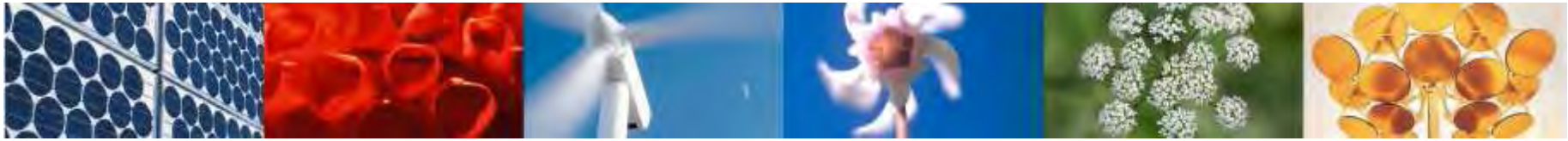

Battery Charger Systems

Test Procedure, Call for Data, & Proposed Standards

April 8, 2008

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April 8, 2008

Battery Charger Systems
Test Procedure, Call for Data, & Proposed Standards

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Agenda

- Background and History
- Test Procedure
- Call for Data
- Tentatively Proposed Standards

Background and History

What is a Battery Charger System?

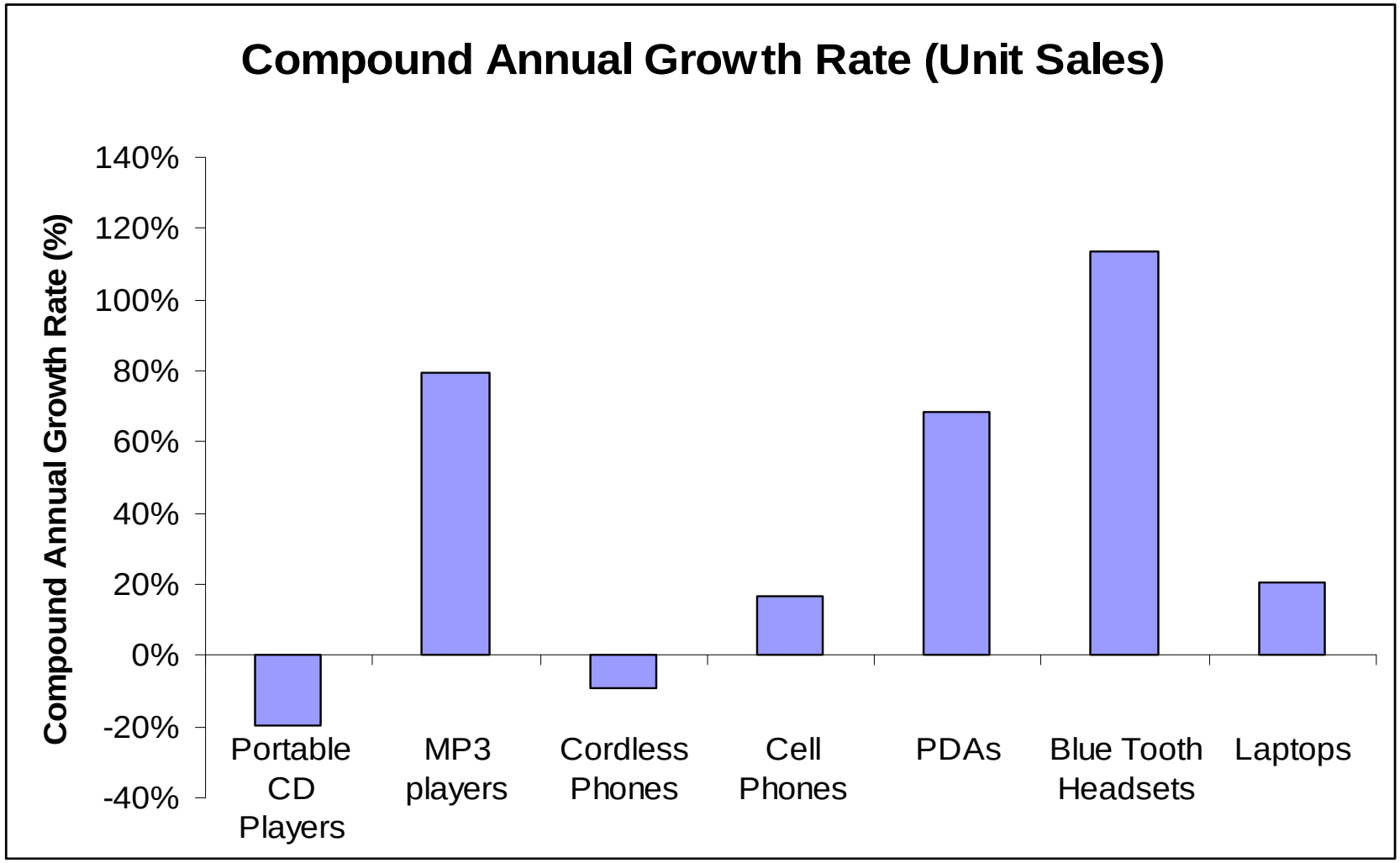
Battery Charger System (BCS)

- Battery chargers coupled with their batteries are together referred to as ***battery charger systems***. This term covers all rechargeable batteries or devices incorporating a rechargeable battery and the chargers used with them.

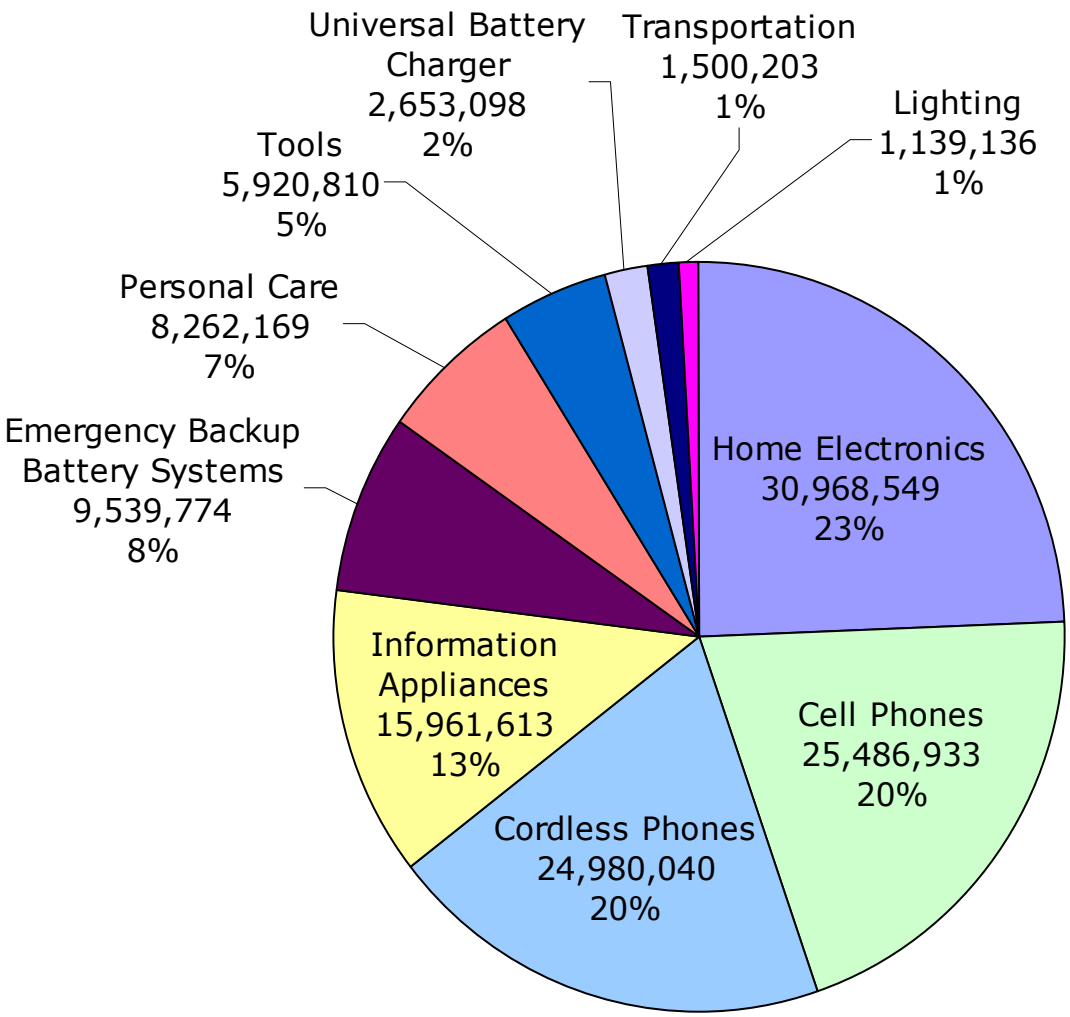
Battery Charger Product Categories

(1) Home Electronics ▸**Audio** ▸**Toys** ▸**Video** ▸**Two-Way Radios**	(2) Cell Phones ▸**Cell Phones** ▸**Cell Phone Accessories**	(3) Cordless Phones	(4) Information Appliances ▸**Laptop** ▸**Other Data Devices** ▸**Business Equipment**	(5) Emergency Backup Battery Systems ▸**Lighting** ▸**Power** ▸**Security**
(6) Personal Care ▸**Oral Care** ▸**Hair Trimmers** ▸**Shavers**	(7) Tools ▸**Electric House wares** ▸**Outdoor Appliances** ▸**Power Tools**	(8) Universal Battery Chargers ▸**Marine** ▸**RV/General Use** ▸**AA/AAA/9V**	(9) Transportation ▸**Forklift** ▸**Personal Electric Vehicle** ▸**Golf Carts/Electric Carts** ▸**Electric Cars**	(10) Lighting ▸**Lanterns** ▸**Flashlights**

Sales Trends of Fastest Growing/Declining Product Categories



CA Stock Estimates



- **Over 126 million products in California**
- **Over 9 products per California household**

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Prior History
Test Procedure Development

Procedure in development for four years, representing input from dozens of stakeholders, including EPA ENERGY STAR and DOE

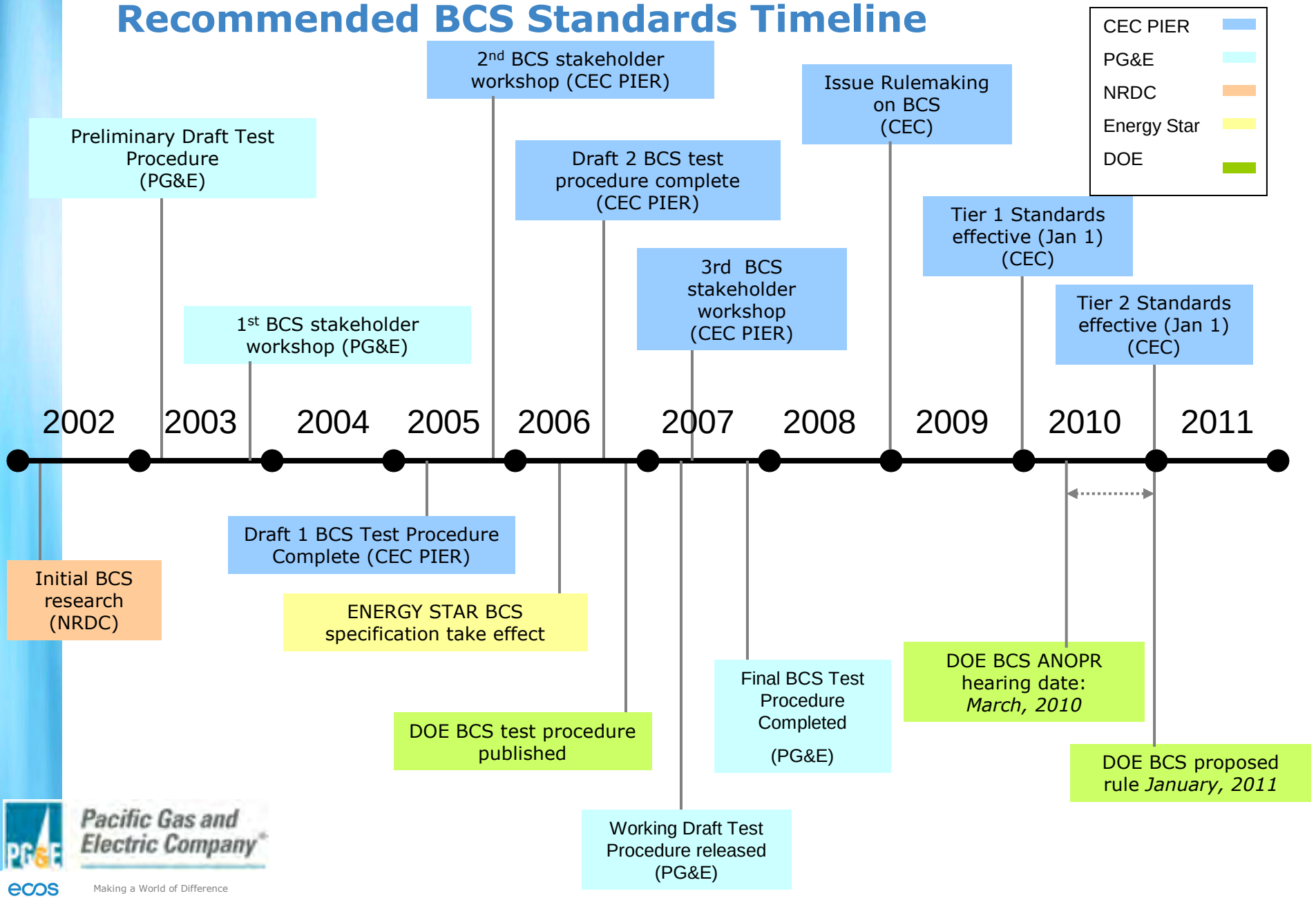
Updated Version 1.1 as of March 5, 2008 covers batteries that do not have a rated charge capacity

Available at www.EfficientProducts.org/bchargers/ along with comment and response document for final revisions

Extensive Data Gathering and Prior Research

- Ecos and EPRI tested and measured over 60 products from the different product categories using the recently approved BCS test procedure
- Total dataset, including legacy research from Ecos, EPRI, and Cadmus Group includes over 250 battery charger measurements
- Dataset includes 24-hour Charge-Maintenance-Discharge Efficiency, Maintenance Mode Power, and No Battery Mode Power

Recommended BCS Standards Timeline



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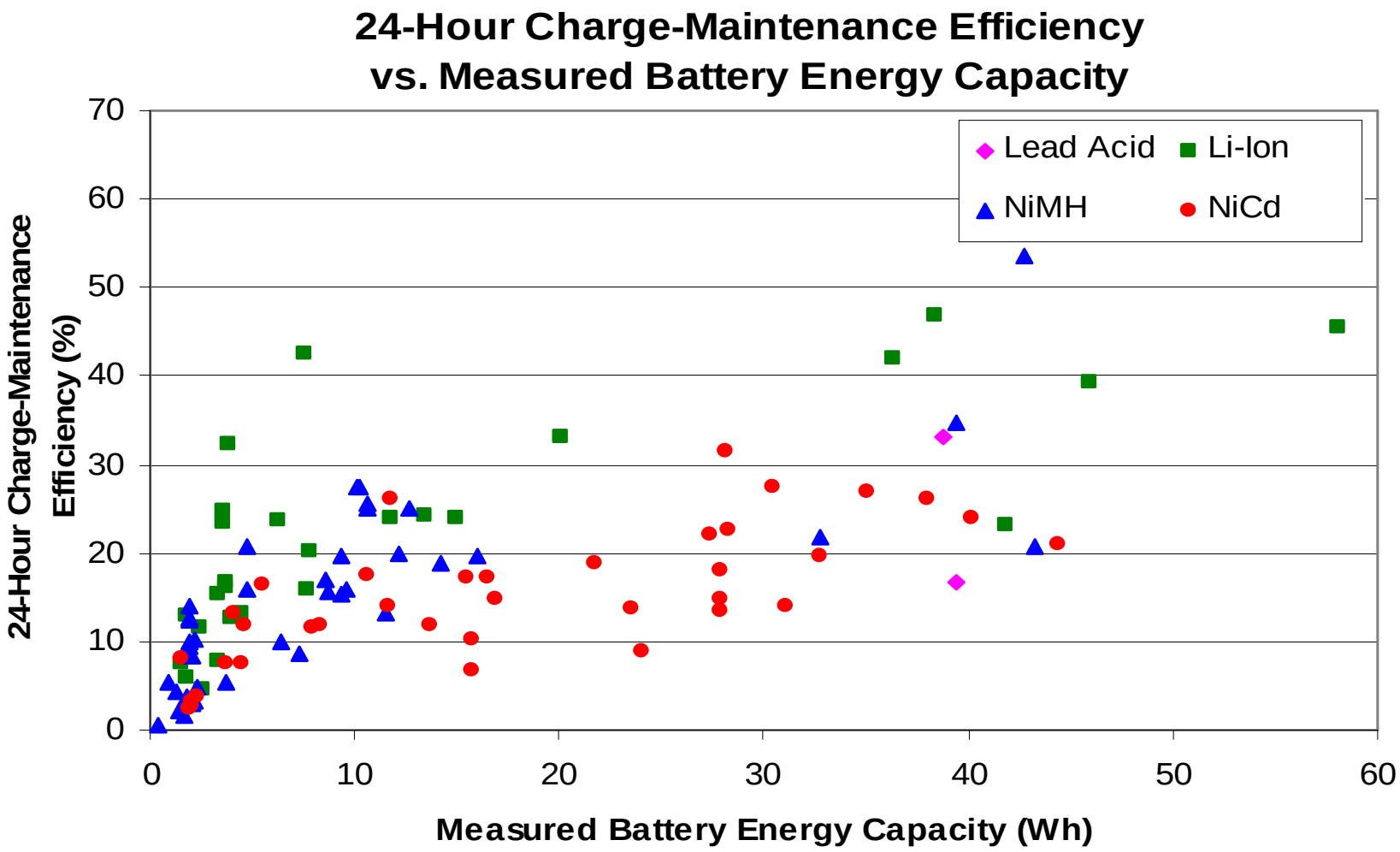
Test Procedure

Snapshot of Current Dataset



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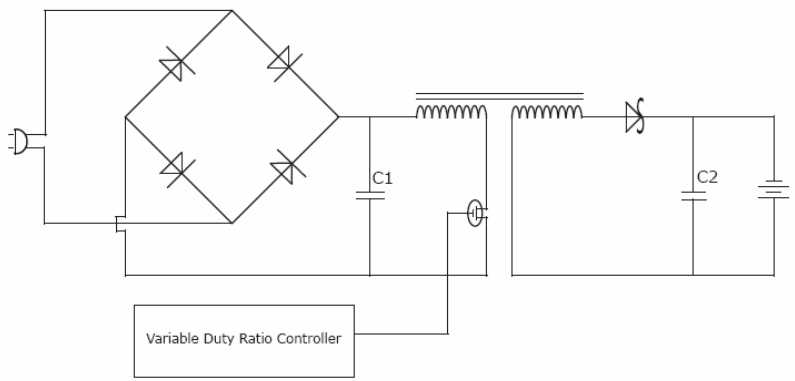
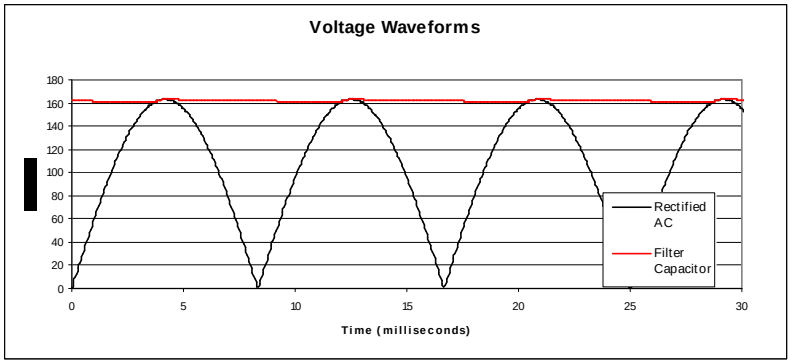
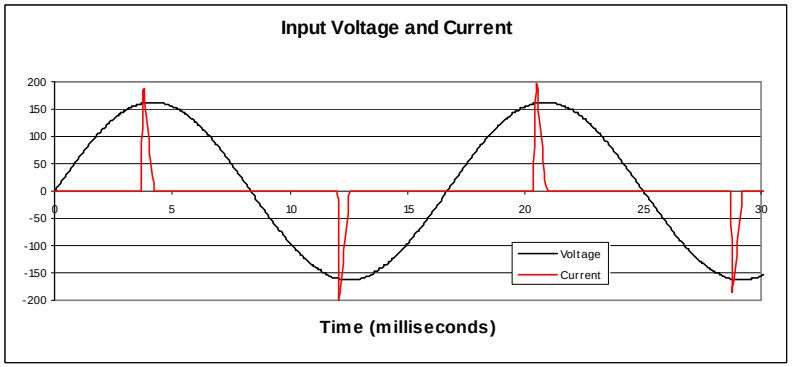
Updates to Test Procedure

- **Batteries without a rated charge capacity**
  - About 30% of products tested
  - Determine an appropriate discharge current
- **Three-phase and over 2kW**
  - Determine if scope can be extended
  - Requesting data and comments
  - Significant savings potential in this category also

Power Factor for Battery Chargers







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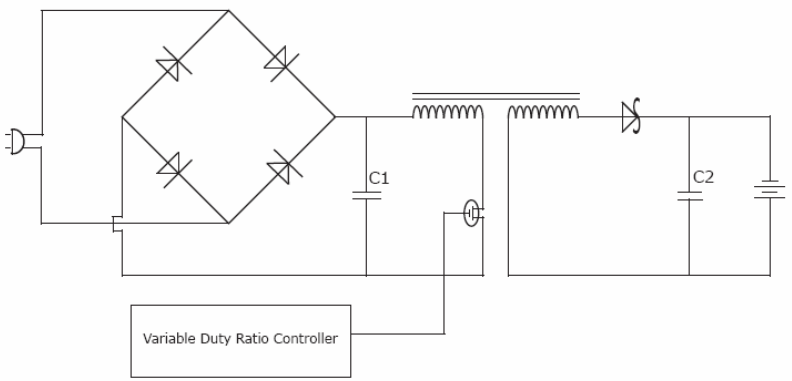
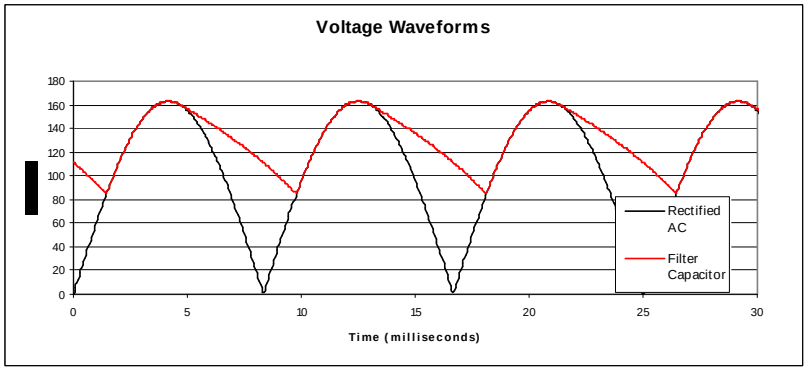
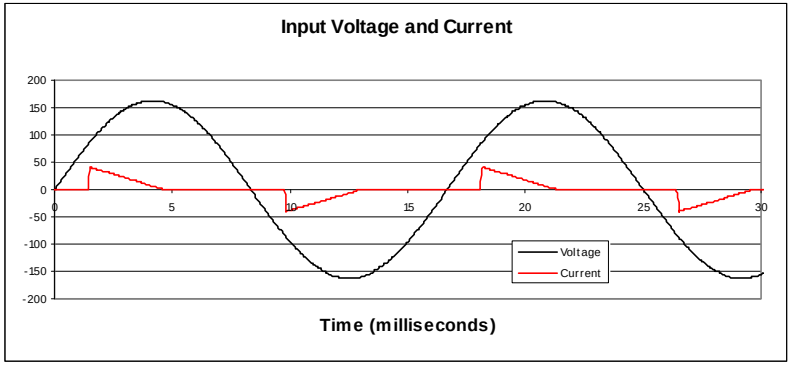
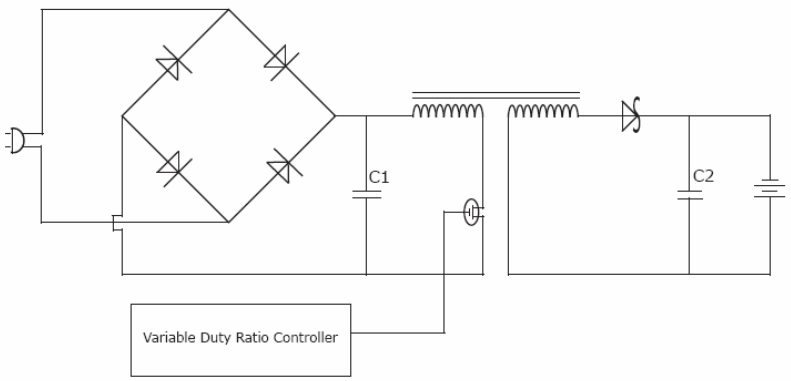
Power Factor for Battery Chargers

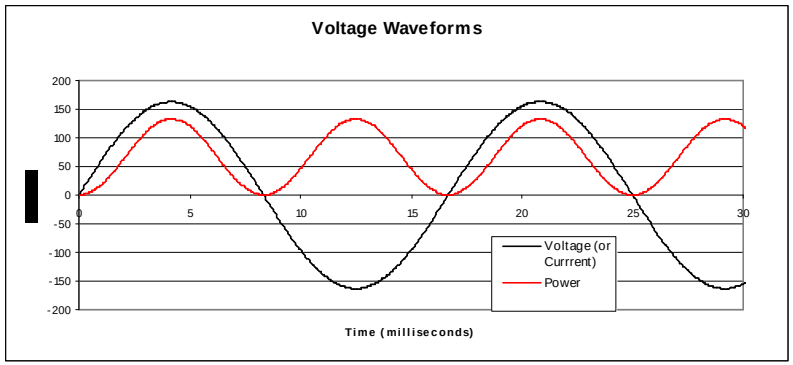






Power Factor for Battery Chargers





Recommended Action

- **Adopt the Battery Charger Test Procedure**
  - Provides proven and reliable techniques for measuring energy consumption in all operating modes
- **Call for data from all interested parties, to be submitted by May 16, 2008**
  - Seeking data on all categories of products to ensure a representative sample
  - Particularly interested in test data on large chargers, including 3-phase and over 2 kW
  - Also interested in test data on any products with special requirements
  - Proposed language for data request is included in proposal submitted to CEC by PG&E, Energy Solutions and Ecos.

Break

Tentatively Proposed Standards

Standards Concepts

- **Three components: Active, Maintenance and No Battery**
- **Active mode considers battery energy:**

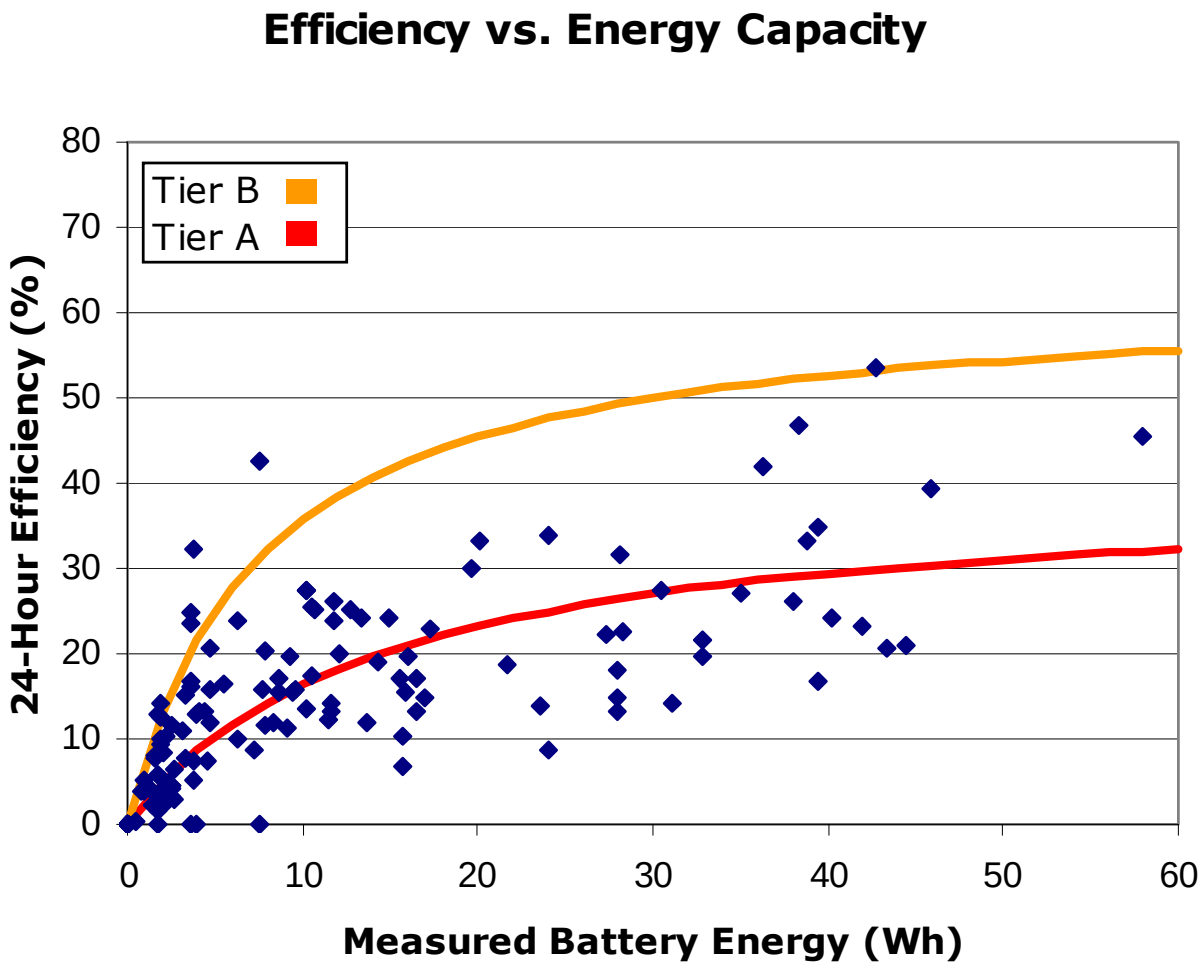
$$Eff = \frac{E_{batt}}{E_{24}} \geq \frac{E_{batt}}{a + b * E_{batt}}$$

- **Can also be considered as an energy budget:**

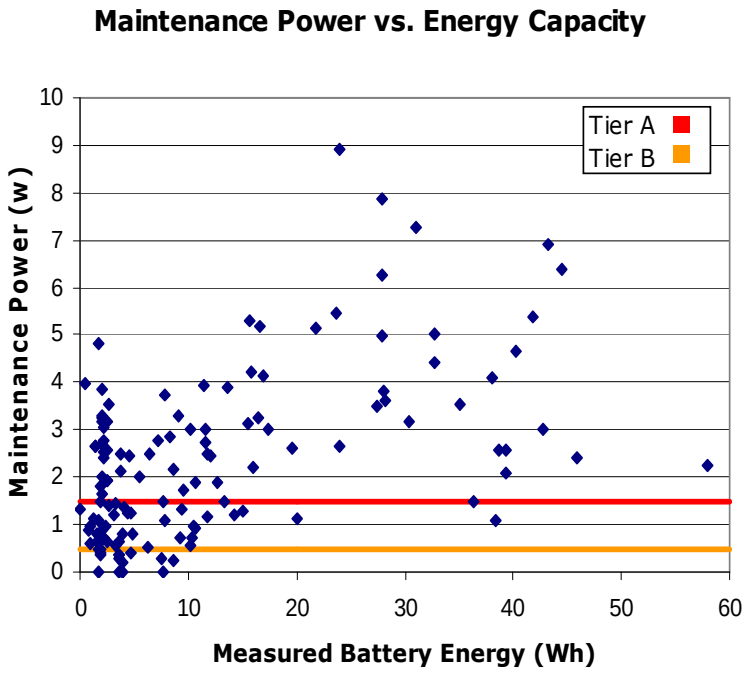
$$E_{24} \leq a + b * E_{batt}$$

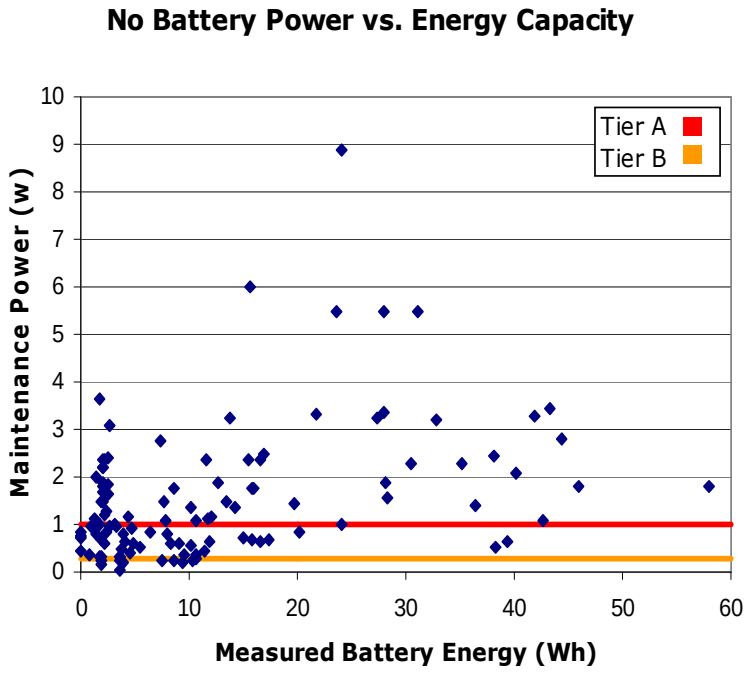
- **Staged Standards**
  - Near Term, removes least efficient chargers
  - Later standard for improved efficiency

Standards Concepts



Standards Concepts





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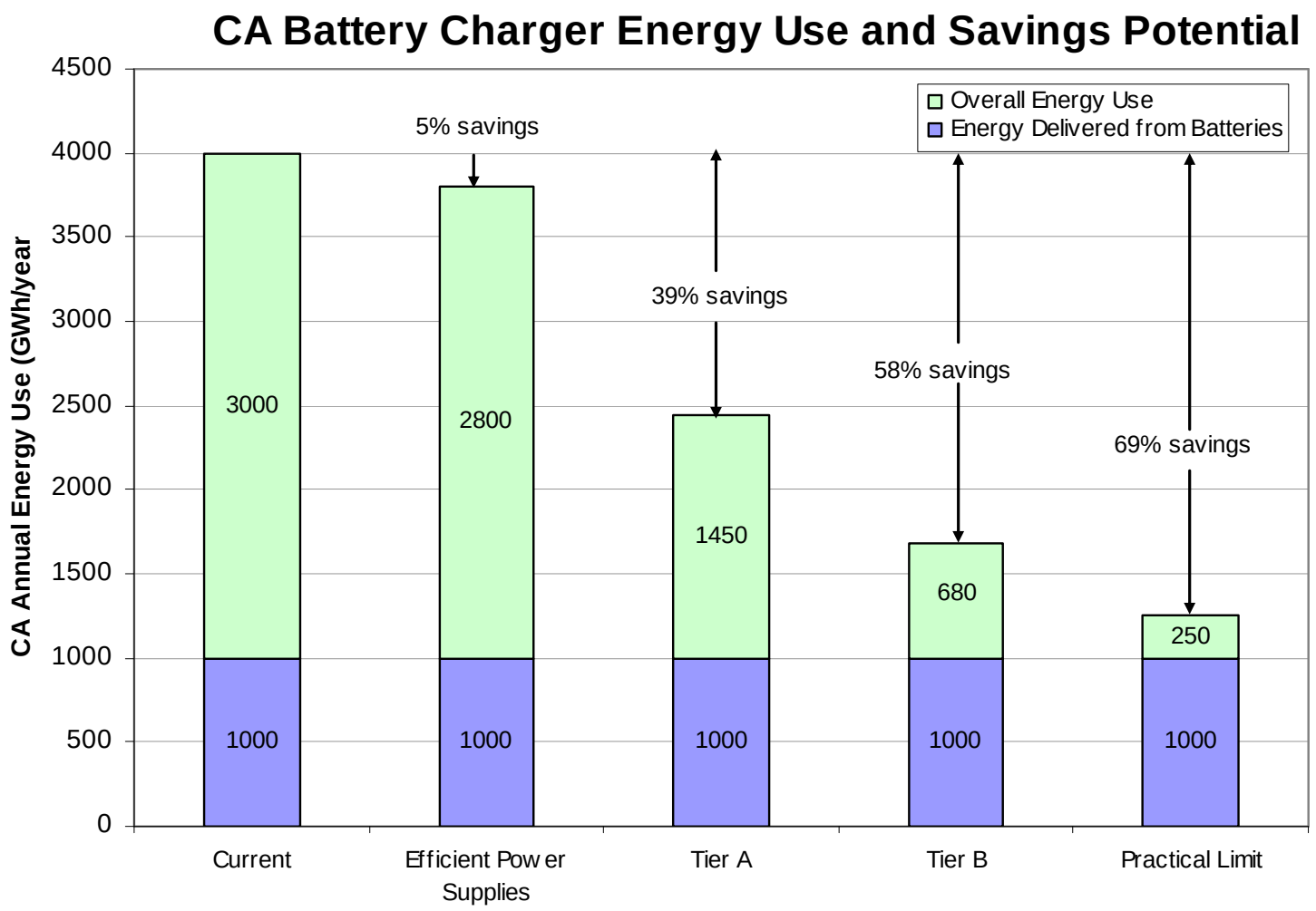

- **Potential to reduce BCS energy use by 39% (1.55 TWh/year) even with early, less stringent standards**

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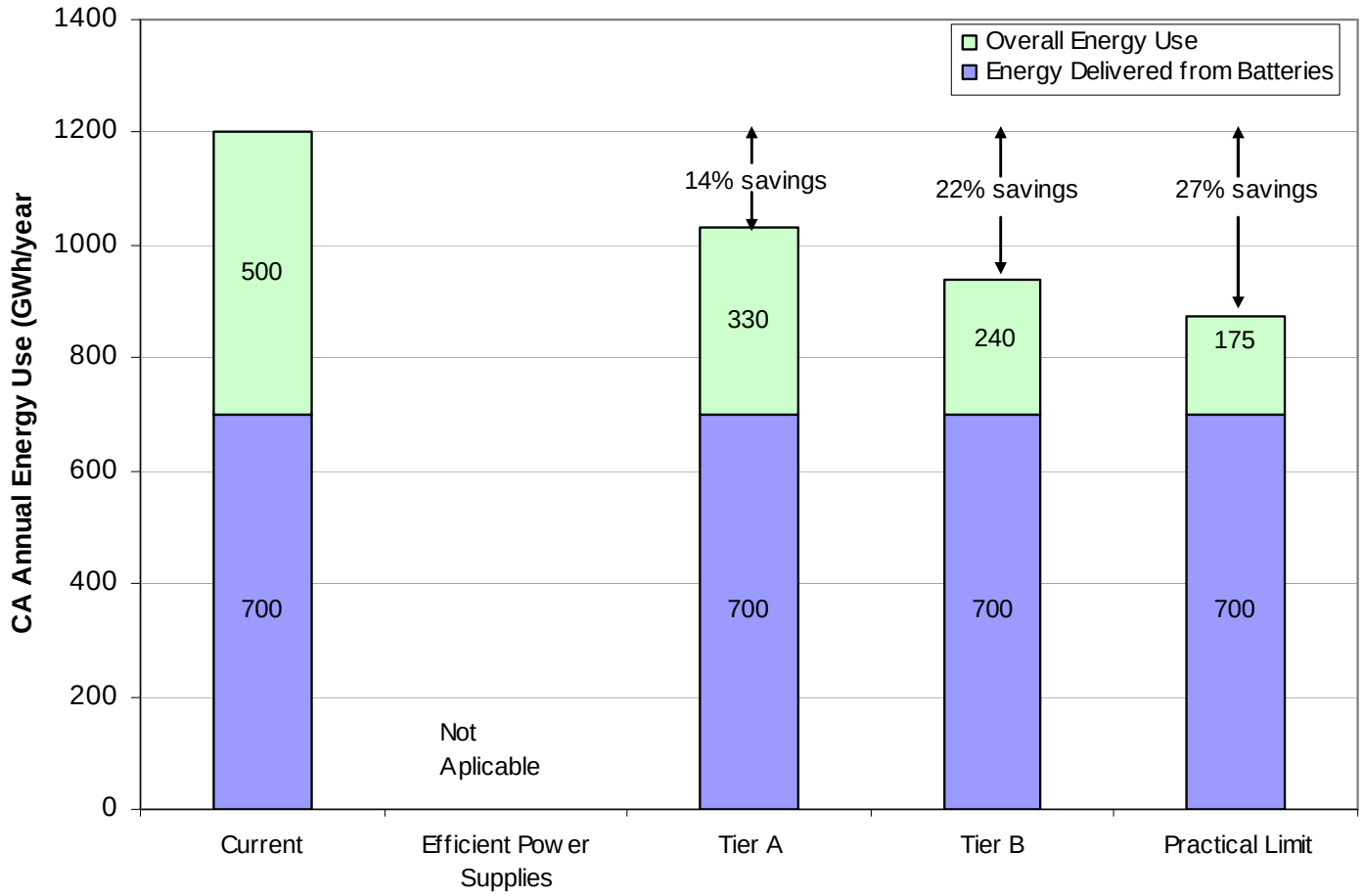
Large 1-Phase Battery Chargers



- Large chargers (golf carts, forklifts, and electric vehicles) have significant potential for savings.

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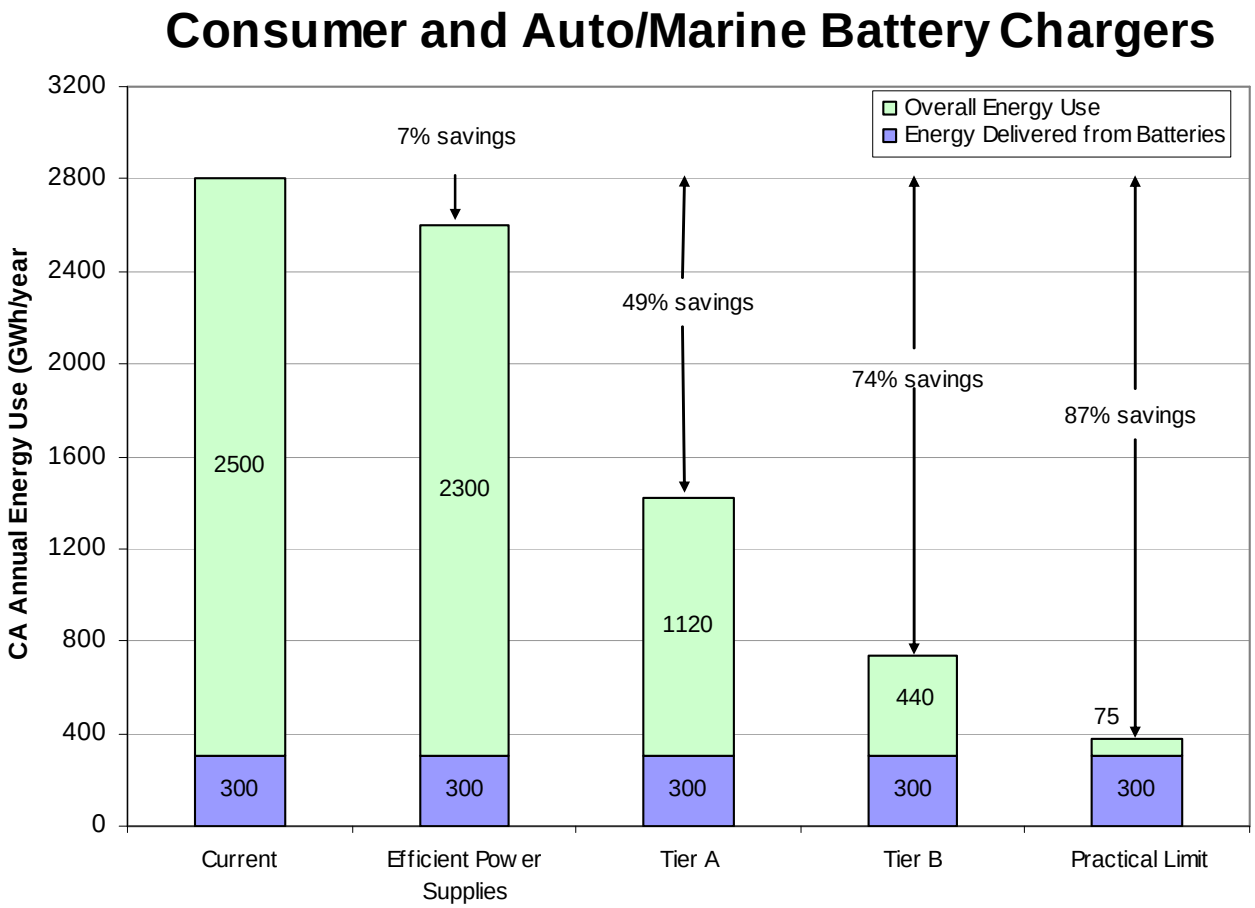
CA Energy Use and Savings Potential



- Small chargers for consumer products have low efficiencies and present an opportunity for large energy savings.

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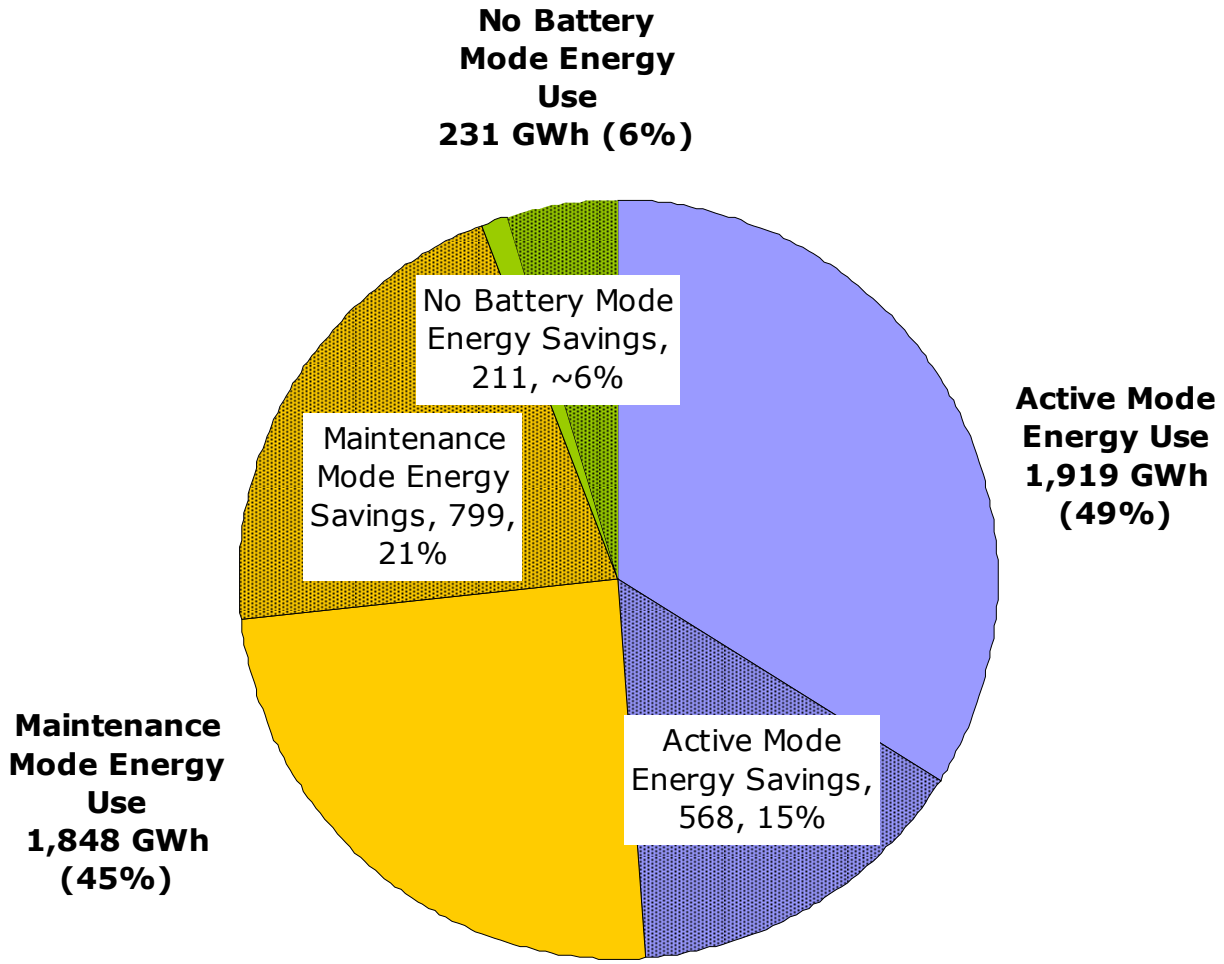
CA Battery Charger Annual Energy Use and Savings by Mode



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Efficient Design Strategies

1. Don’t continue to charge batteries are already fully charged
2. Reduce standby power when not actively charging the battery
3. Use an efficient power conversion process, including an efficient power supply
4. Use power factor correction

- These recommendations can be achieved through multiple design paths

Economic Analysis

Product Examples – Power Tools

Product A	Product B	Product C
NiCd battery	Li-Ion battery	Li-Ion Battery
11.8% 24-hr Efficiency	23.7% 24-hr Efficiency	42.6% 24-hr Efficiency
Maintenance Mode: 2.8W	Maintenance Mode: 0.5W	Maintenance Mode: 0.28W
No Battery Mode: 0.6W	No Battery Mode: 0.42	No Battery Mode: 0.2W
Purchase Price: $23.99	Purchase Price: $34.97	Purchase Price: $95.99
Difference in Technology: Charging Circuitry Incremental Cost: Minimal		

Economic Analysis

Product Examples – Universal Chargers

Product A	Product B
NiMH batteries	NiMH batteries
13.1% 24-hr Efficiency	27.5% 24-hr Efficiency
Maintenance Mode: 2.74W	Maintenance Mode: 0.7W
No Battery Mode: 2.4W	No Battery Mode: 0.2W
Purchase Price: $25.00	Purchase Price: $20.49
Difference in Technology: Charging Technology	
Incremental Cost: Minimal to none	

Economic Analysis

Product Examples – Cordless Phones

Product A (Base Unit Only)	Product B
NiMH batteries	Li-Poly Battery
3.64% 24-hr Efficiency	5.80% 24-hr Efficiency
Maintenance Mode: 1.82W	Maintenance Mode: 1.07W
No Battery Mode: 1.47W	No Battery Mode: 1.00W
Purchase Price: $54.99	Purchase Price: $65.99
Difference in Technology: Battery Chemistry, Charging Circuitry	
Incremental Cost: Minimal	

Economic Analysis

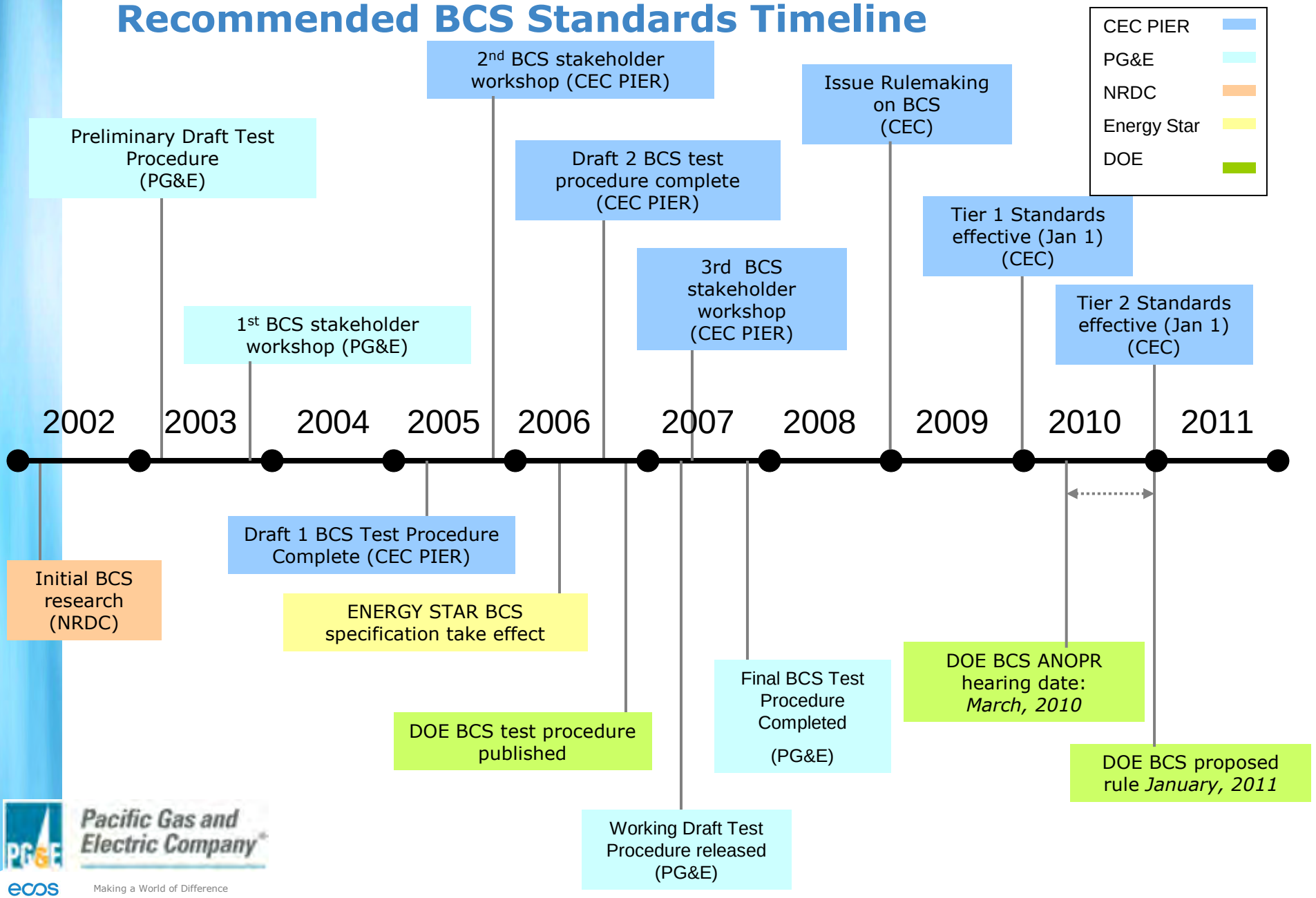
Product Examples – Two-Way Radios

Product A	Product B
NiMH batteries	Li-Ion Battery
10%-20% 24-hr Efficiency	20%-24% 24-hr Efficiency
Maintenance Mode: 2.43W	Maintenance Mode: 1.3W
No Battery Mode: 1.15W	No Battery Mode: .74W
Purchase Price: $69.95	Purchase Price: $79.95
Difference in Technology: Battery Chemistry, Charging Technology	
Incremental Cost: Minimal	

Products with Unique Requirements

- Some types of products may need energy allowances, but should not be excluded from standards.

Recommended BCS Standards Timeline



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