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Rechargeable Battery Market and Industry Trends *Results from Industry Survey 2007*

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This document provides an outline of a presentation and is incomplete without the accompanying oral commentary and discussion.

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Objectives and Context

- Discuss future evolution of the rechargeable industry, specifically
 - Application and battery requirement trends
 - High-level technology and manufacturing trends
 - Expected shifts in sources of competitive advantage for battery manufacturers
- Discussion will be based on findings from a survey of Power Conference 2007 participants
- For questions and inquiries, please contact Holger Koehler (hkoehler@monitor.com, 617-252-3189)

Rechargeable Technology and Industry Trends

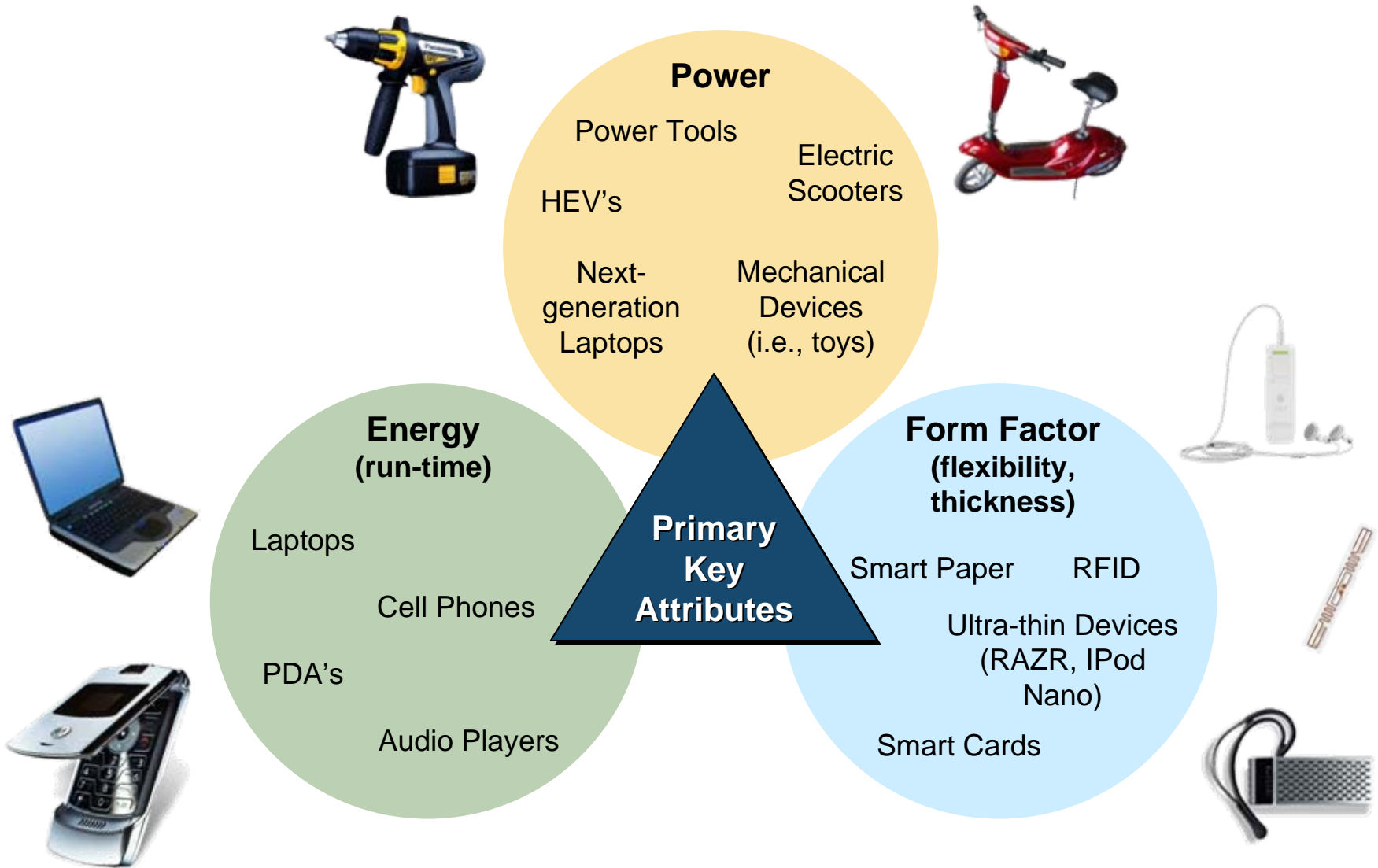
Summary of Findings

- 1 Lithium Ion is likely to continue to be the dominant rechargeable battery chemistry in the short-term, driven by the fact that it is the most appropriate rechargeable technology for meeting the performance requirements of the largest applications in the rechargeable market
- 2 While the current performance paradigm for the largest portable power applications remains energy density, R&D is expected to increasingly focus on power density in the longer-term, given that power-applications are expected to drive much of the longer-term growth of the industry
- 3 Given the continuing dominance of Lithium-based chemistries, short-term focus among rechargeable battery manufacturers is to control costs and achieve high levels of customer service through efficient manufacturing processes, quality control and OEM relationship building
- 4 However, in the medium term, manufacturers perceive significantly greater threats and opportunities emerging from technological breakthroughs and new sources of demand from portable power applications

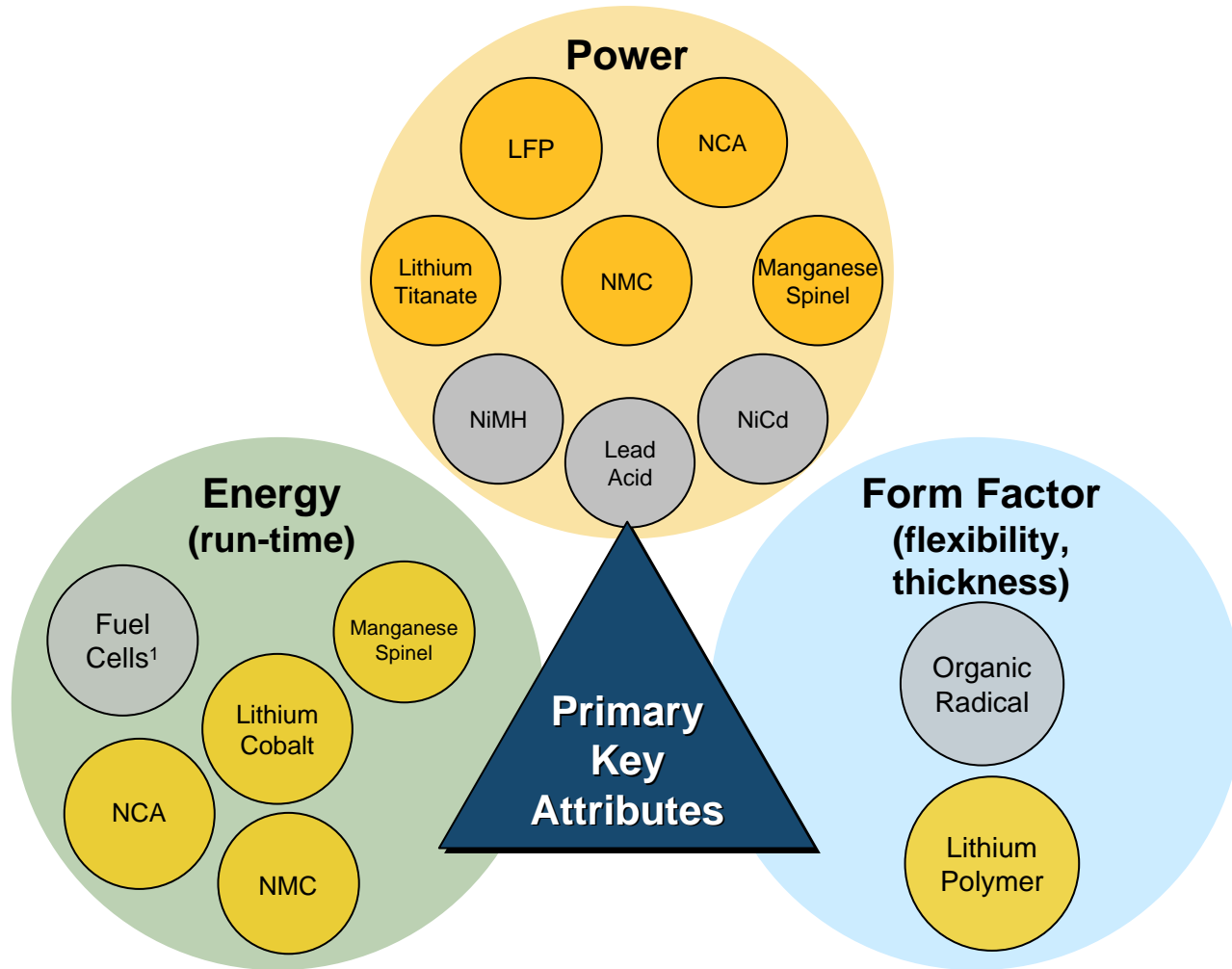
1 Lithium Ion Expected to Remain Dominant Rechargeable Battery Chemistry

- a Lithium Ion along competes favorably along key battery performance dimensions
- b Lithium Ion technologies have still room for improvements, competing NiMH and NiCd technologies are further down the technology life cycle
 - Given the technology maturity of, and the remaining development potential of Lithium based chemistries in all performance areas (Energy, Power and Form Factor), Lithium is likely to remain the rechargeable chemistry of choice for the majority of OEMs

1a Battery Performance Requirements of Most Portable Applications Can Generally Be Categorized Into 3 Groups: Power, Energy and Form Factor



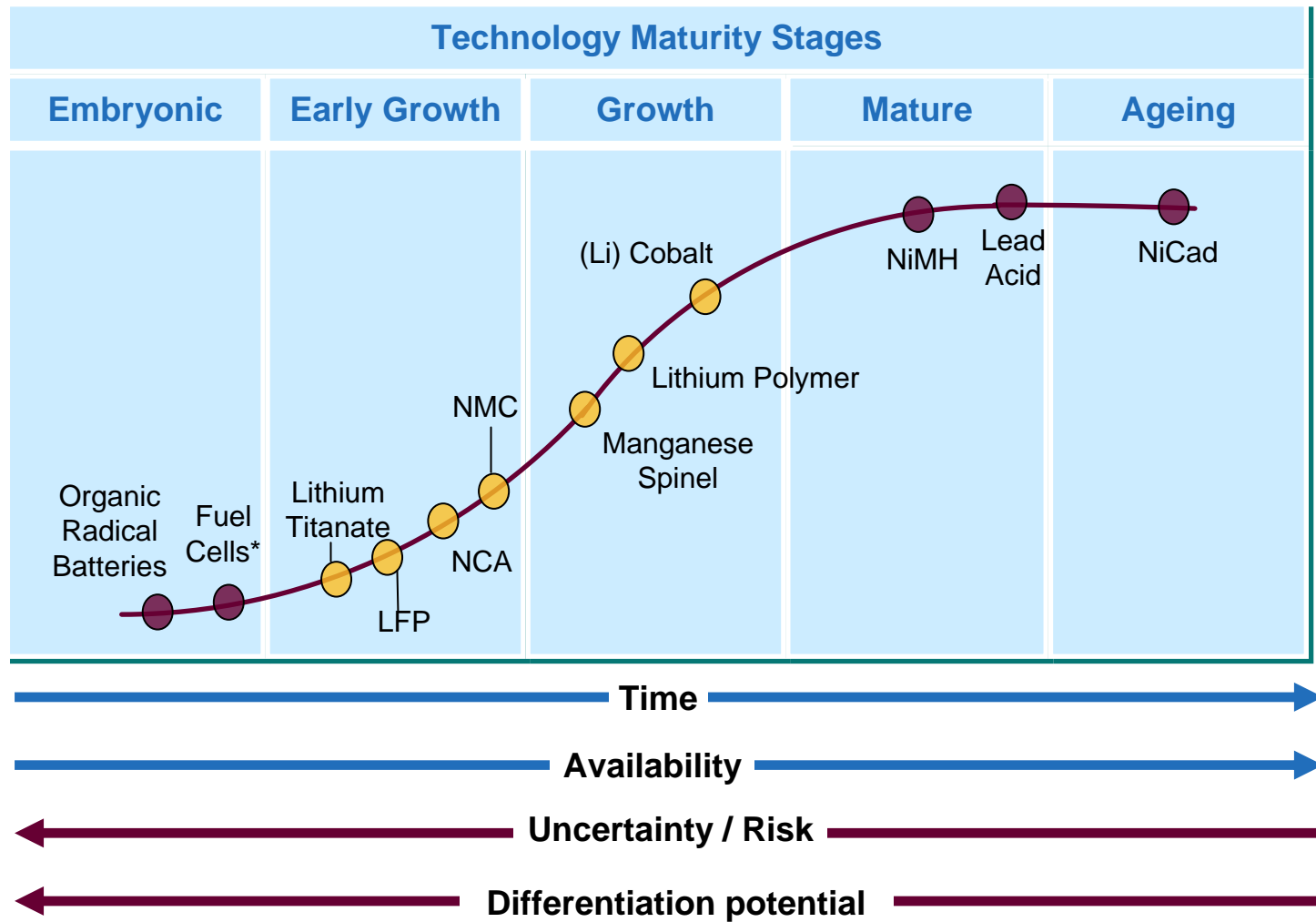
1a These Needs Entail Trade-Offs That Do Not Allow One Solution to Provide All Attributes. However, Li-Ion Is Already the Key Technology Along All Dimensions



¹ Fuel cells are refillable, but not rechargeable in the conventional sense

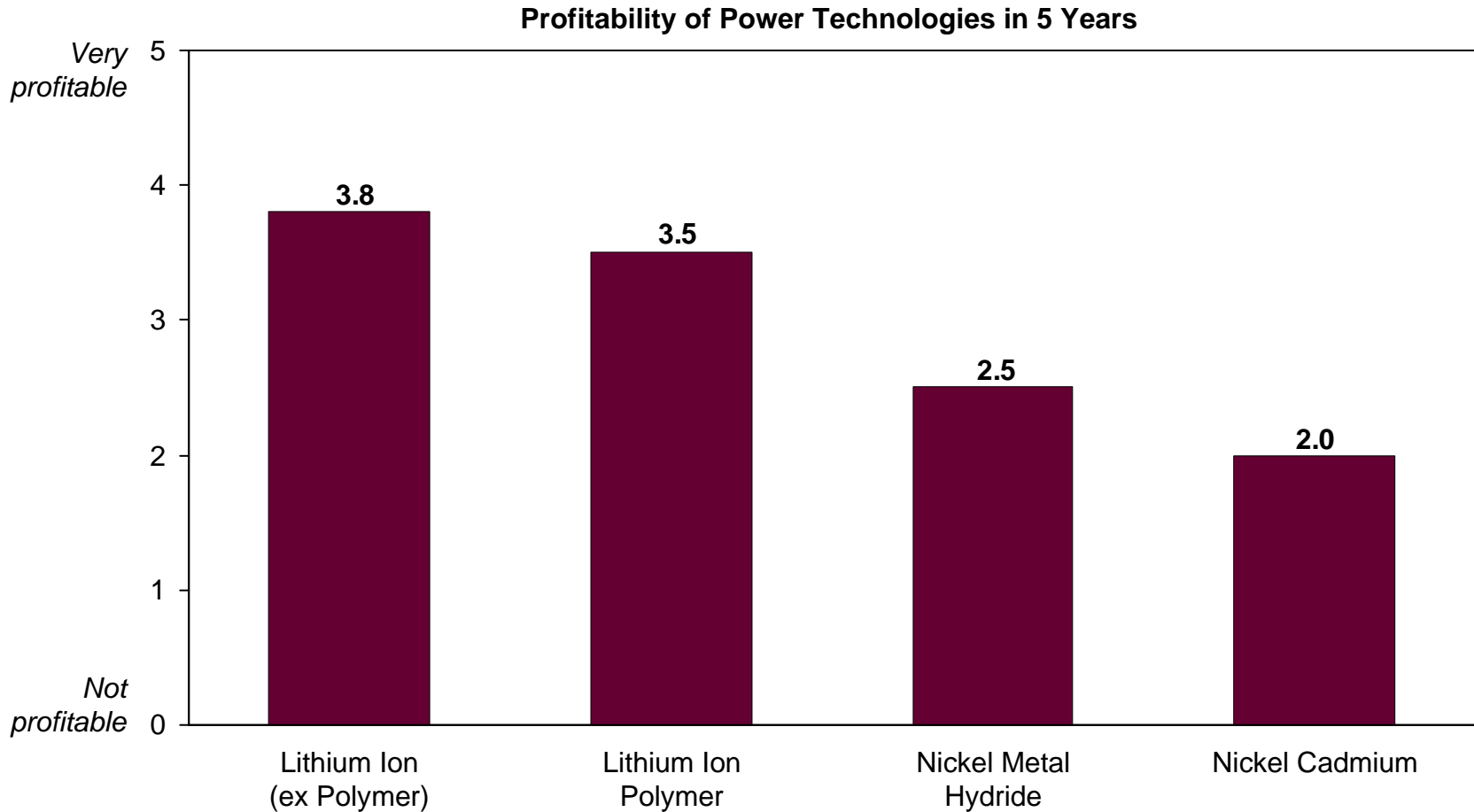
Ni Chemistries Are Reaching Technological Maturity, While Lithium Based Chemistries and Fuel Cells Have the Greatest Remaining Development Potential

↑
Development potential



¹ Fuel cells are refillable, but not rechargeable in the conventional sense

1b Industry Observers Share This View, as They See Greatest Medium-term Profitability in Li-Ion and Continuing Erosion of Ni Chemistries



Question: Please rate the profitability of the following power technologies for portable applications in 5 years:

Note: N = 10; 5. Very profitable, 1. Not profitable

Source: Battery Power Conference Survey, April 2007

1b Li-Ion Will Therefore Continue to Dominate Rechargeables Due to Versatility and Remaining Performance Improvement Potential



Power

Expectation is that Li Ion (LFP, NCA, Manganese, Lithium Titanate and NMC) will increase share relative to NiMH and NiCad



Energy

Mixed Metals (NCA and NMC) are likely to improve energy density over coming years, while fuel cells and lithium metal continue to face significant challenges

Lithium Ion

Form Factor

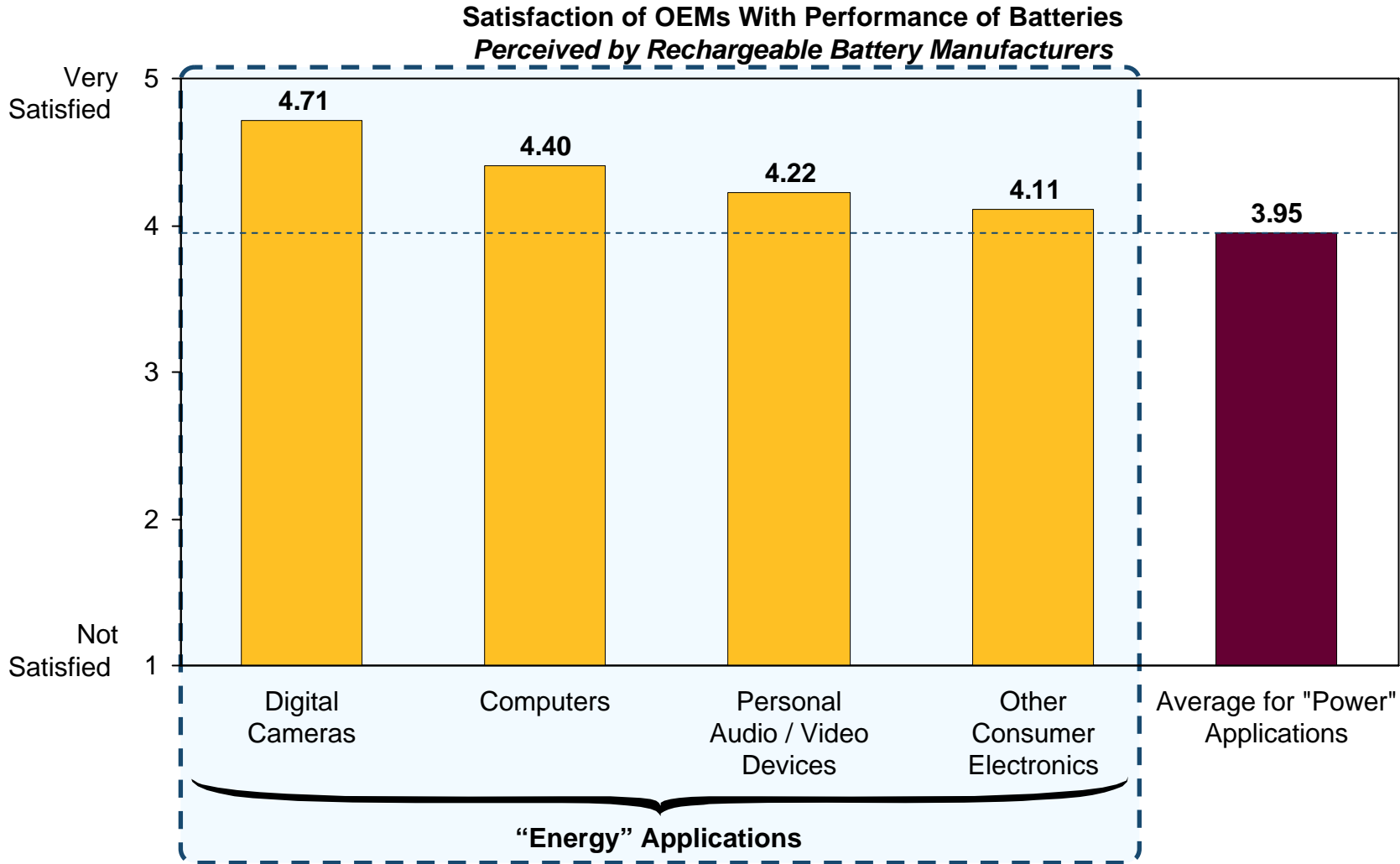
Lithium Polymer is the only commercial viable option for the thinnest and most flexible batteries. Used in bluetooth headsets and other min devices (e.g., I-Pod Shuffle)



2 Current Performance Paradigm in Li-Ion Remains Energy Density, Although R&D Will Increasingly Focus on Power Density in the Longer-term

- a Further improvements in energy density will continue to be the primary concern for the rechargeable market in the medium term
- b Industry R&D efforts are likely to increasingly focus on improving power density given the increasing importance of these applications
- c Even though some portable electronic devices are reaching ergonomic limits form factor will continue to be a major R&D challenge in the future

2a Technological Advances to Increase Energy Density, and the Shift to Li-Ion Have Led to High Perceived OEM Satisfaction in Some “Energy” Applications

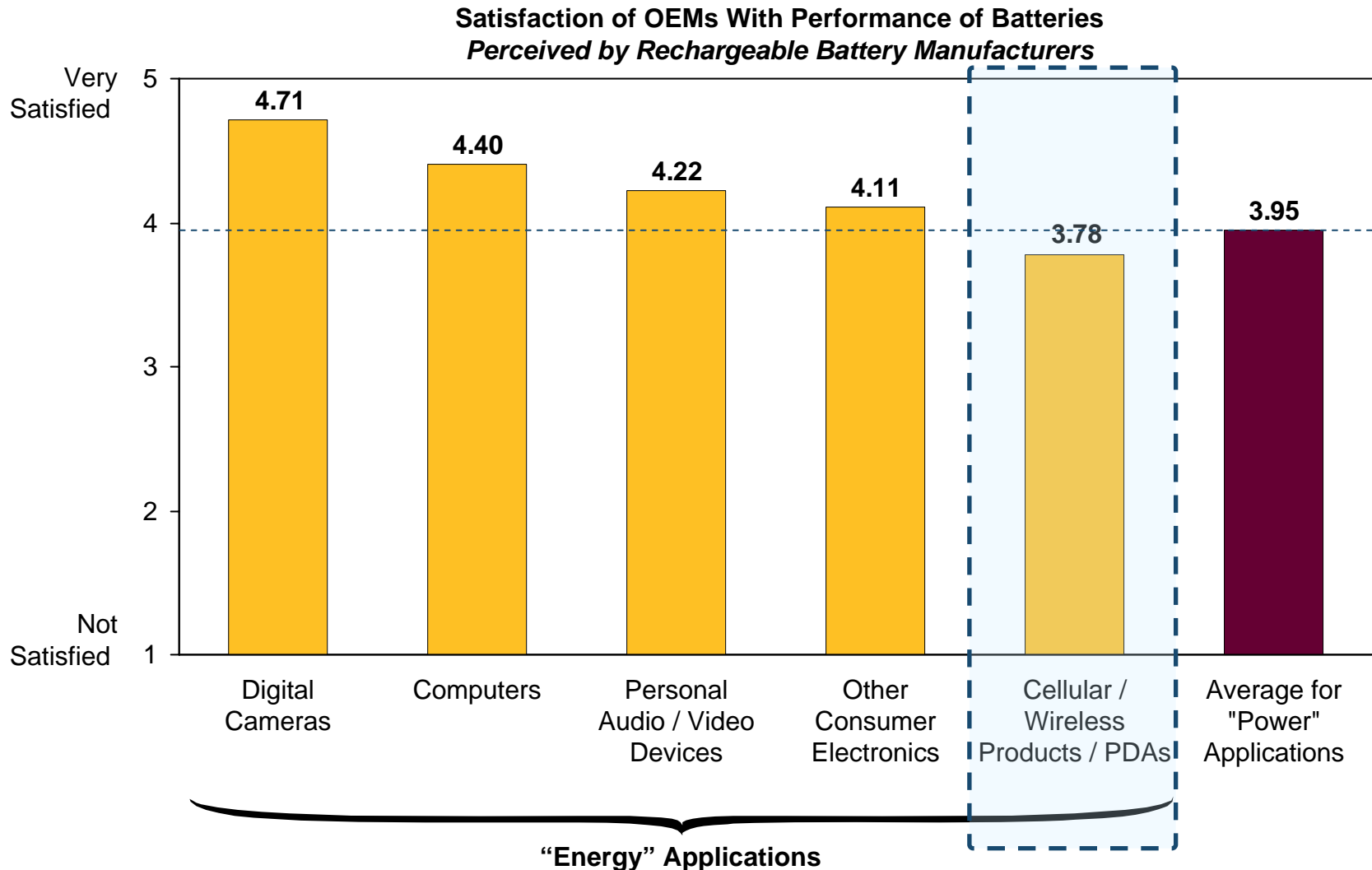


Question: *How satisfied do you believe OEMs are with the performance of your batteries in each device type?*

Note: All Battery Manufacturers

Source: Battery Power Conference Survey, April 2007

2a However, in Highest Volume “Energy” Applications Such as Mobile Phones, There Continue to be Significant Unmet Performance Needs

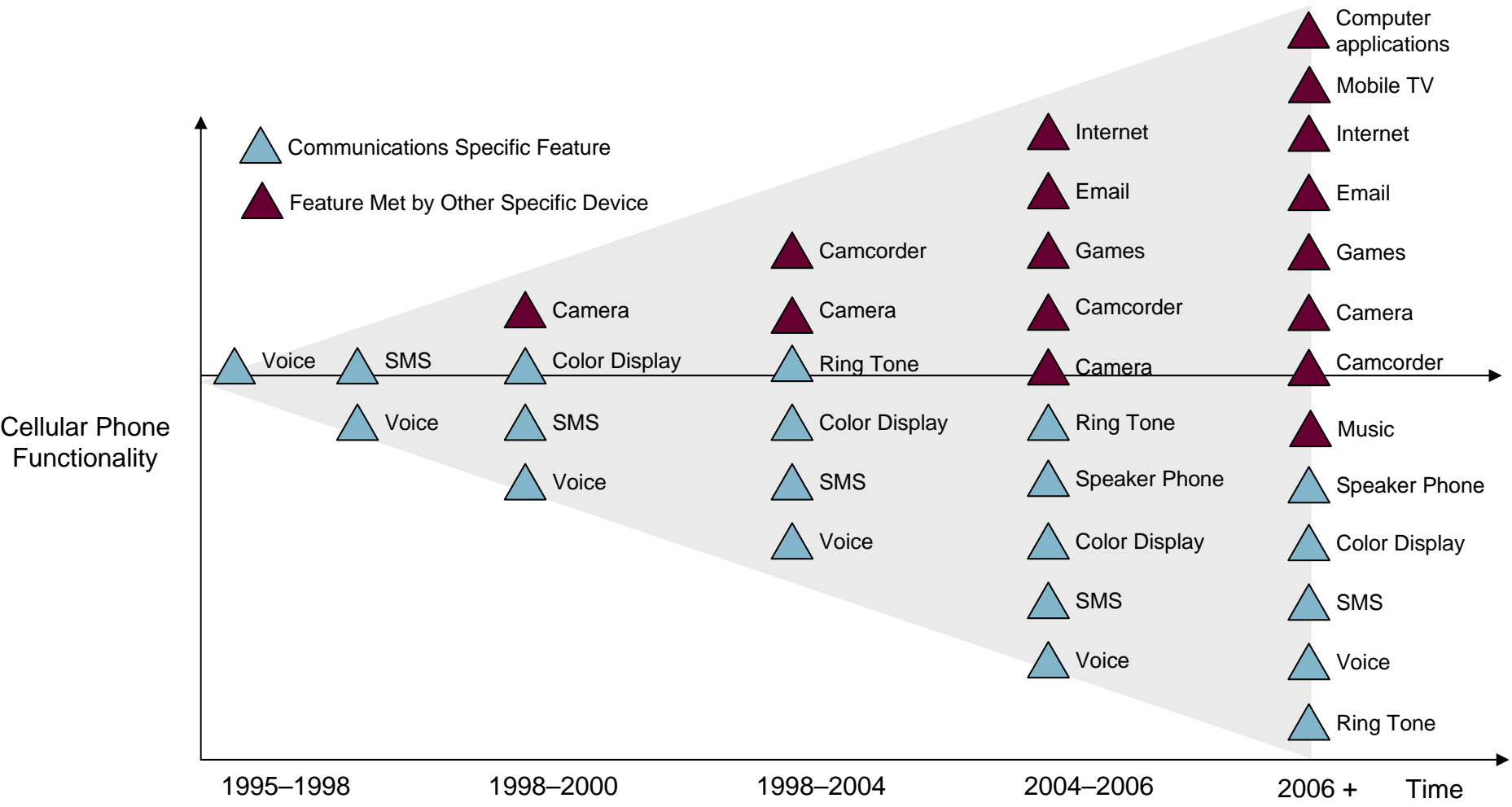


Question: *How satisfied do you believe OEMs are with the performance of your batteries in each device type?*

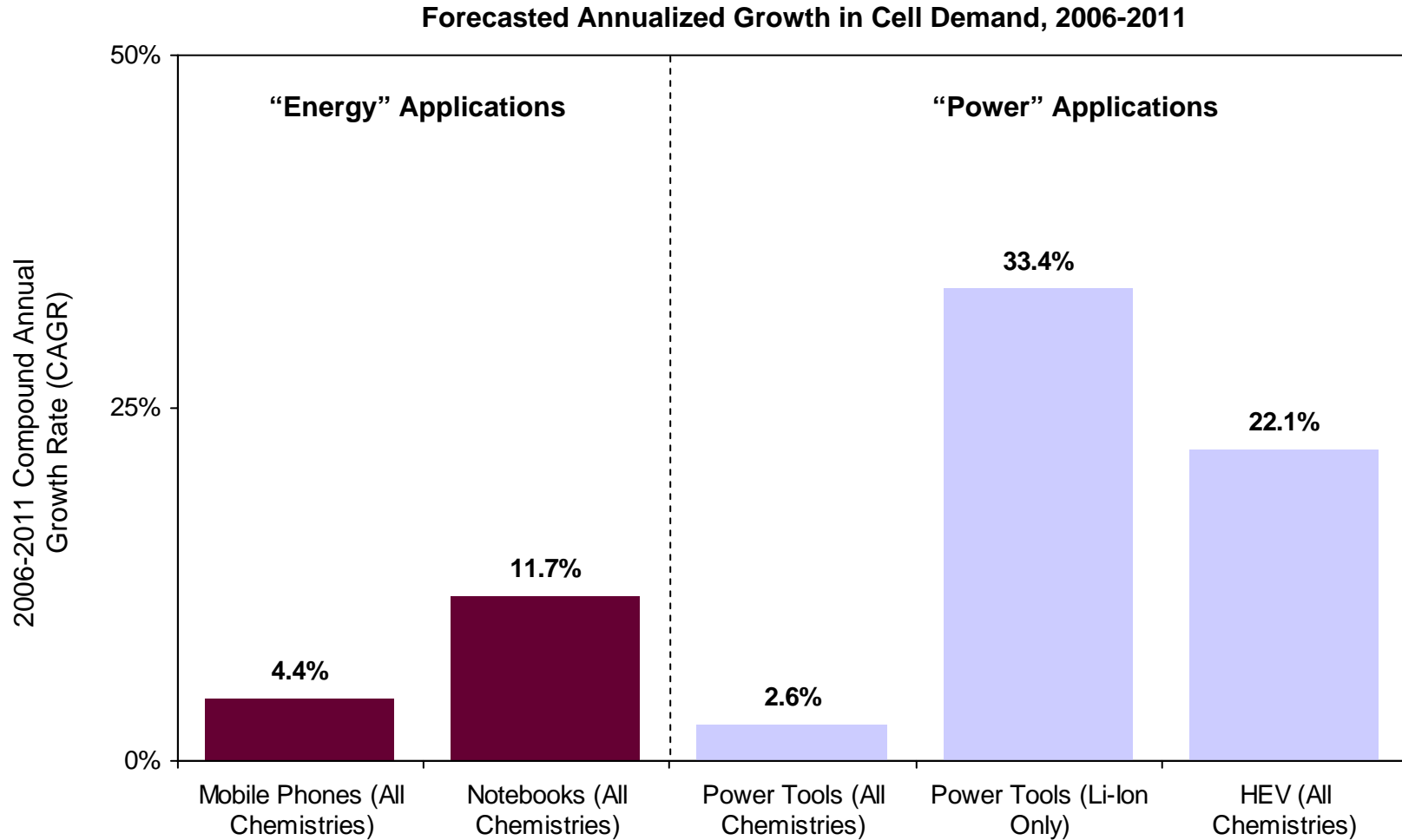
Note: All Battery Manufacturers

Source: Battery Power Conference Survey, April 2007

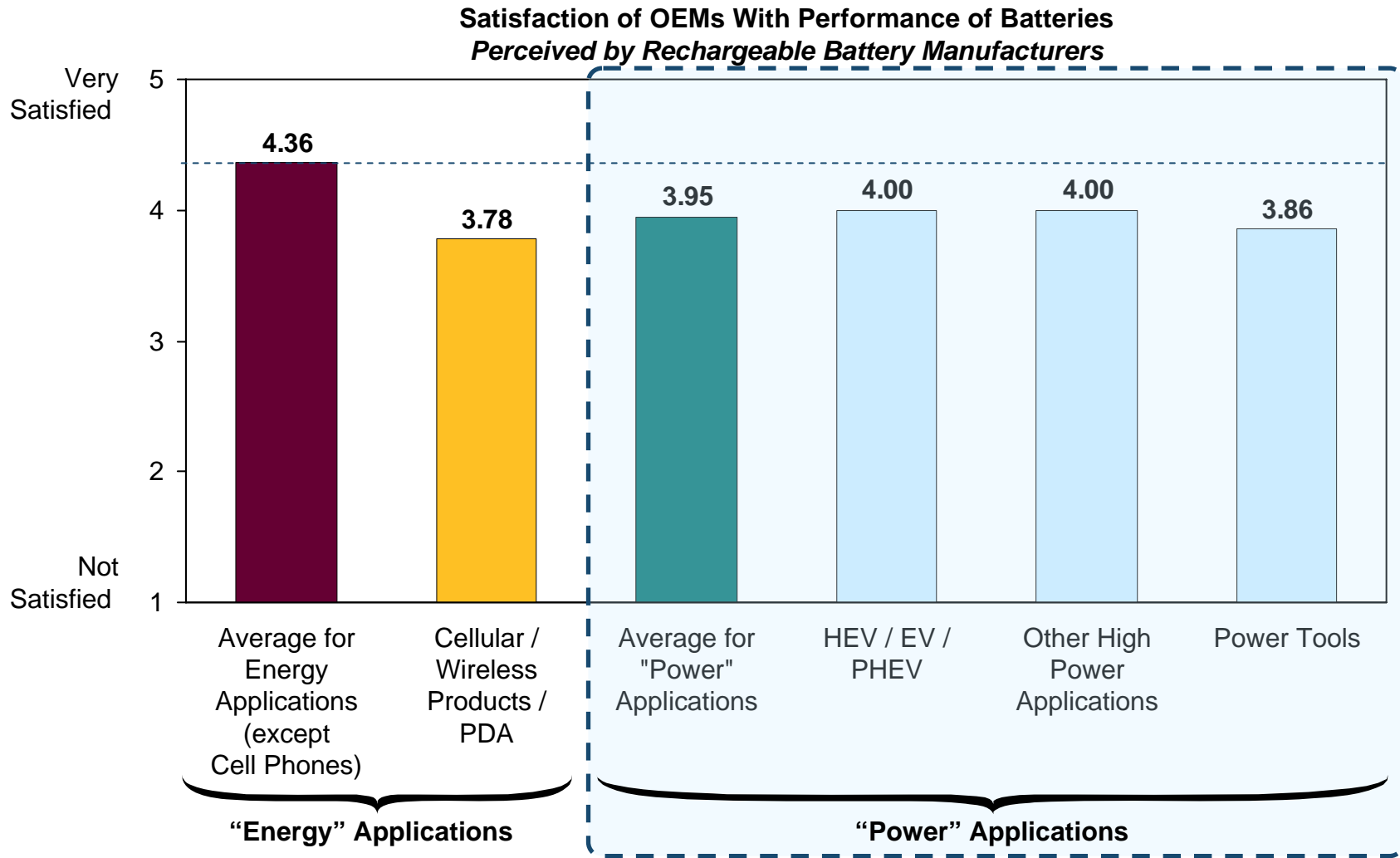
2a The Increasing Energy Requirements in Mobile Phones Are Driven by Feature Convergence and Corresponding Increased Device Usage



2b Industry R&D Efforts Are Likely to Increasingly Focus on Improving Power Density Given the Increasing Importance of These Applications



2b OEMs of “Power” Applications Have Among the Highest Level of Unmet Performance Requirements



Question: *How satisfied do you believe OEMs are with the performance of your batteries in each device type?*

Note: All Battery Manufacturers

Source: Battery Power Conference Survey, April 2007

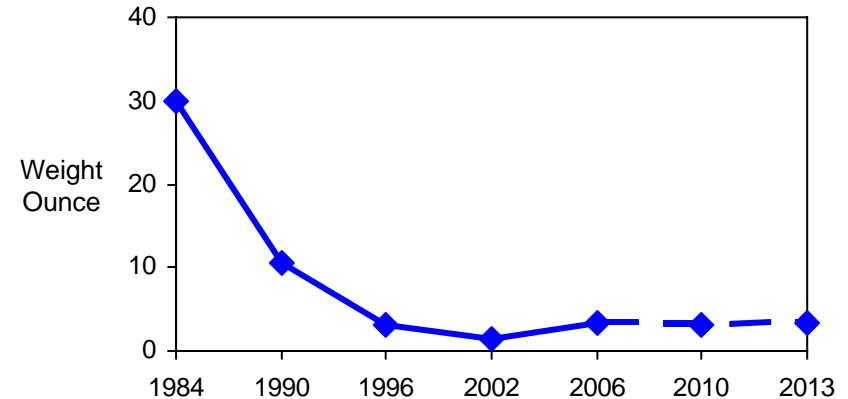
2c

Even Though Some Portable Electronic Devices Are Reaching Ergonomic Limits Form Factor Will Continue to Be a Major R&D Challenge in the Future

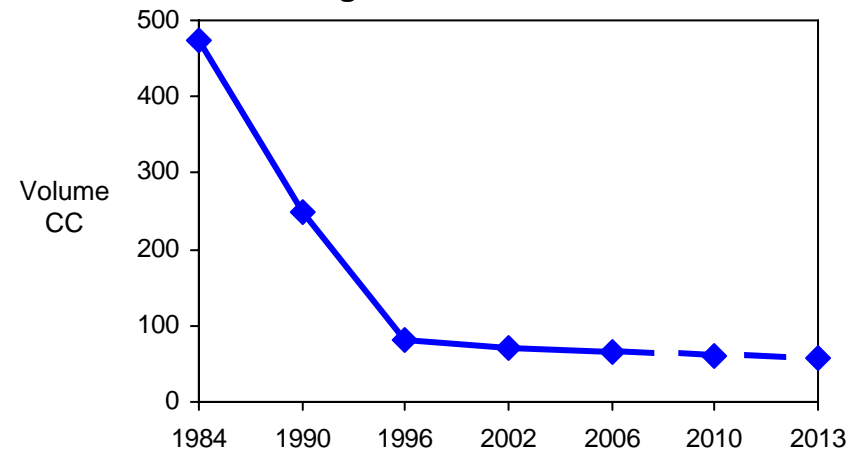
What we heard . . .

- “You can’t continue to shrink the device forever, overall size and weight may begin to stabilize but form factors become very important — especially getting thinner”
- “There is a limit to how small cell phones can go . . . Screens and keyboards are essentially staying the same size, but handsets are getting lighter and thinner”
- “There will be continued pressure on batteries to conform to design guidelines . . . and constraints on battery size will be driven by smaller device specs”
- “Smaller battery compartments means we can make it [the device] smaller or add features valued by the consumer”

Average Weight of Wireless Handset¹



Average Size of Wireless Handset¹



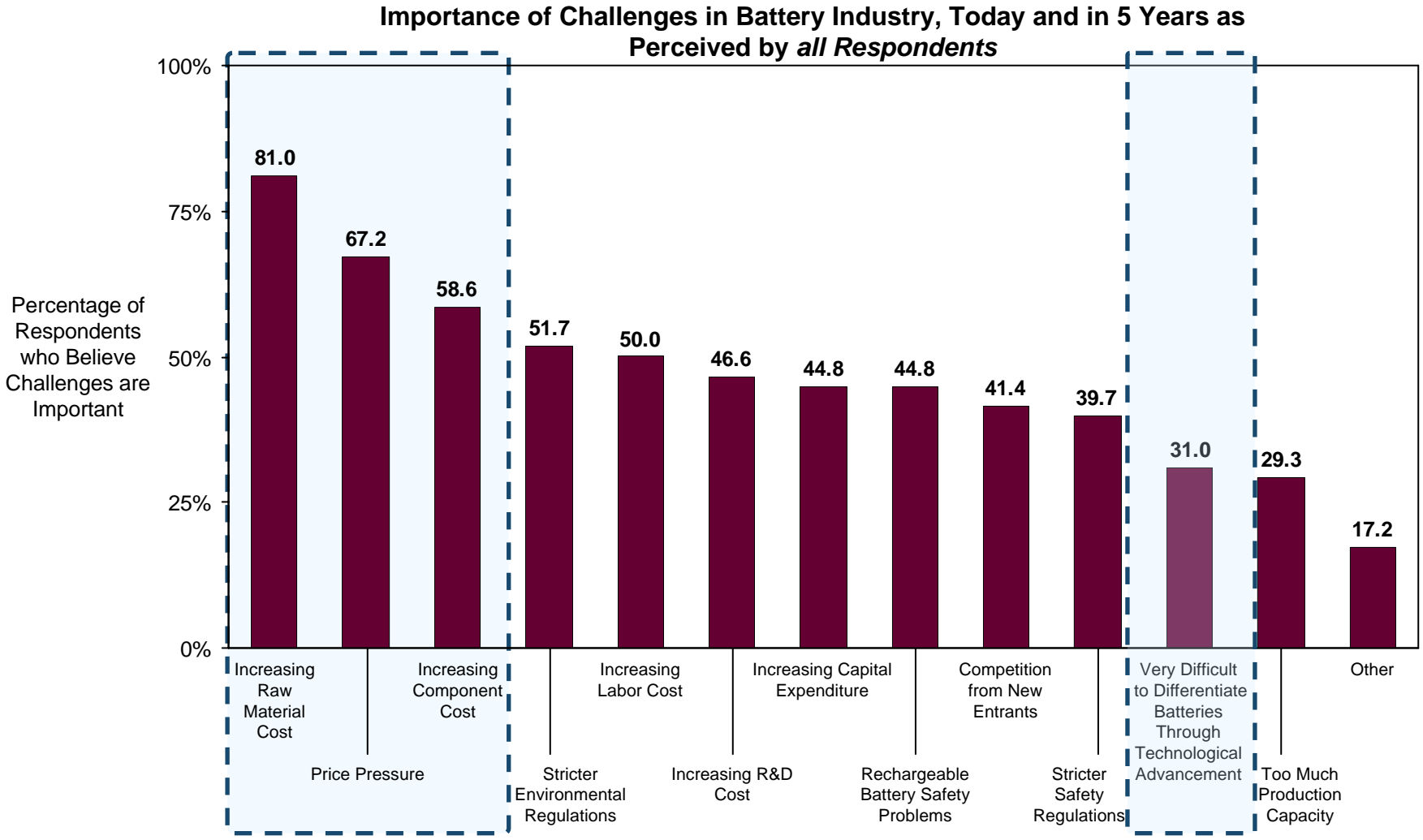
¹ Average based on sampling of top selling Motorola phones

Source: Motorola, Sony Ericsson

3 Short-term Focus Among Rechargeable Manufacturers Is to Control Costs and Achieve High Levels of Customer Service

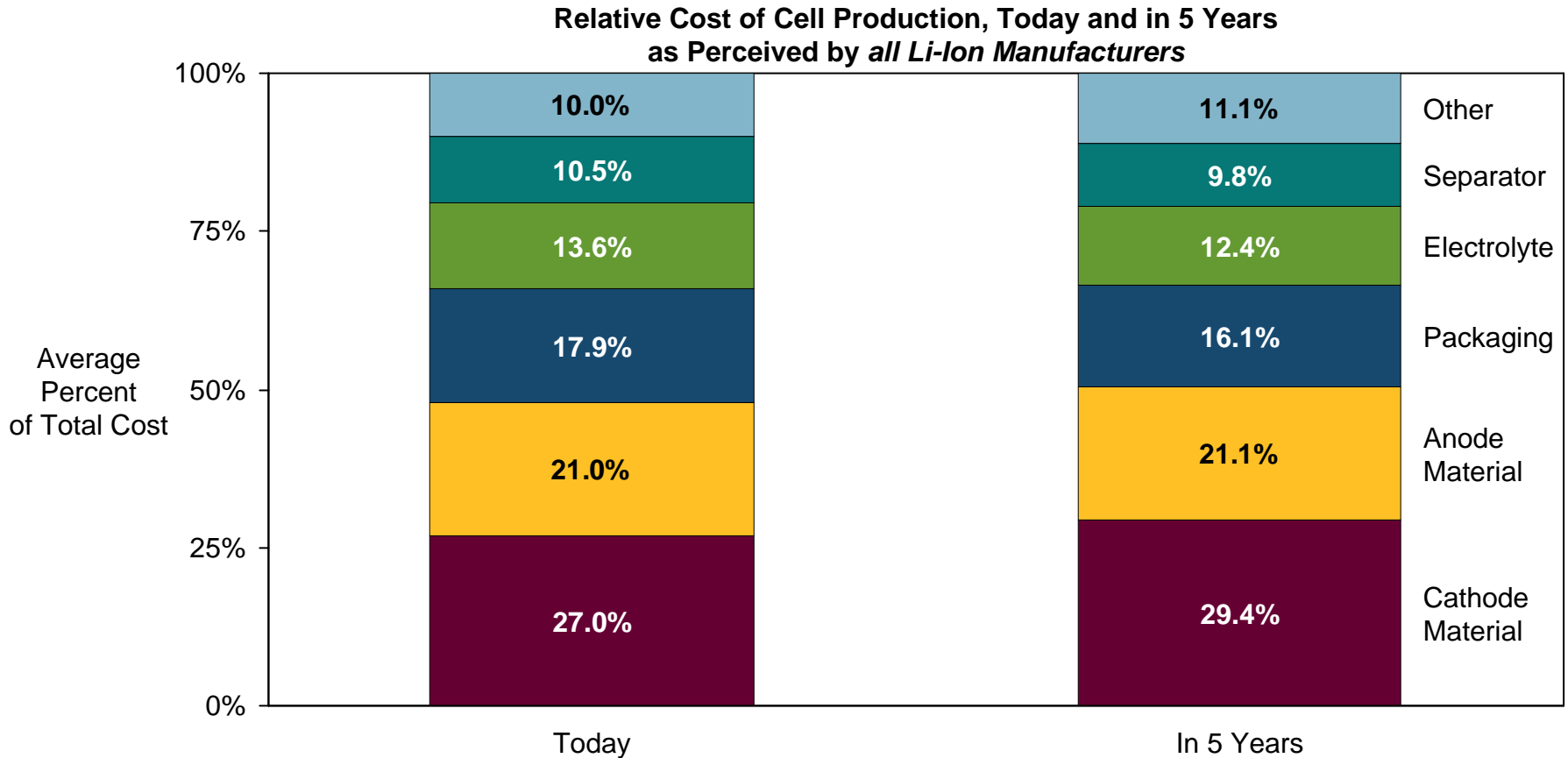
- a In the next 5 years, manufacturers appear most concerned about operational aspects of the rechargeable industry, and see significantly less of an opportunity for disruption (and competitive advantage) through technological advancement
- b Controlling the costs of the basic cell components, in particular, is a top priority, given that anode, cathode, electrolyte and separator account for approximately 70% of total battery pack production costs
- c Manufacturers — especially those with sufficient scale — therefore attempt to perform a large portion of the manufacturing process in house to control costs, and are seeking to increase this ration even further, especially in package, electrolyte and anode production
- d Manufacturers are also increasingly expected to move their manufacturing operations out of higher labor cost geographies such as Japan, to lower cost destinations such as China, Korea and India
- e In addition to striving for operational excellence, manufacturers are attempting to differentiate themselves based on customer-service relevant metrics

3a Manufacturers are Most Concerned About Operational Aspects, Especially High Raw Material Cost, and See Fewer Challenges From Technological Advancement



Question: Please rate the importance of the following challenges that you / or your company see in the battery industry in Today / 5 years
 Note: N = 58; All Respondents; "Important Challenges" are those rated as a 1 or 2 on scale of 1-5 (1. Very important, 5. Not Important);
 Source: Battery Power Conference Survey, April 2007

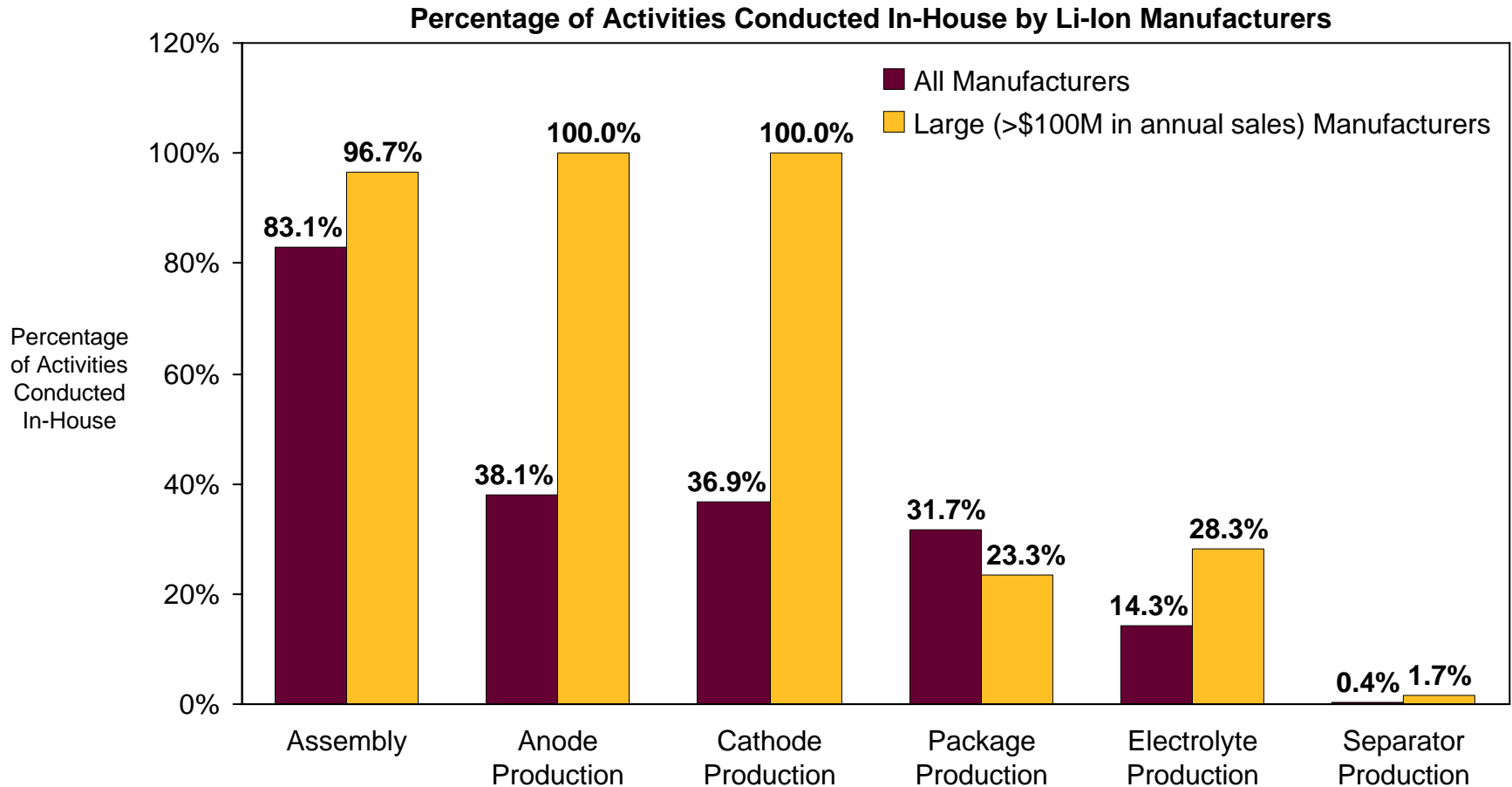
3b Controlling the Costs of Cell Components, in Particular, Is a Top Priority, Given That These Account For ~70% of Manufacturing Costs



Question: *What percentage of the total cost of a cell are the following inputs?*

Note: N = 10; All Li-Ion Manufacturers; Source: Battery Power Conference Survey, April 2007

3c Manufacturers — Especially Those With Scale — Already Perform a Large Portion of the Manufacturing Process In-House to Control Costs . . .



Question: *What percentage of the following activities do you conduct in-house?*

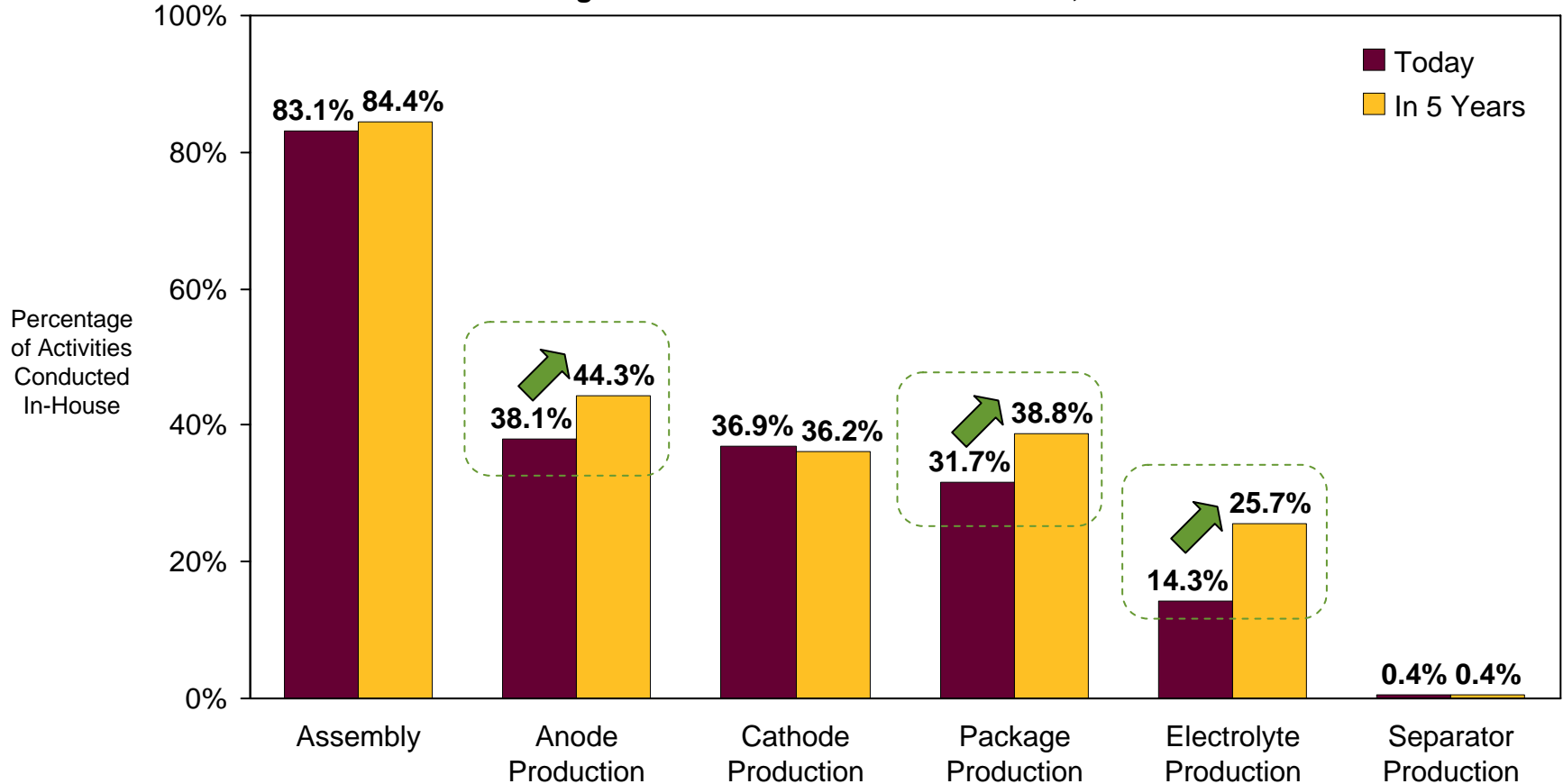
Note: N = 18; All Li-Ion Manufacturers

Source: Battery Power Conference Survey, April 2007

3c

. . . and Are Seeking to Increase This Ratio Even Further, Especially in Package, Electrolyte and Anode Production

Percentage of Activities Conducted In-House, Now and in 5 Years



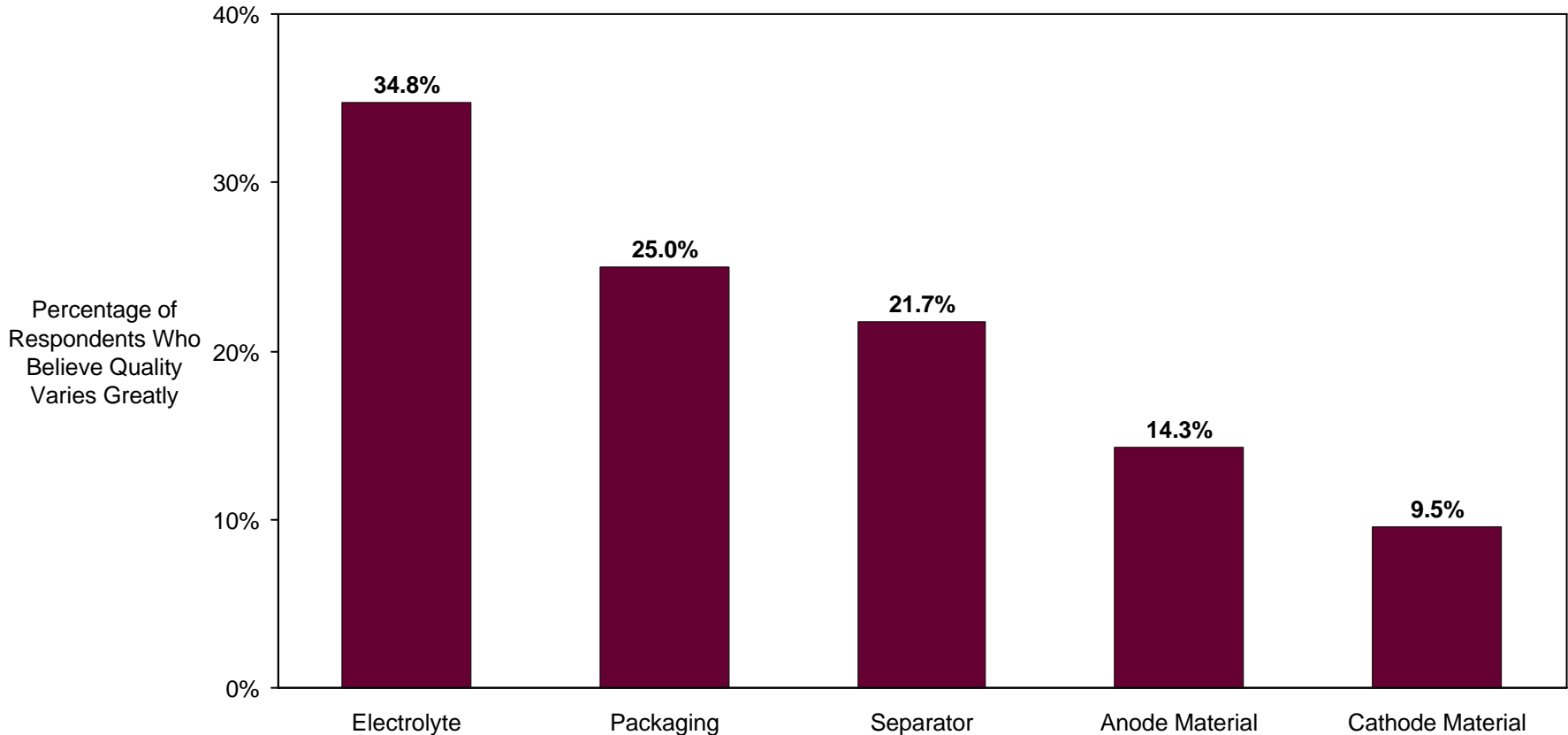
Note: N = 18; All Li-Ion Manufacturers

Source: Battery Power Conference Survey, April 2007

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3c Although, in the Case of Electrolyte, This May Be Driven by Perceptions of Significant Quality Differences (and a Desire to Better Control Quality)

Component Variety Across Suppliers as Perceived by *all Secondary Battery Manufacturers*



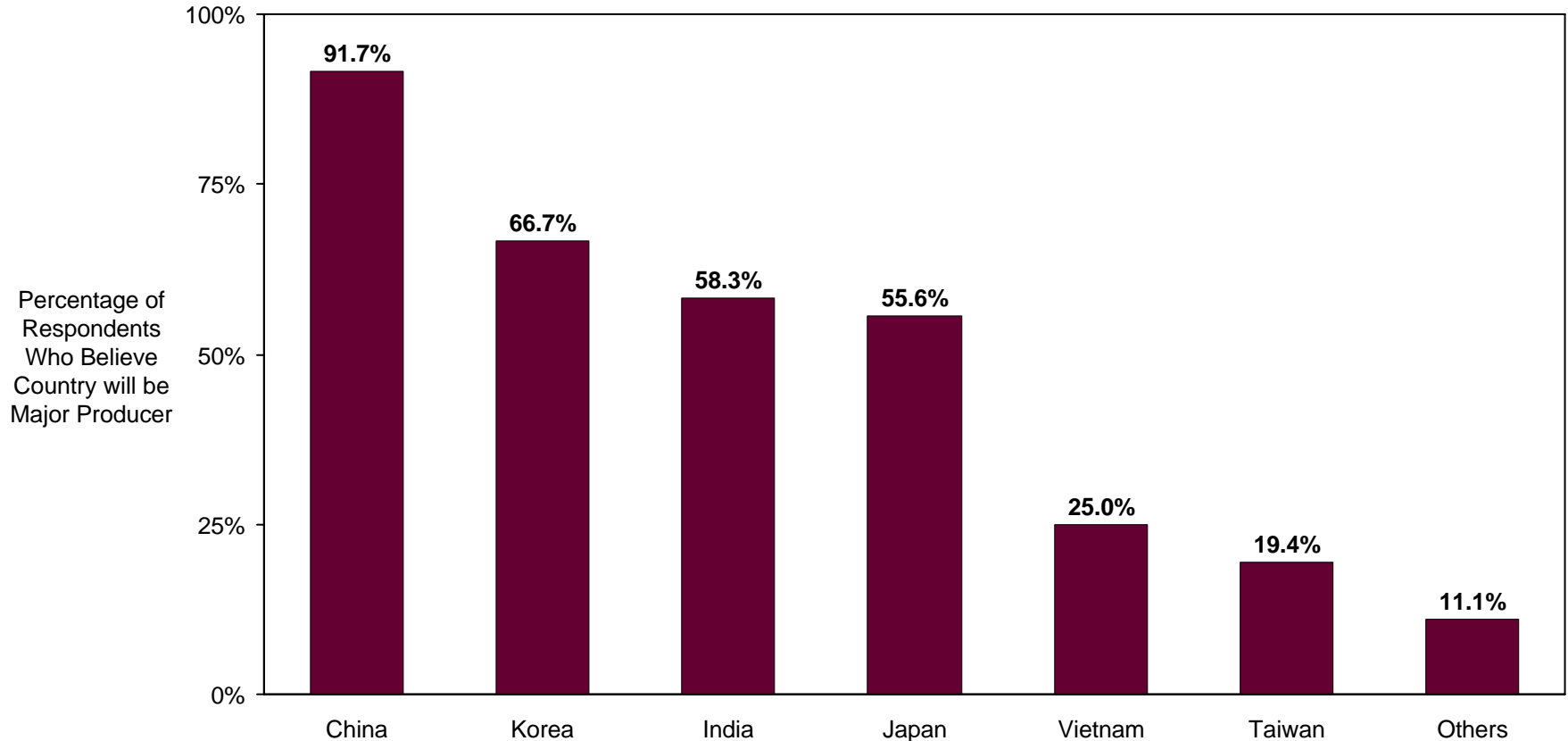
Question: *How significantly does the quality of components differ across suppliers?*

Note: N = 24; Only Secondary Battery Manufacturers; "Varies greatly" is a score of 1 or 2 on a scale of 1-5 (1. Varies greatly, 5. does not vary)

Source: Battery Power Conference Survey, April 2007

3d Manufacturers Are Increasingly Expected to Move Manufacturing Out of Higher Labor Cost Geographies, to Lower Cost Destinations

Secondary Battery Manufacturer Expectations on Locations of Production of Batteries in 5 Years



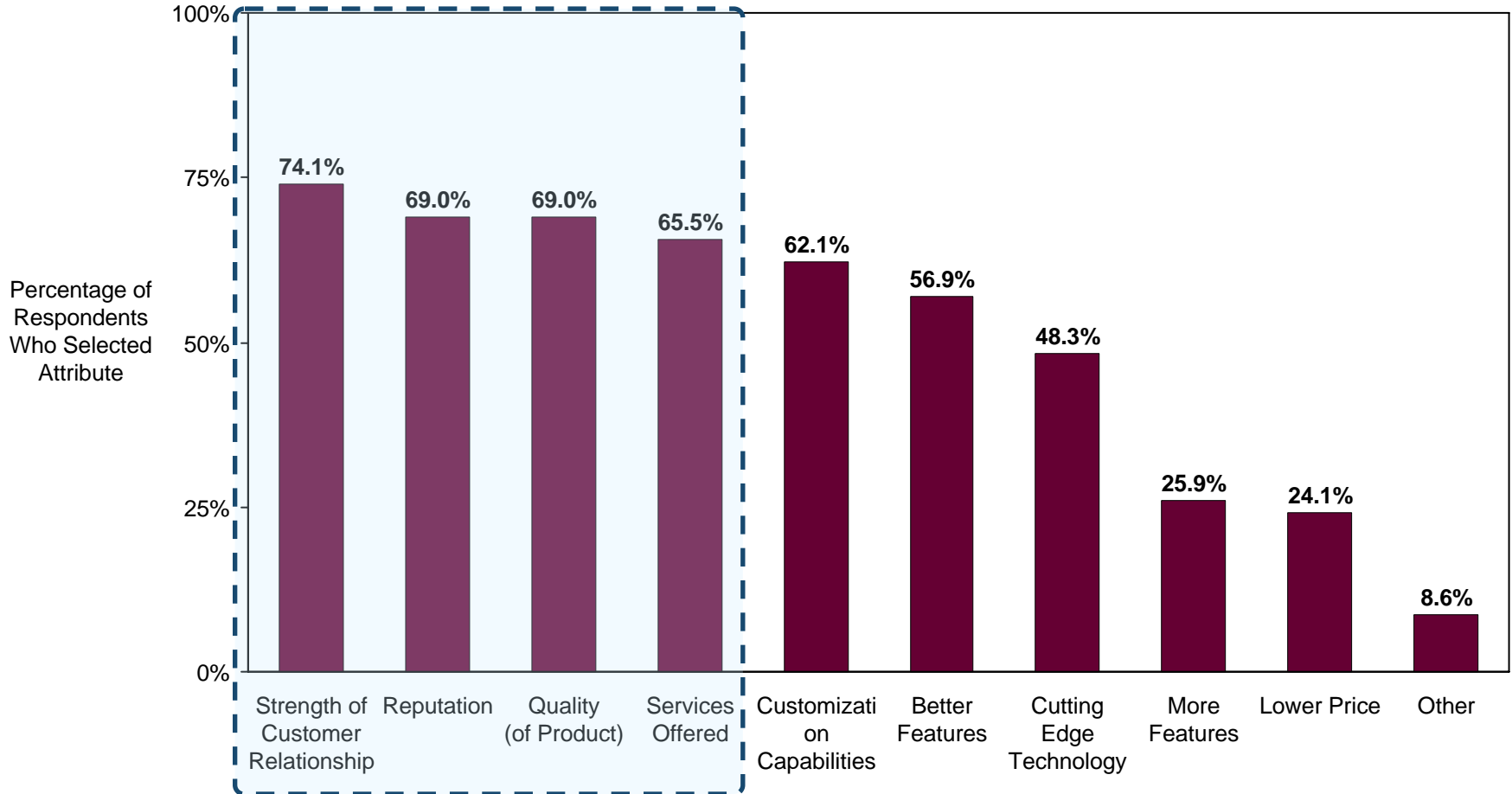
Question: *Today, most rechargeable batteries are produced in Japan, Korea, and China. Five years from now, which countries will be major producers of rechargeable batteries (greater than 5% market share)?*

Note: N = 36; Only Secondary Battery Manufacturers

Source: Battery Power Conference Survey, April 2007

3e In Addition to Striving for Operational Excellence, Manufacturers Are Attempting to Differentiate Themselves Based on Customer Service

Perceived Sources of Differentiation Across Battery Manufacturers



Question: *How do you differentiate yourself from your competitors?*

Note: N = 58; All Respondents

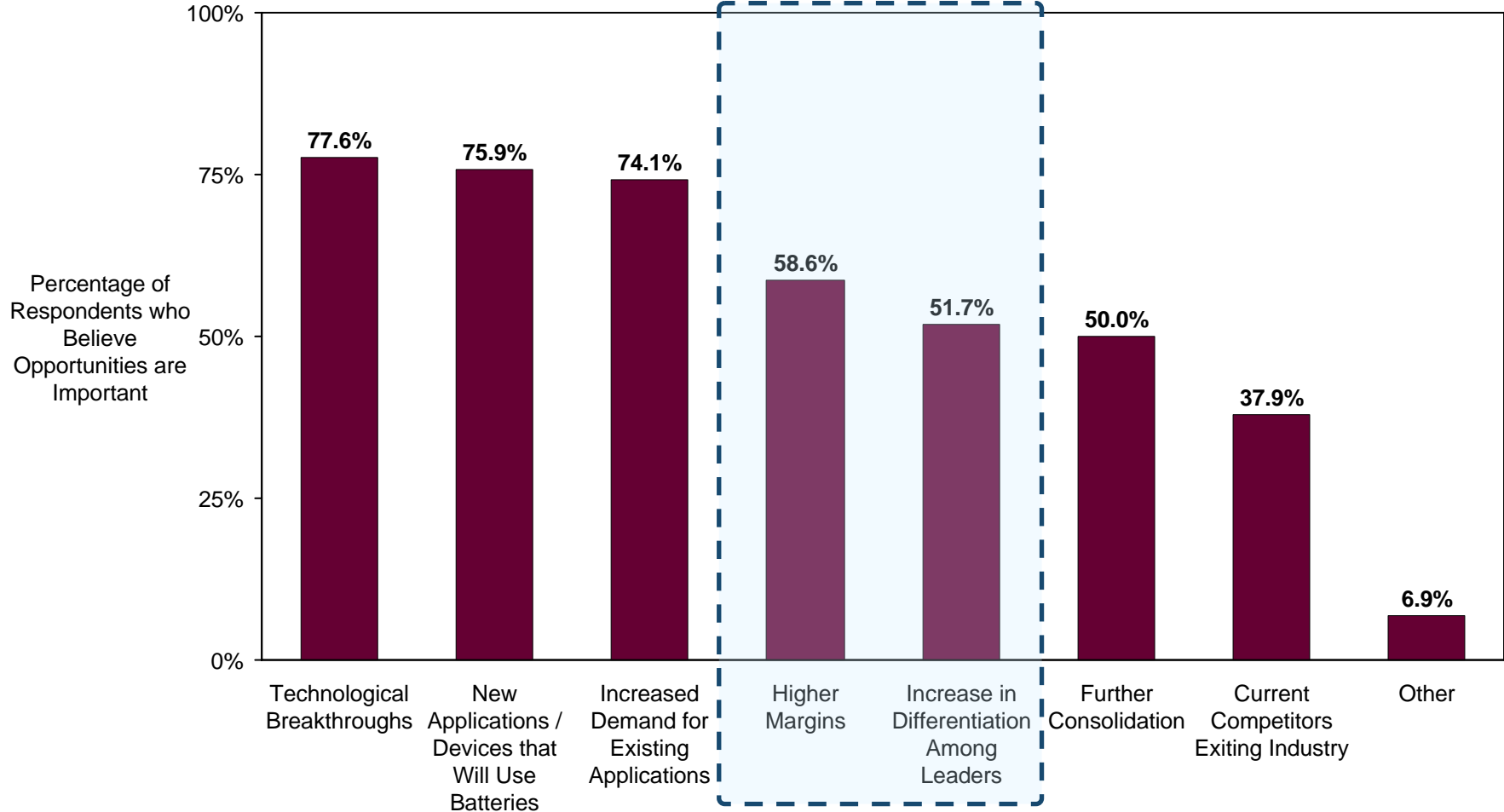
Source: Battery Power Conference Survey, April 2007

4 In the Longer Term Manufacturers Perceive Significantly Greater Likelihood of Disruptive Technologies New Sources of Demand

- a Industry participants expect more limited potential for improved margins and significant differentiation among leading players . . .
- b . . . and instead view technology disruption and increased demand from new and existing portable power applications as yielding the greatest potential for manufacturers
- c Manufacturing participants themselves expect a significantly greater threat from technology disruption in the medium term, expect increasing R&D and Capital Expenditure Requirements in the future in order to remain competitive

4a Industry Participants Expect More Limited Potential for Improved Margins and Significant Differentiation Among Leading Players . . .

Importance of Future Opportunities, In 5 Years, as Perceived by *all* Respondents



Question: *Please rate the importance of the following challenges that you / or your company see in the battery industry in 5 years*

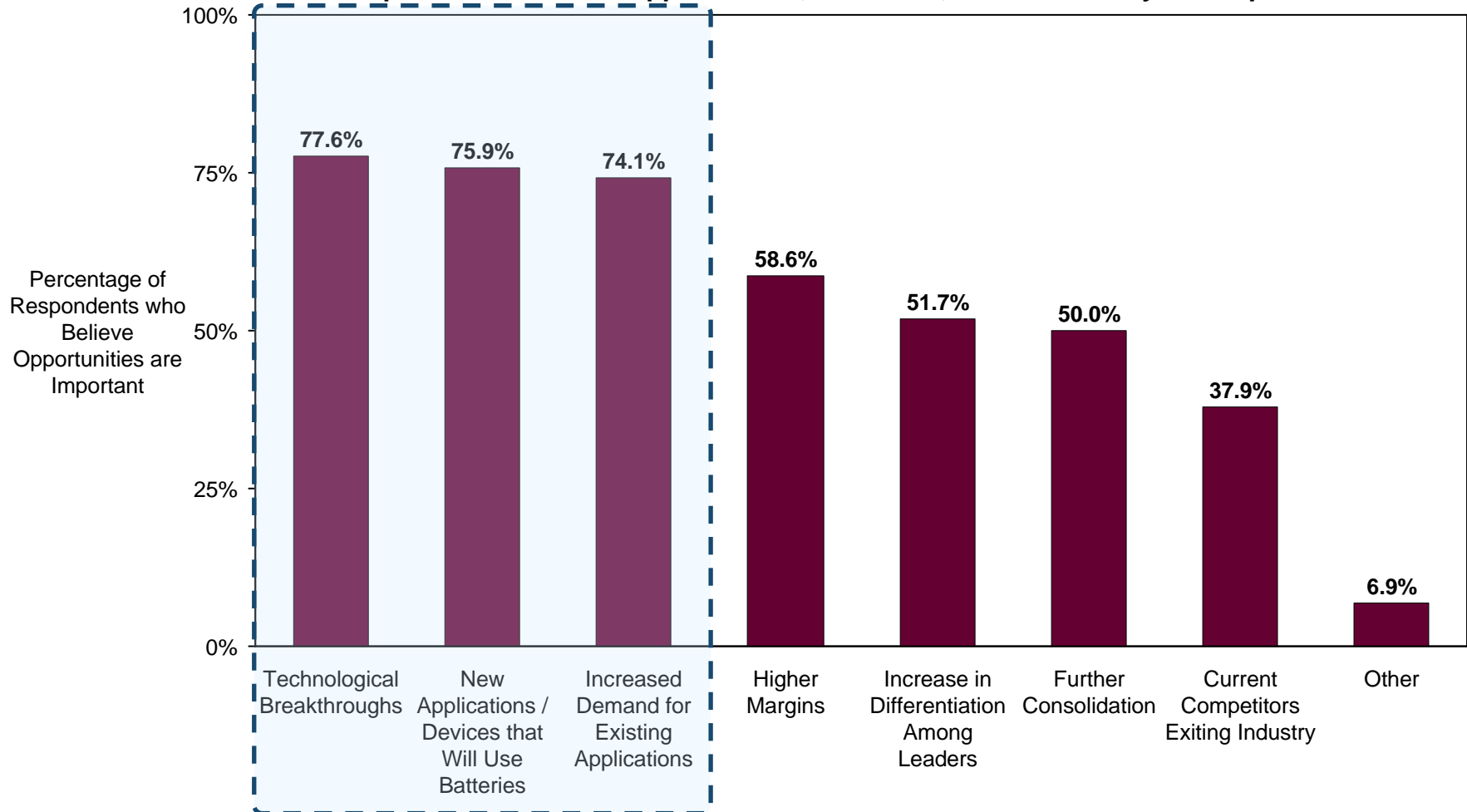
Note: N = 58; All Respondents; "Important Challenges" are those rated as a 1 or 2 on scale of 1–5 (1. Very important, 5. Not Important)

Source: Battery Power Conference Survey, April 2007

4b

. . . and Instead View Technology Disruption and Increased Demand From New and Existing Portable Power Applications as Yielding the Greatest Potential

Importance of Future Opportunities, In 5 Years, as Perceived by *all* Respondents



Question: *Please rate the importance of the following challenges that you / or your company see in the battery industry in 5 years*

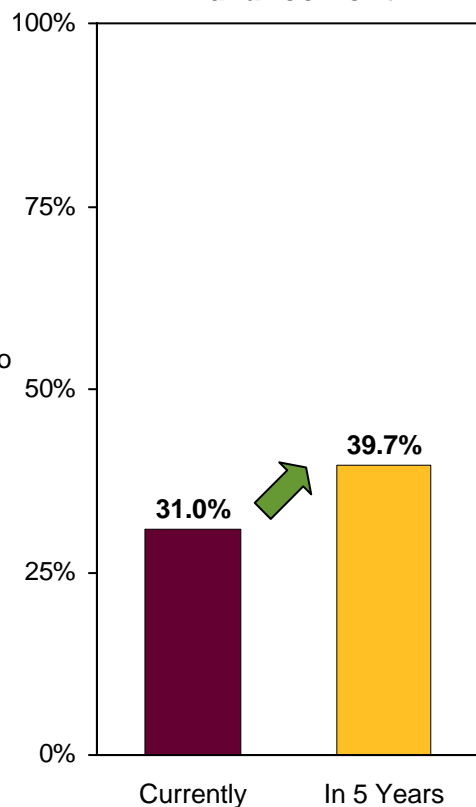
Note: N = 58; All Respondents; "Important Challenges" are those rated as a 1 or 2 on scale of 1–5 (1. Very important, 5. Not Important)

Source: Battery Power Conference Survey, April 2007

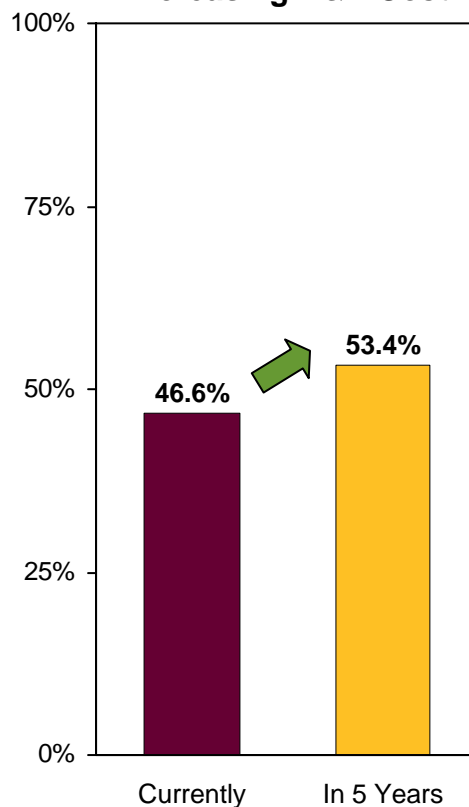
4c **Manufacturers Expect Greater Threat From Technology Disruption in the Medium Term, and Anticipate Increasing R&D and CapEx to Remain Competitive** Confidential

Importance of Challenges in Battery Industry, Today and in 5 Years as Perceived by all Respondents

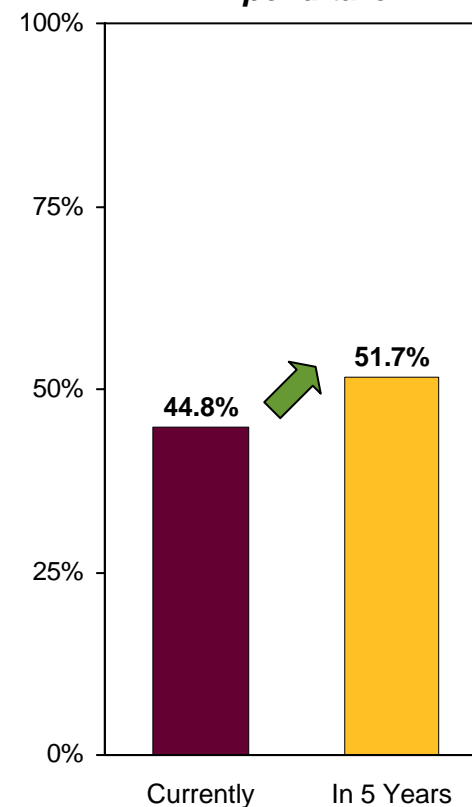
Very Difficult to Differentiate Batteries Through Technological Advancement



Increasing R&D Cost



Increasing Capital Expenditure



Percentage of Respondents who Believe Challenges are Important

Question: *Please rate the importance of the following challenges that you / or your company see in the battery industry in Today / 5 years*

Note: N = 58; All Respondents; "Important Challenges" are those rated as a 1 or 2 on scale of 1–5 (1. Very important, 5. Not Important)

Source: Battery Power Conference Survey, April 2007