

# Obligatory Credential Establishment Slide

- Roy formed Four Winds in 1996, went off-grid in 1997
- NABCEP Certified Solar PV installer since 2004
- Eligible PV and small wind installer for NYSERDA in NY State
- Board member, North American Board of Certified Energy Practitioners
- Chair and Co-chair of several NABCEP JTA and exam Committees
- Past board member of the SWCC and DWEA (thanks for the mug!)
- Instructor and curriculum developer for several colleges and organizations

**I really have to stop volunteering for stuff.....**

# Zero Export = Energy Storage

Batteries....to some people, it's a dirty word!

Is it time to get the lead out?

Not just yet.....



# Points to Ponder

- We have a new generation of grid tie system installers and customer who have never touched a deep cycle battery
- Battery system sizing, installation and maintenance experts- few and far between
- Look for the grey hair and acid burns 😊
- What could possibly go wrong?

# Ouch

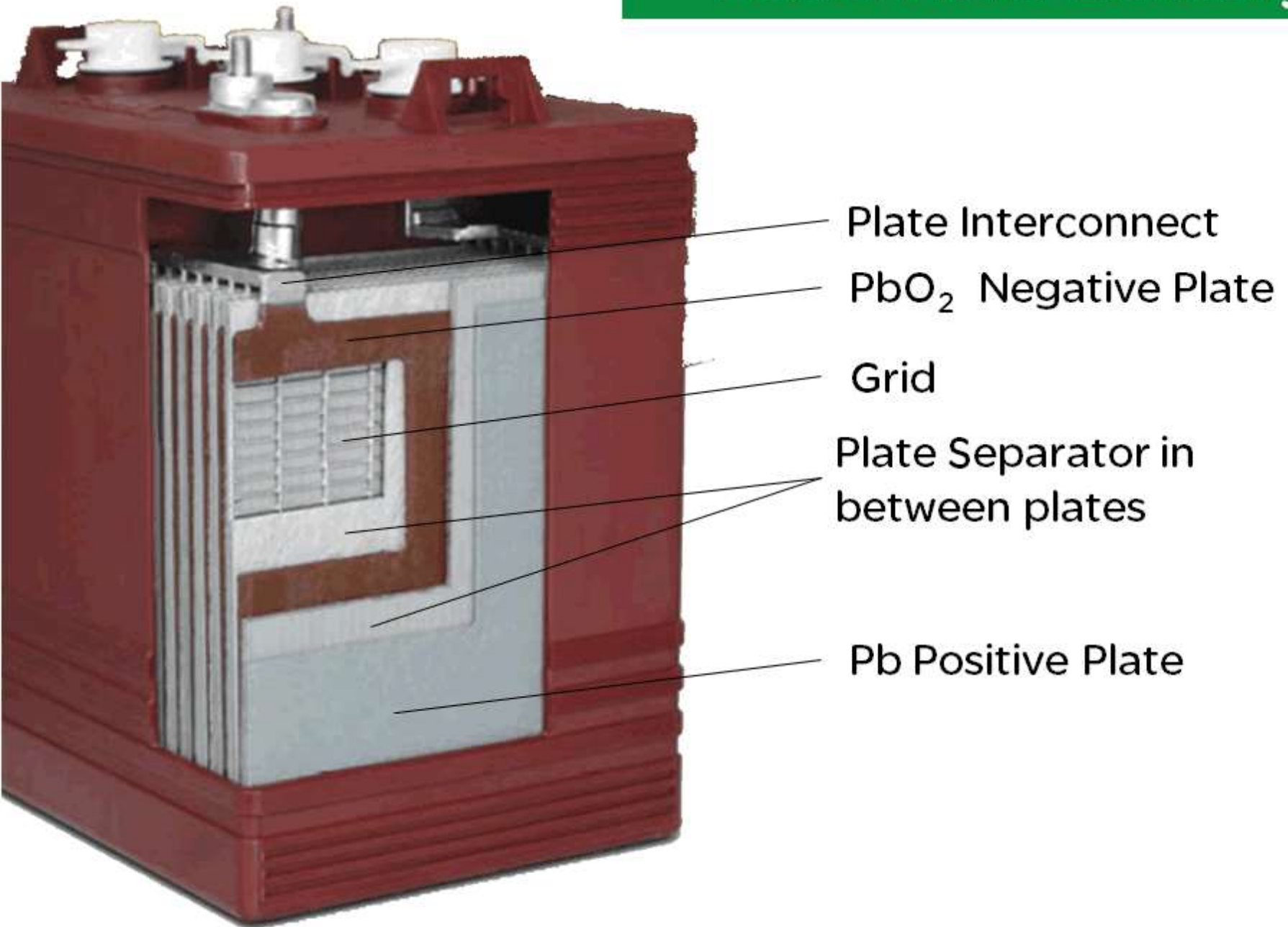


# Lead Acid Energy Storage

- Flooded Lead Acid (FLA)
  - Lead Antimony
  - Lead Calcium
- Sealed Lead Acid (SLA)/ (VRLA)
  - Absorbed Glass Mat (AGM)
  - Gel
- Which one is the best for zero export?



# Lead Acid Battery



# Lead Acid Energy Storage

They're all good for certain applications

- FLA- Lead Antimony
  - Lowest cost
  - Longest life (with proper care!)
  - Available in many voltages- 2, 4, 6, 8, 12, etc.
  - 100% recyclable
  - Needs to be cycled

# Lead Acid Energy Storage

They're all good for certain applications

- FLA- Lead Antimony- continued
  - Stratification of electrolyte in standby usage
  - Needs to be fully charged every 10-30 days
  - Prone to sulfation, equalizations needed
  - Needs venting and maintenance
  - Good for off-grid use but.....
- Not good for most standby systems



# Lead Acid Energy Storage

- FLA- Lead Calcium
  - Formulated specifically for standby use
  - Low self-discharge rate
  - Recyclable
  - Higher cost, shorter life than lead antimony
  - Inequalities between cells can be an issue
  - Needs venting and maintenance
- A somewhat better choice for standby systems but far from ideal

Batteries rarely die a natural death  
Most are murdered



# Lead Acid Energy Storage

- VRLA- AGM and Gel
  - Usually maintenance free, some AGMs are EQ'd
  - Good for standby or cycling applications
  - Little to no gassing
  - Can be installed in any position
  - More tolerant of heat and cold than FLAs

# Lead Acid Energy Storage

- VRLA- AGM and Gel – continued
  - Less tolerant of over/ undercharging than FLAs
  - Longer absorb times
  - More prone to thermal run away
  - Higher cost and shorter life
  - Gel is the highest cost
- Not perfect but a better choice for standby

# Thermal runaway aka “plumping”



These are in good shape - round is a shape!

What's Dave trying to say???



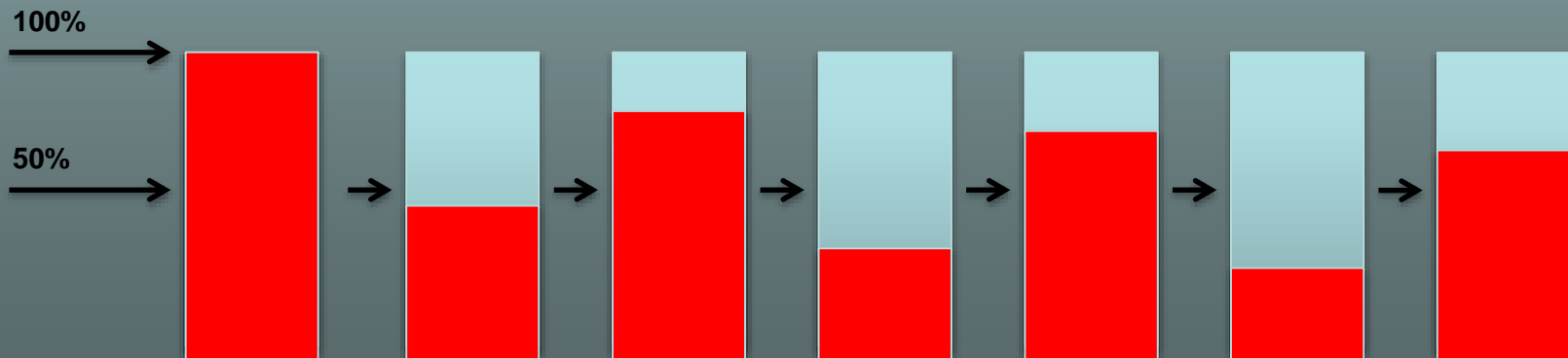


# Sizing of a Battery Bank

- Proper sizing is critical for maximizing efficiency and reliability
- 15.75 Kwh of Daily Load @48V
  - $15,750 \div 48$  Nominal Battery Voltage = 328 Ah
  - 328 Ah X 2 (assuming 50% DOD) = 656ah
  - Add 15% Assumed Losses = 754.4 Ah
  - For one day of autonomy a battery capacity of 754.4 AH is required
- And let's not forget inverter requirements!
  - Surge capacity, etc.

# Items to Consider

- Days of Autonomy
  - The time between chargings from the grid
- Deficit Cycling
  - Deficit cycling is when a system is loading and charging the battery from the 80-90% on the high end to 40-60% SOC on the low end.



# Maintenance



Tip of the day: If you look in the battery and see ice, it's frozen!

# Our new director of operations

