
# Novel Lead Battery Electrolyte Improves Safety and Performance

## NAATBatt
## Battery Innovation Summit

March 14, 2019

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# Global Rechargable Battery Market in 2017[1]

| | Capacity | % | Revenue | % | Average Intial Cost |
|---|---|---|---|---|---|
| Lead | 380GWh | 75% | $36.5B | 49% | $96/kWh |
| Lithium ion | 120GWh | 24% | $35.7B | 48% | $298/kWh |
| Others[2] | 10GWh | 1% | $2.8B | 3% | $280/kWh |
| Total | $75B | | 510GWh | | $147/kWh |

- Lead is the most widely used technology, lowest cost & most sustainable
- Lead battery weakness is operating life (and weight for vehicle applications)
- Improving lead battery operating life will significant impact battery industry

1- *AVICENNE Energy, January 2019*
2- other technologies include NiCD, NiMH, NaS, flow

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# Revolutionizing the Lead Battery

**Tydrolyte™ demonstrates significant reduction in major battery failure modes**

- Reduced water loss, corrosion sulfation and $H_2$ evolution
- 25-100% Longer Operational Life based on early test results

**Tydrolyte improves performance**

- Improved pSOC charge and discharge resistance after run-in
- Faster charging & higher roundtrip efficiency

**Eliminates toxic sulfuric acid with non-toxic substitute**

- Reduced worker hazard, remediation & liability insurance
- Safety cost saving may offset incremental material costs

**Easily adoptable drop-in replacement**

- No equipment or major process change required

*Automotive Lead Battery*

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# Business Overview

**The Company**

- Tydrolyte LLC has the exclusive rights to novel chemistry for all battery applications
- Multiple composition-of-matter and application patents in process

**Successful Validation Testing**

- Initial testing by multi-billion dollar mfg demonstrated exceptional results
- Contracted Electric Application Inc, a leading independent battery testing co
- Commercial testing/qualification beginning at several major battery manufacturers

**Licensing & Marketing Business Model**

- In-house low volume production for material samples
- Scale through manufacturing sublicensing
- Minimize capital costs for expansion

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# Management & Advisory Board

**Paul Bundschuh, Tydrolyte CEO**
- Successful clean tech/battery CEO who has lead a startup through successful NASDAQ IPO
- Authored several US patents and successful DOE (ARPA-e & SBIR) grants
- Registered investment banker with experience in early stage equity financing and M&A
- Masters/Bachelors in Engineering from RPI & Executive MBA from UT Austin

**Honorable Stephen L. Johnson, Chairman Tydrolyte Technical Advisory Board**
- Administrator for the Environmental Protection Agency 2005-2009
- First EPA career employee and scientist to head the Agency
- Expert on toxic materials including their effects and regulations
- Masters in Pathology from George Washington University

**Dr. Boris Monahov, member Tydrolyte Technical Advisory Board**
- Top global independent lead battery expert
- Previously Technical Program Manager at the Advanced Lead Acid Battery Consortium
- 20 years of fundamental battery research followed by 11 years of product development
- Worked under Dr Pavlov, author of definitive textbook on lead battery technology

*"Tydrolyte's ability to replace sulfuric acid is a unique and novel approach to evolving lead batteries. Based on initial test results the electrolyte appears to be one of the most significant technical advancements in the 150-year history of lead batteries,"*
- Dr. Boris Monahov

# Tydrolyte Economics to Battery Manufacturer

**0.5-1% of battery sales price is sulfuric acid material**

**4X Cost Multiple for Tydrolyte (3X additional material cost)[1]**

**1.5-3% increase in material cost for Tydrolyte batteries**

**25-100% Higher Battery Value/Revenue (due to longer life)**

**8-66X Potential Return on Investment for Tydrolyte material (no CapEx)**

*1- Assumes manufacturer purchases Tydrolyte material.*
*High volume customers may obtain mfg license with lower overall costs.*

*2- Reducing hazards from toxic sulfuric acid enables additional cost reductions not considered in simplified analysis.*



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# Proposed Financing

## $1.0-$1.5M Convertible Debt Financing:

- 8% interest paid at conversion or maturity(PIK)
- 20% discount to next round of equity
- $12.5M cap on valuation in equity round

## Use of Proceeds:

- $300,000 third party battery validation testing
- $300,000 Shared Overhead
- $400,000 working capital



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