

Battery Capacity and Charge Mode Battery Charger Power Consumption

June 21, 2005

Chris Calwell

calwell@ecosconsulting.com

970-259-6801 x301

Director of Policy and Research

Ecos Consulting

New Battery Charger Measurements Ongoing...



Li-Ion power tool charger

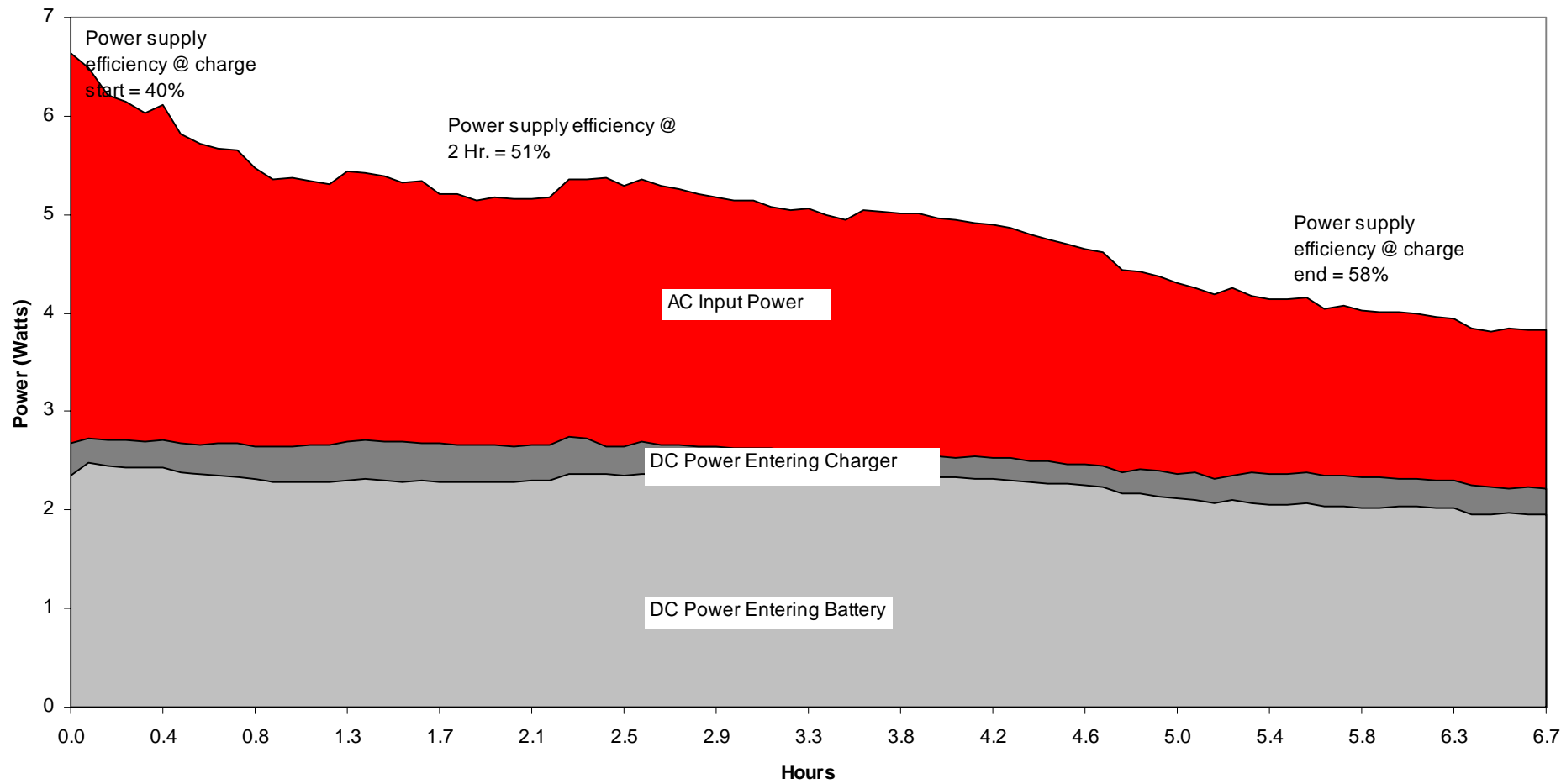


NiCd power tool chargers



Cordless hygiene products

Power Conversion Durring a Cordless Tool Battery Charge Cycle



Power supply efficiency @ charge start = 40%

Power supply efficiency @ 2 Hr. = 51%

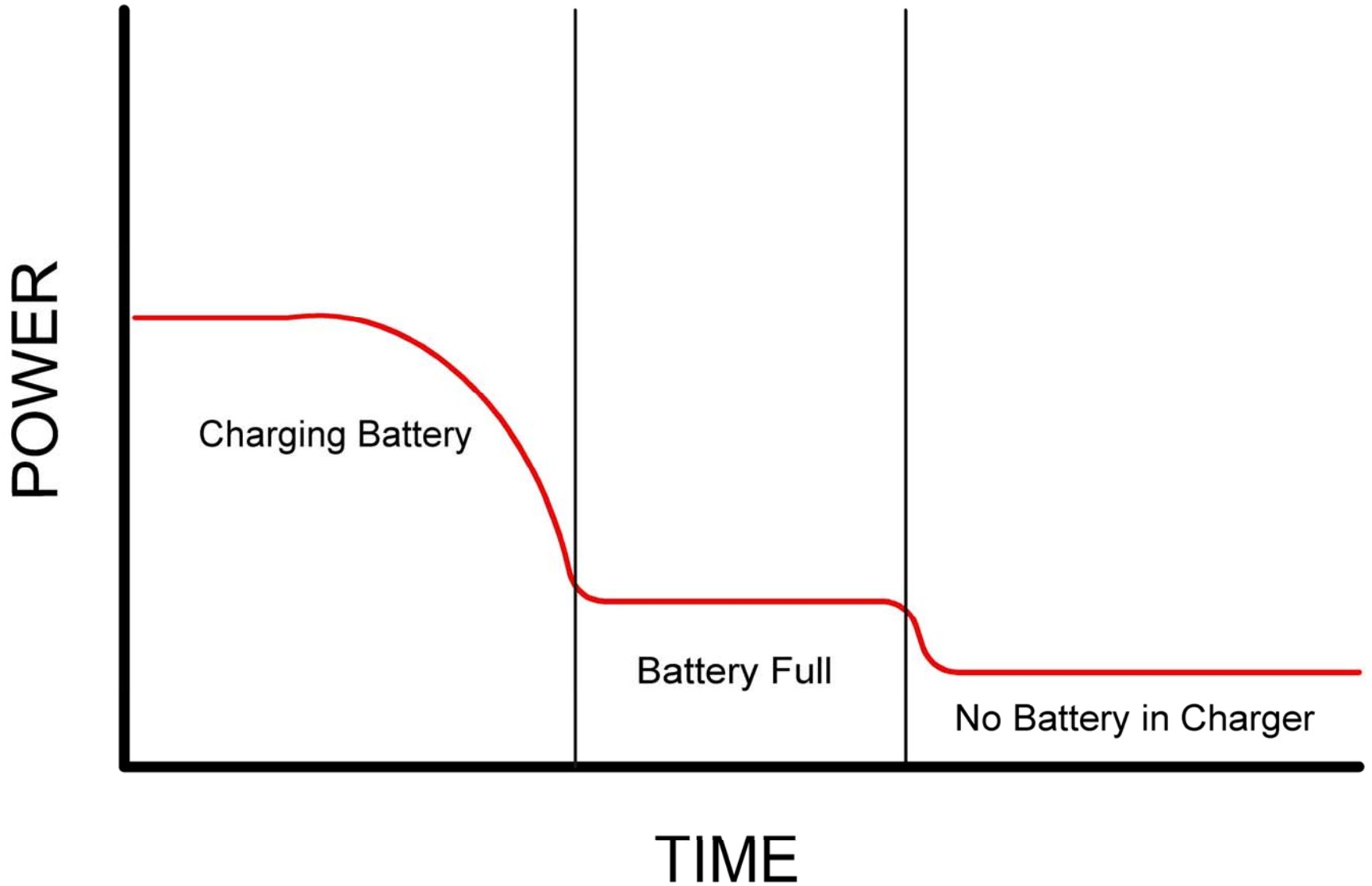
Power supply efficiency @ charge end = 58%

AC Input Power

DC Power Entering Charger

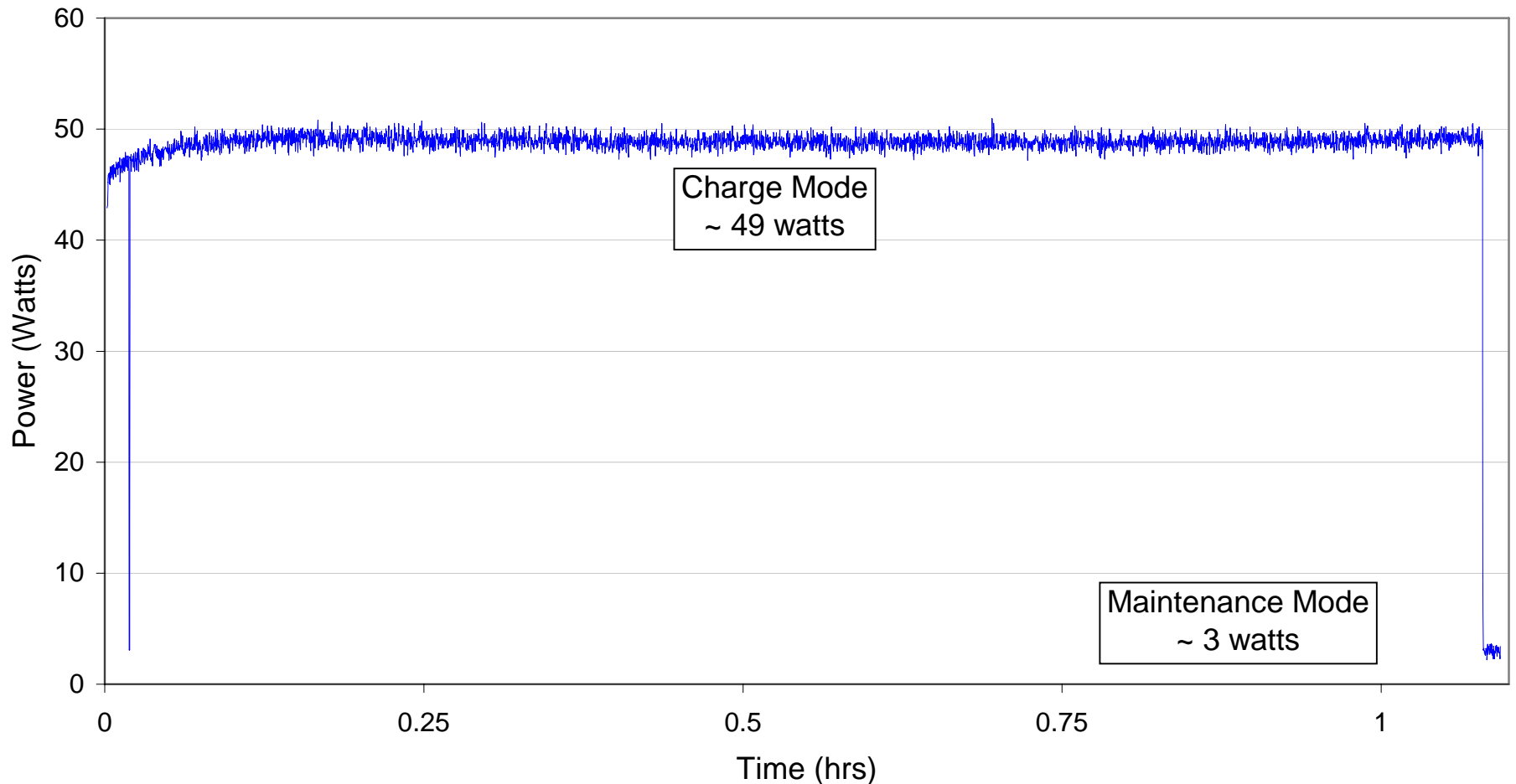
DC Power Entering Battery

AC Energy Input



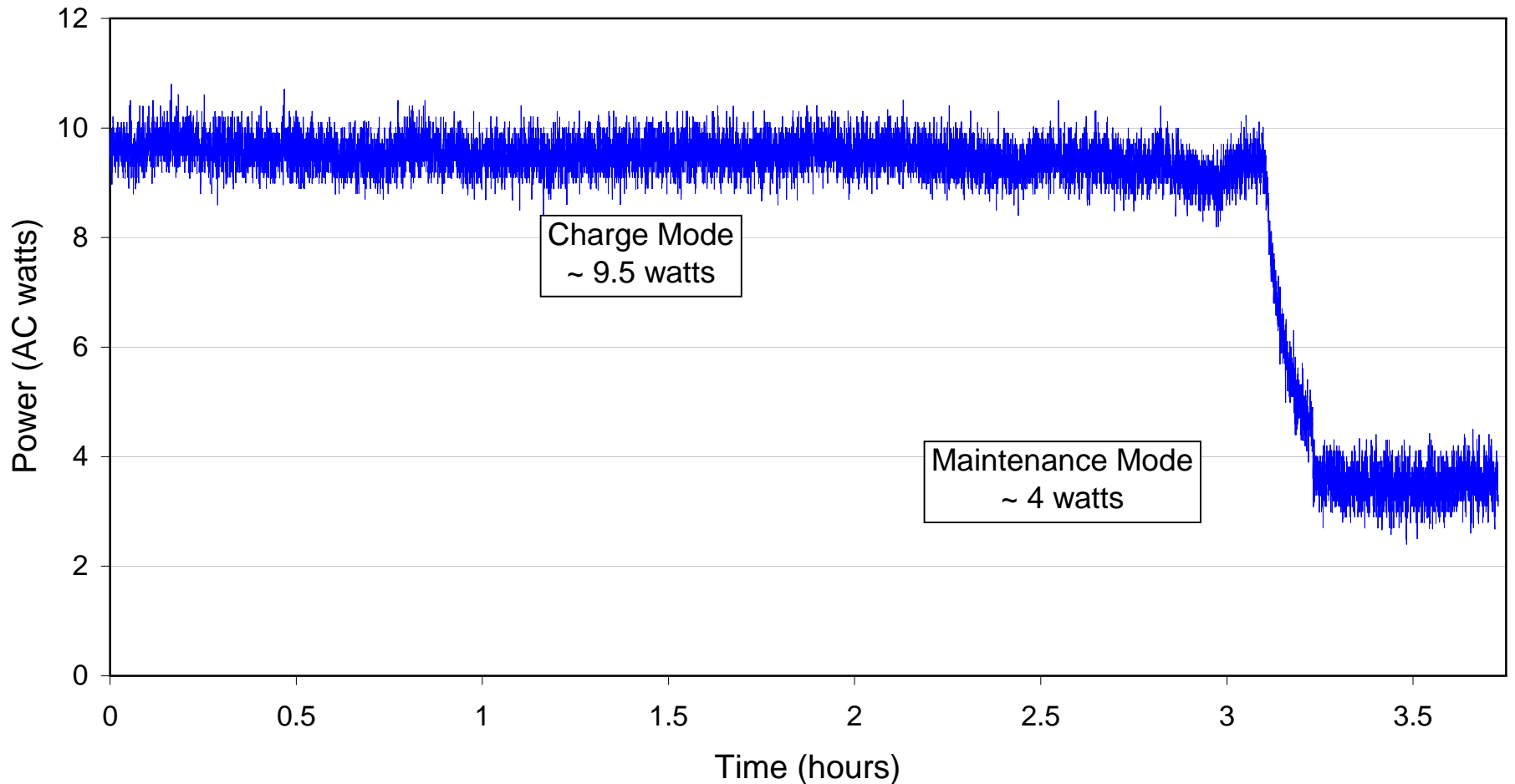
Big differences between charge and maintenance mode power use in fast chargers

Charge for 14.4V NiMH Power Tool Battery Charger



Not all Lithium Ion Chargers Have Low Power Use in Battery Maintenance Mode

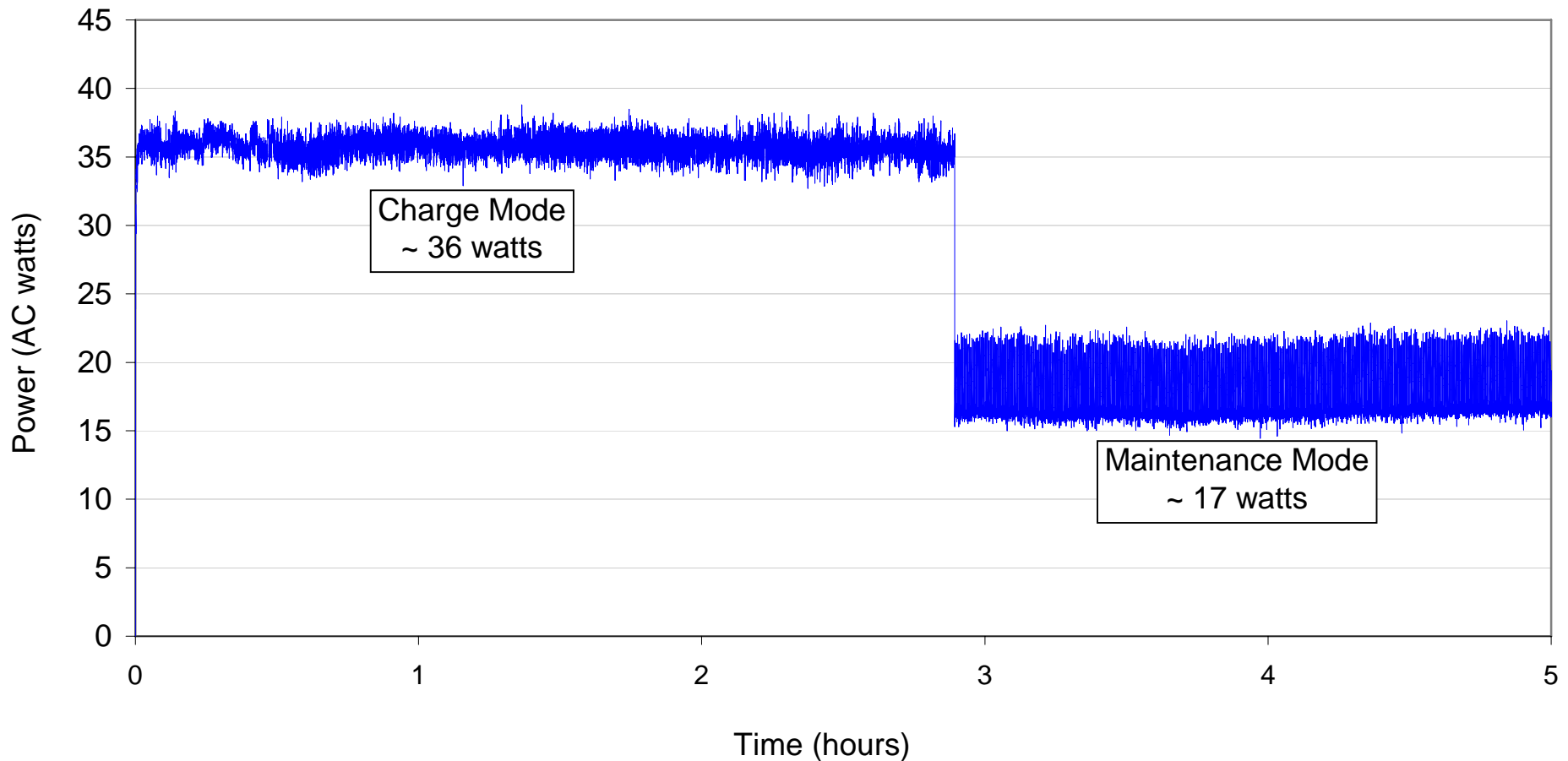
Charge for 10.8V Li-Ion Multipurpose Tool Battery Charger





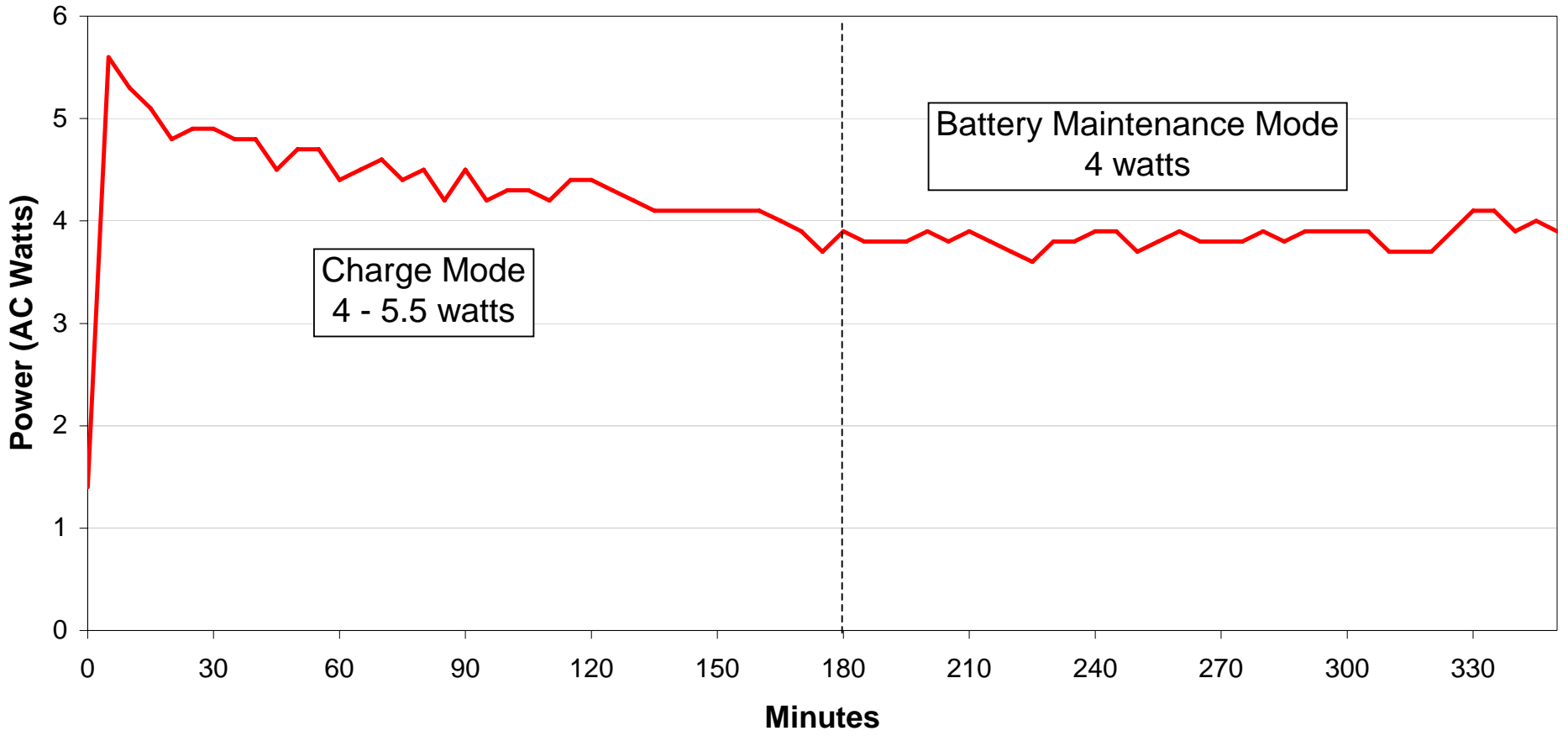
In some products, power use high in all “low power” modes, even with extra features switched off

Charge for 12V Power Tool Battery Charger/Portable Stereo

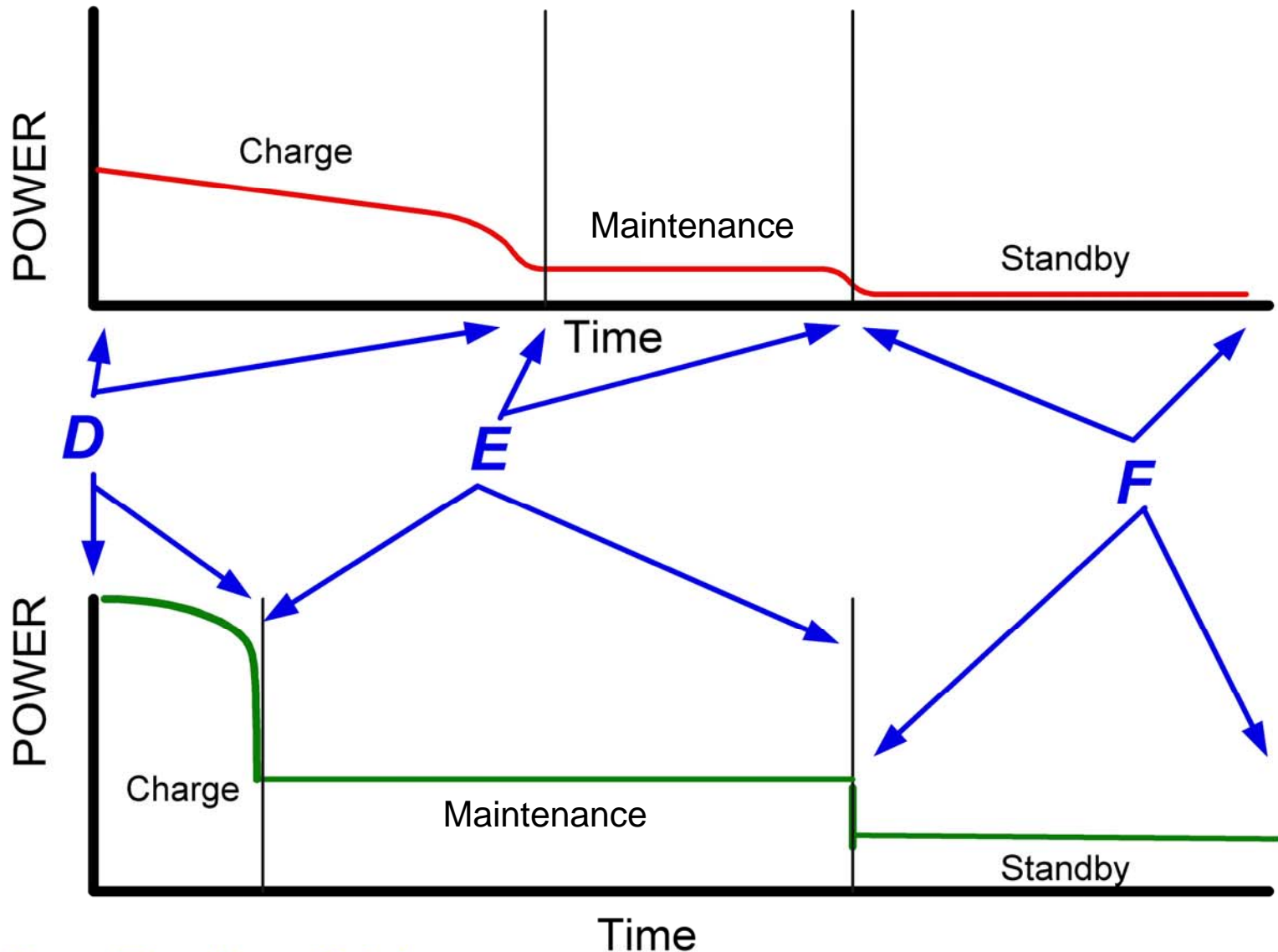


In some consumer battery chargers,
little difference between charge and maintenance

Charge Curve for 9.7 Volt Cordless Drill NiCd Battery Charger

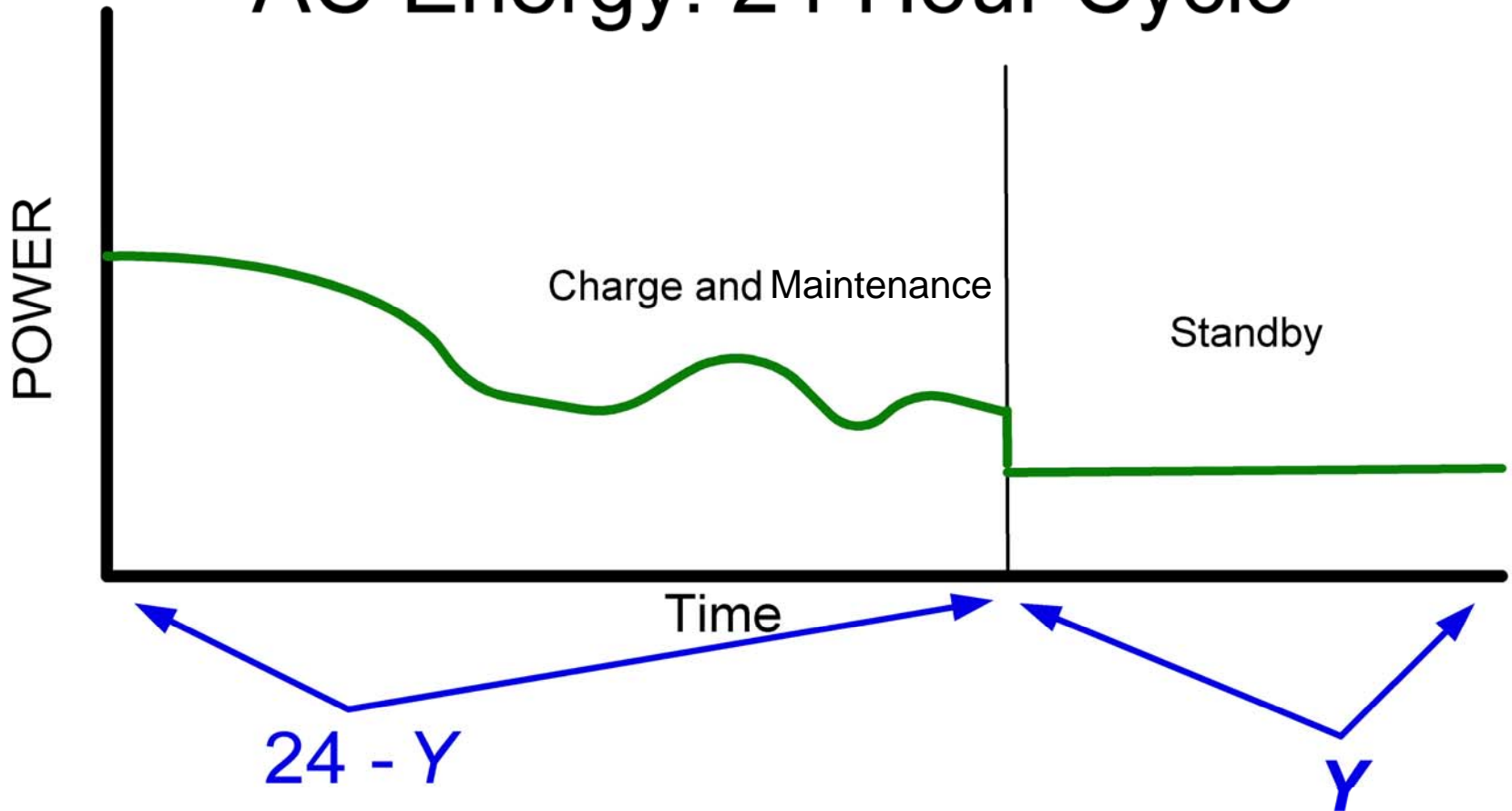


AC Energy: 24 Hour Cycle

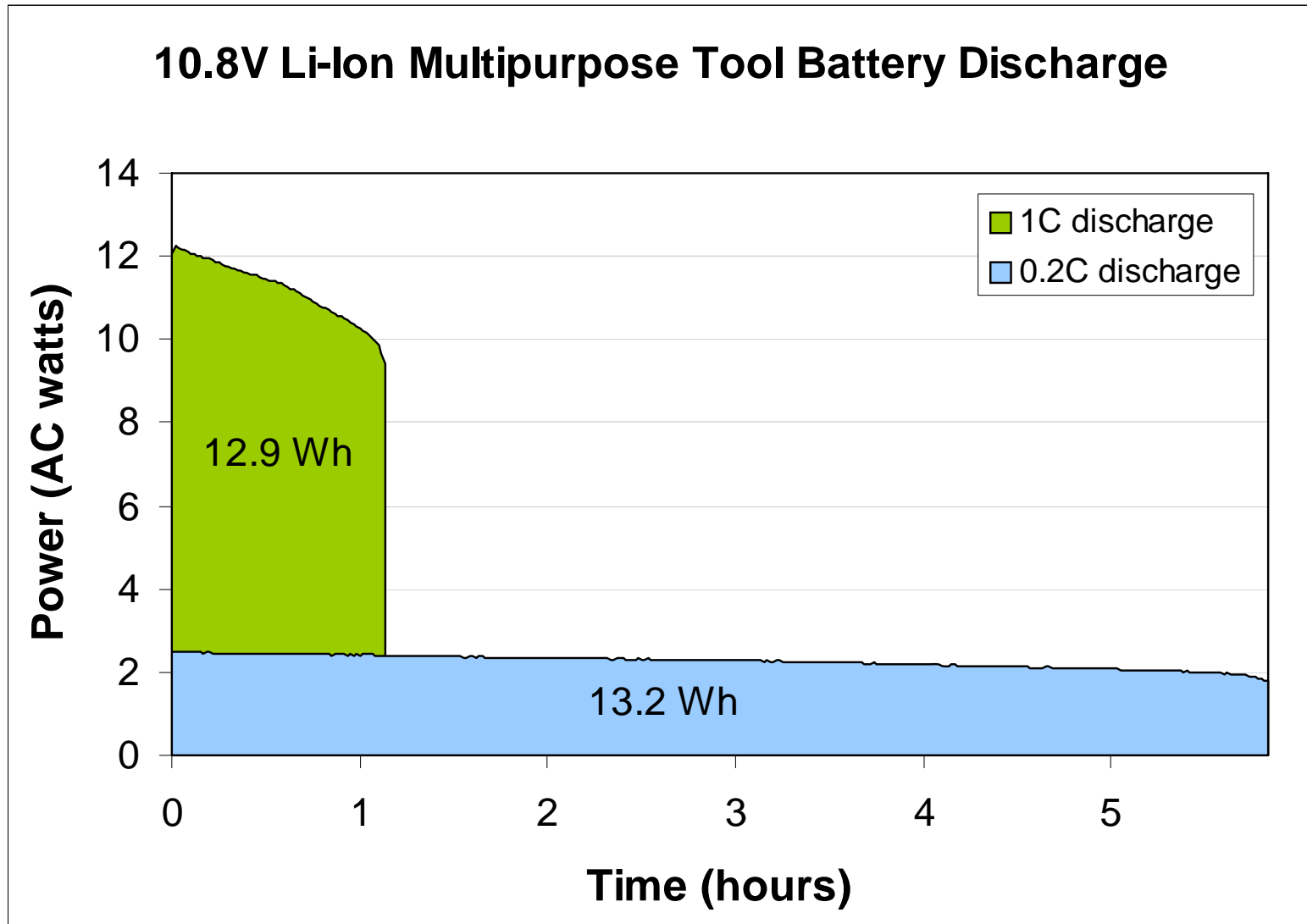


$$D + E + F = 24 \text{ hours}$$

AC Energy: 24 Hour Cycle

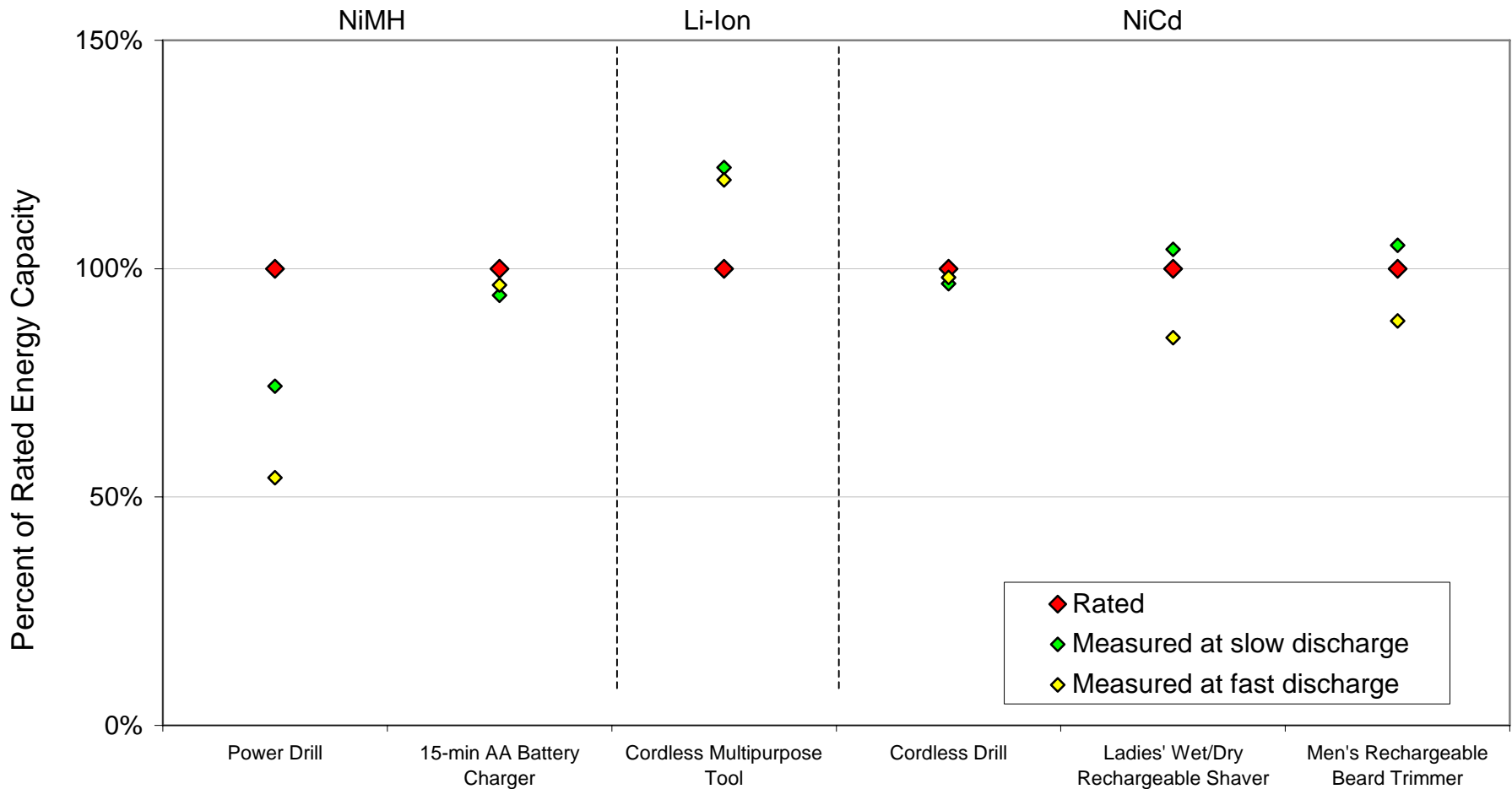


Battery discharge at different rates can yield more/less energy



On a percentage basis, nominal battery capacity can be higher than, lower than, or similar to measured battery capacity

Normalized Comparison of Battery Capacity

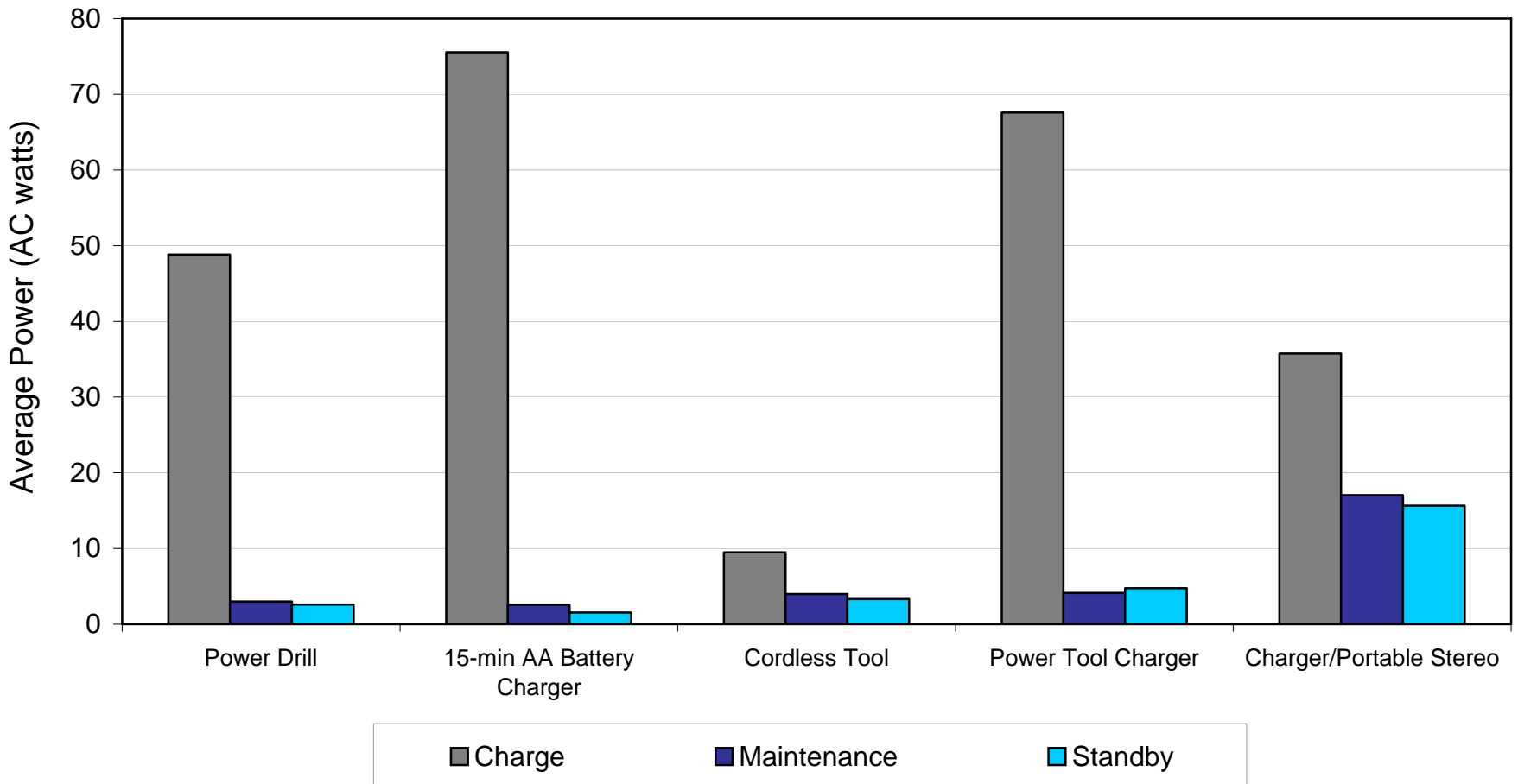


Differences by Chemistry

Charge Rates	Nicad	NiMh	Li-Ion	Lead Acid
Slow	0.2C	0.2C	0.2C	?
Fast	1.0C	0.5C	1.0C	?
Voltage Indicating End of Charge	0.9 volts	0.9 volts	3.0 volts	1.75 volts

Charge and Maintenance Power Levels Are Closer to Each Other in Slow Chargers; Much Different in Fast Chargers

Power Consumption in Battery Chargers



User behavior determines which mode dominates annual energy use

