - Lower price point at point of sale
  - Ready to operate out of the box

## Challenge to OEMs!

- **What primary battery devices can be enabled with this new high power performance standard?**
- **Talk to us about your needs!**



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