Deep Cycle Battery "Useful" Life Analysis – The mythical 50% DOD "Limit" - Busting the Myth

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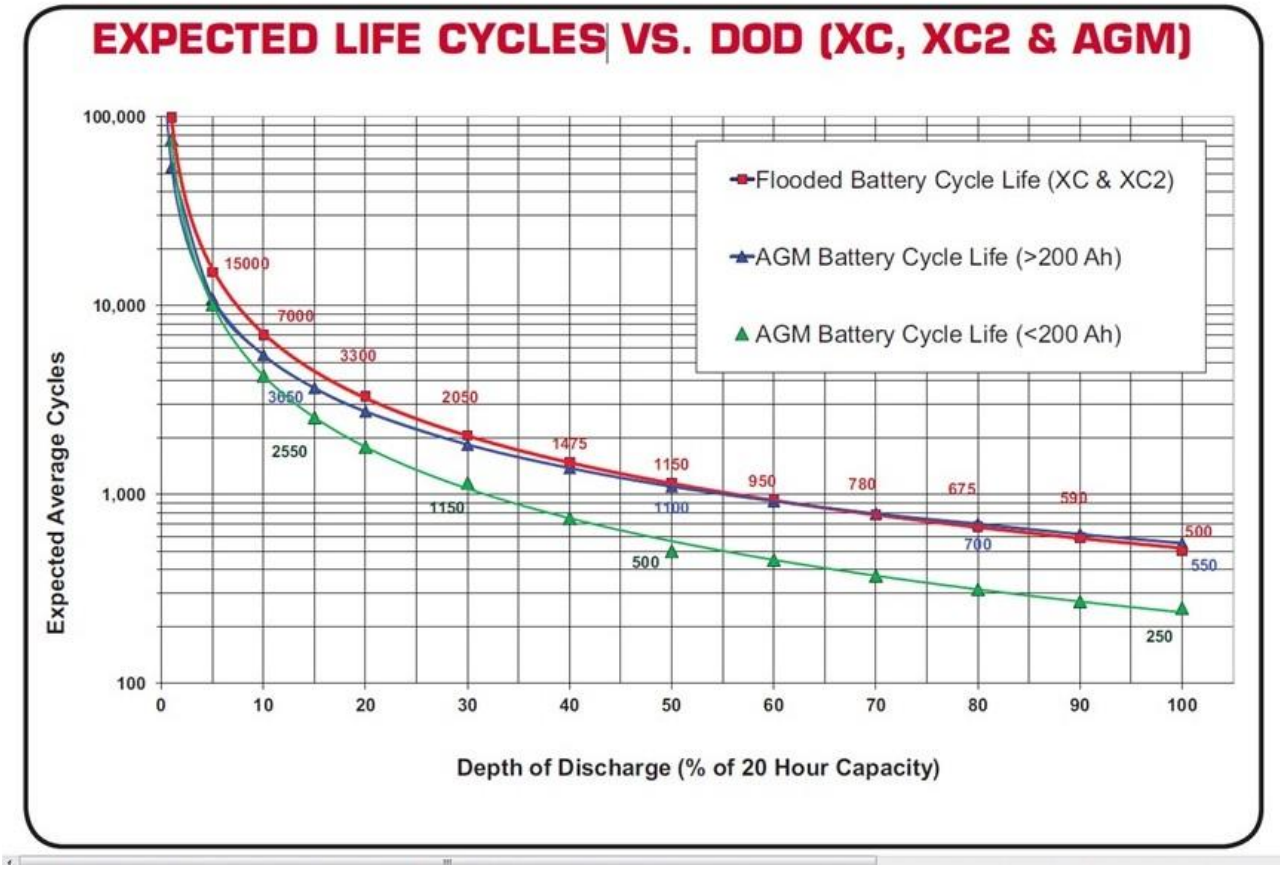
I have often seen many RV and boat owners misstate (IMO) that battery "Life" is significantly degraded if one discharges their batteries below a Depth Of Discharge (DOD) greater than 50%. This analysis is intended to illustrate why I believe this is false.

Definitions: It is important to define Battery Life – Some will speak in terms of years while others quote cycle life (# cycles). No battery Mfg. will provide life in terms of years as that will depend on many variables and almost every quoted life ln years is strictly anecdotal. **Cycle life** data is a valid measure and available from many battery manufacturers. Where many go wrong, in my opinion (IMO) is this fail to take into account the **"Useful Life"** **"Useful Life"** of a batty may better be defined as how much energy, in total, that battery provides over it's life. I believe this is a much better measure of a battery and provides a much better comparison between various batteries and DOD conditions. If one adds in the cost you can easily calculate a cost / AH delivered over its life.



Above is a Life Cycle Graph from US Battery showing different battery types and the # cycles expected for various DOD's. The analysis and conclusions below utilizes this graph as an illustration. A similar analysis is possible for any battery manufacturer's life cycle chart or data.

To determine the useful energy a battery provides for any given cycle one needs to know and multiply the AH Capacity (Most often defined as the 20HR Rate), and the DOD. E.g. A 200 AH batty discharged to a 50% DOD provides 200 AH x 50% = 100 AH

To determine the useful energy a batty provides over it's life one needs only multiply the energy / cycle X # cycles. If the above batty had a life expectancy of 1000 cycles at the 50% DOD the useful energy that batty provides over it's life is 200 AH x 50% DOD X 1,000 cycles = 100,000 AH over it's expected cycle life.

Now let's look at the same battery over several DOD's –

EX 1: A common 100 AH FLA Batty and plug in the life cycle data from the chart

The resulting calcs show a **FLA user loses 13% of the AH over the life of the batty if DOD is 50% vs 20%**
It **also shows that there is only an additional 5% loss going from 50% to 80% DOD**. Designing and purchasing a batty bank to only be discharged to 20% vs 80% is impractical, in most mobile situations, as you would need to invest 4X$ and accommodate 4X the # battys and 4X the weight.

Type	AH (20Hr)	DOD	Cycle Life	AH/Life	+/- AH/Life
FLA	100	20%	3300	66,000	Base
FLA	100	50%	1150	57,500	-13%
FLA	100	80%	675	54,000	-18%

EX 2: I'll choose another common configuration - a 200AH AGM Batty

The resulting calcs **show the AGM user actually gains 8% when going from a 20% DOD to a 50% DOD and gains an additional 2% going to 80% DOD!**

Type	AH (20Hr)	DOD	Cycle Life	AH/Life	+/- AH/Life
AGM	200	20%	2550	102,000	Base
AGN	200	50%	1100	110,000	8%
AGM	200	80%	700	112,000	10%

Conclusion: A Max of 75% to 80% DOD is a very practical limit for battery bank design purposes for both FLA & AGM batteries.

Note: To reinforce the above I quote the **Trojan Battery Co User Guide**
https://www.trojanbattery.com/pdf/TrojanBattery_UsersGuide.pdf

Maximizing the Performance of Your Trojan Battery

1. *Follow all the procedures in this User's Guide for proper installation, maintenance and storage.*
2. *Do not discharge your battery to more than 80% depth of discharge. This safety factor will eliminate the chance of over-discharging and damaging your battery*