How to evaluate cleantech startups

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Harvard Energy Journal Club
October 13, 2017

Contents

WHO ARE YOU?

Introduction

B.S. Marine Chemistry
Eckerd College | *St. Petersburg, FL*

M.Eng. Mechanical Engineering
Duke University | *Durham, NC*

Mechanical Engineer
Open Water Power | *Somerville, MA*

Research Associate, Energy Storage
Lux Research | *Boston, MA*

Podcast Co-Host
Talk Clean To Me | *Boston, MA*

Top: *Talk Clean To Me podcast with co-host Joe Caron*
Left: *Collecting pteropods on Hood Canal, WA, 2013*
Right: *Open Water Power at the WHOI Marine Robotics Entrepreneurship Forum, 2016*

WHAT ARE THE LOCAL STARTUP HUBS?

What are the local startup hubs?

Startup Accelerator Programs

Definition: *Programs for early-stage startups to accelerate their growth*

- *Participant resources include mentorship opportunities, capital investment*
- *Defined start and end dates, usually culminating in a demo day or pitch competition*

Local examples:

⇒ Bolt
⇒ Cleantech Open Northeast (CTONE)
⇒ HBS Rock Center for Entrepreneurship
⇒ MassChallenge
⇒ MIT The Engine
⇒ Techstars

MassChallenge

http://www.512tech.com/technology/boston-based-startup-accelerator-masschallenge-coming-austin/qOfbDJ4xO1bhXTnTyEiTyK/

What are the local startup hubs?

Startup Incubators

Definition: *Coworking spaces for startups to develop their products with optional support*

- *Membership resources include makerspace access, software licenses, mentorship opportunities, and introductions to industry leaders*
- *Rolling admission with no defined start and end dates*

Local examples:

⇒ Greentown Labs (GTL)
⇒ Harvard Innovation Lab (i-Lab)
⇒ MIT The Engine

Startup Coworking Spaces (these are *not* incubators):

⇒ CIC Boston
⇒ CIC Cambridge

Greentown Labs

http://wvtf.org/post/massachusetts-pushes-brew-new-green-businesses-help-fight-climate-change

Greentown Labs

https://vimeo.com/198430989

What are the local startup hubs?

Funders:

⇒ Breakthrough Energy Ventures
⇒ Clean Energy Venture Group
⇒ Massachusetts Clean Energy Center (MassCEC)

Networks:

⇒ New England Water Innovation Network (NEWIN)
⇒ Northeast Clean Energy Council (NECEC)

Academic Centers:

⇒ BU Center for Sustainable Energy
⇒ MIT Energy Institute

NEWIN Water Pitch Night @ MassCEC

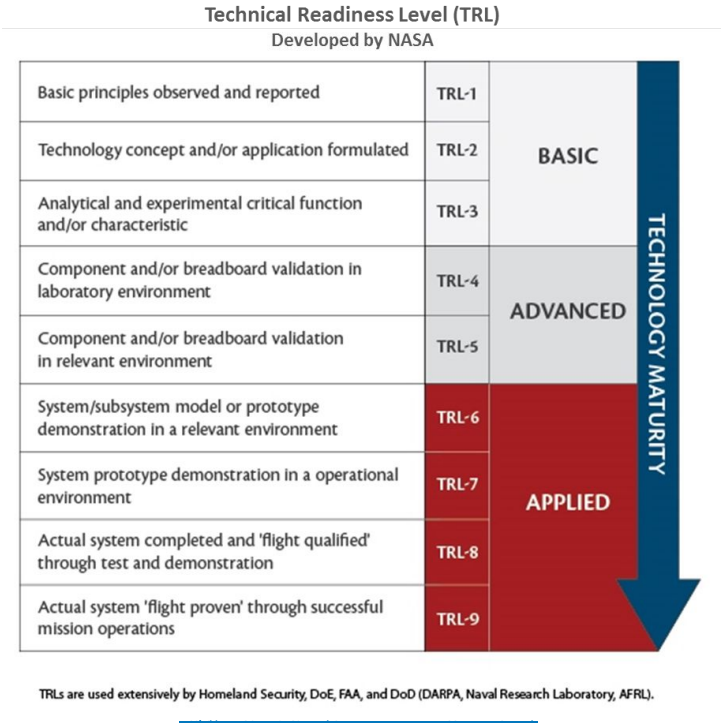
Josh Adler, Founder and CEO at Sourcewater, pitches at Water Pitch Night
http://www.newengland-win.org/water-pitch-night-december-2015/

EVALUATING STARTUPS

Criteria for assessing startup health

Technology:

- Technology validity
- Deployments to date
- Founders'/directors' backgrounds
  - Technical experience
  - Startup experience
  - Industry experience



Criteria for assessing startup health

Strategy and Markets:

- Funding to date
- Number of employees
- Intellectual property, patents
- Business model
- Target markets
- Competitors

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STARTUP CASE STUDIES

CASE STUDY:
Open Water Power in May 2016

Aluminum-water primary batteries for subsea applications

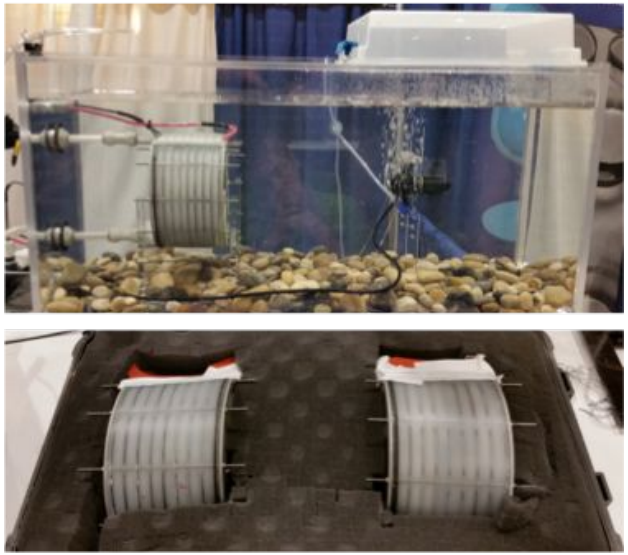


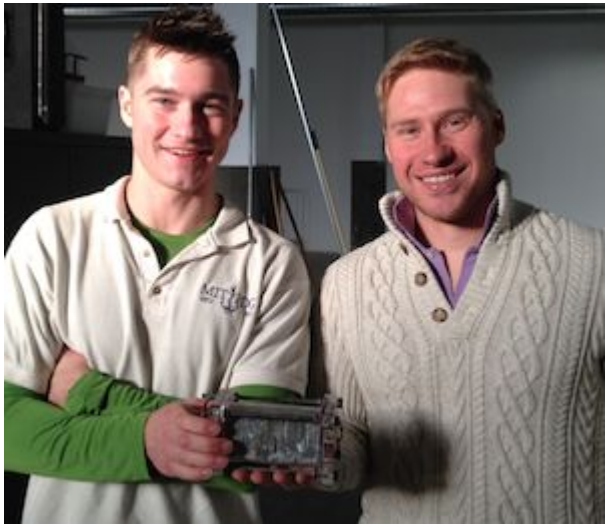
Photo Credit: Chloe Holzinger

CASE STUDY:
Open Water Power in May 2016

Aluminum-water primary batteries for subsea applications

YEAR FOUNDED :: 2013

Leadership: MIT, Stanford, Viztu, Stroud



http://archive.boston.com/business/technology/innoeco/2014/01/openwater_power_developing_new.html

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TECHNOLOGY

TRL 6 (cells) and TRL 4 (system):

"Specifically, [the] prototype cells have been tested on the benchtop using lab-grade pumps, electronics, and monitoring equipment, but they are run on real seawater, at environmental temperatures, generating operationally relevant power levels."
- Open Water Power website

Deployments: none

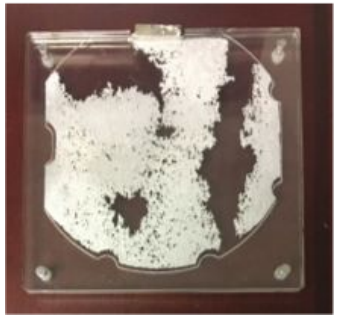

Photo Credit: Chloe Holzinger

CASE STUDY:
Open Water Power in May 2016

Aluminum-water primary batteries for subsea applications

STRATEGY AND MARKETS

Funding & Partners: U.S. Special Operations Command $2 million grant (2016); Riptide AS

 # employees: fifth team member and looking to grow

Patents: exclusive license from MIT

Business model: defense contracts

Target markets: UUVs, subsea sensors

http://www.unmannedsystemstechnology.com/2017/04/sparton-ahrs-integrated-onto-riptide-micro-uuv/

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TODAY :: acquired by L3 Technologies

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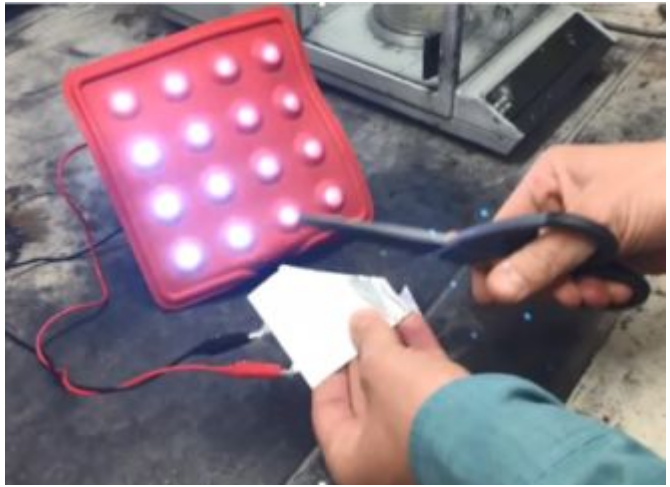
Ionic Materials

Lithium metal solid-state batteries for all applications



http://ionicmaterials.com/media/

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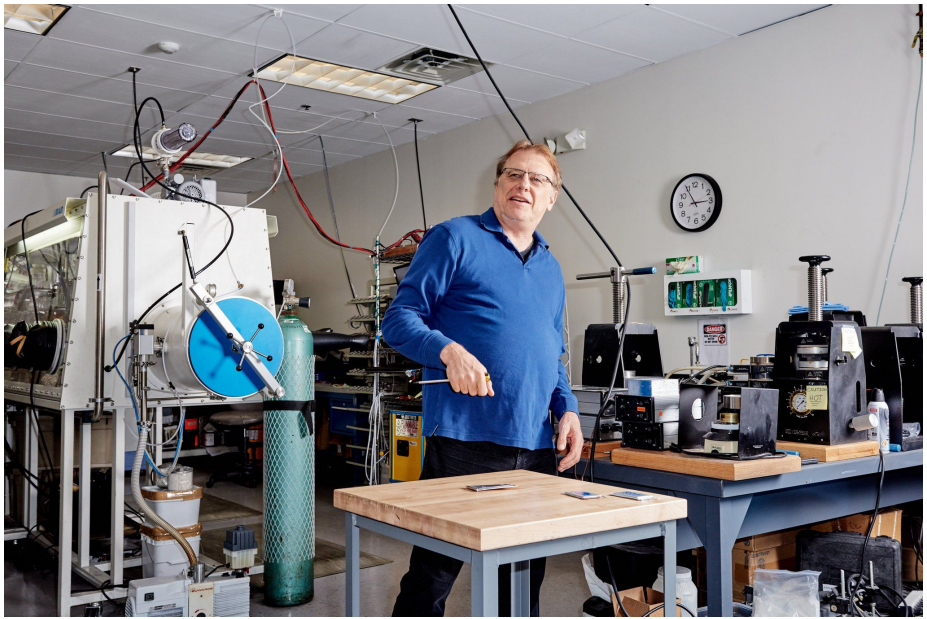

https://www.nytimes.com/2017/08/01/technology/alkaline-batteries-replace-lithium-ion.html

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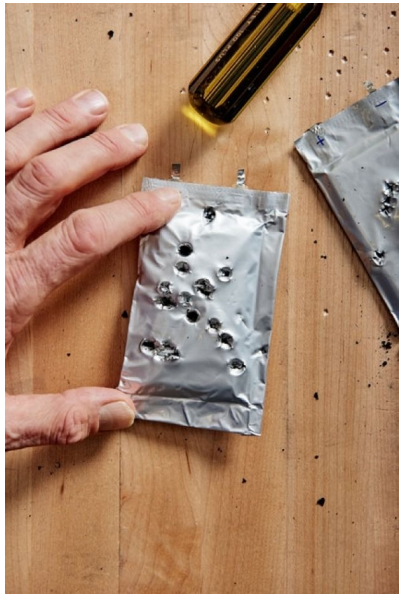
TRL 6:

"Lithium metal (not lithium ion) rechargeable battery cell that employs a novel solid polymer electrolyte… extremely high specific energy (400 Wh/kg or more versus 285 Wh/kg for the best Li-Ion cells today)"
- ARPA-E project description

Deployments: none



http://www.afr.com/technology/mobiles-and-tablets/ionic-materials-phone-battery-wont-catch-fire-even-if-you-put-a-nail-through-it-20161212-gt9nnx

CASE STUDY:
Ionic Materials

Lithium metal solid-state batteries for all applications

STRATEGY AND MARKETS

Funding & Partners: $3 million ARPA-E grant (2017-2019)

 # employees: 20-25 (LinkedIn)

Patents: one granted, nine applications

Business model: licensing

Target markets: mobility, stationary, and consumer electronics applications (no real focus)

http://ionicmaterials.com/about-us/

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CASE STUDY:
Pellion Technologies

Magnesium-ion batteries for electric vehicles and consumer electronics

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TECHNOLOGY

TRL 4:

- *Magnesium-ion batteries with a metallic magnesium anode, an unknown cathode, and an unknown electrolyte*
- *Claim energy density greater than 1000 Wh/L*

Deployments: none

CASE STUDY:
Pellion Technologies

Magnesium-ion batteries for electric vehicles and consumer electronics

STRATEGY AND MARKETS

Funding & Partners: Motorola Solutions invested an undisclosed amount (2016); ARPA-E (2010-2012)

 # employees: 20-25 (LinkedIn)

Patents: five granted

Business model: N/A

Target markets: electric vehicles, consumer electronics

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YEAR FOUNDED :: 2009

Leadership: MIT

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YOUR TURN!

CASE STUDY:
Ivys Energy Solutions

Hydrogen refueling station for fuel cell electric vehicles

http://www.ivysinc.com/simplefuel-main-page/

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Hydrogen refueling station for fuel cell electric vehicles

YEAR FOUNDED :: 2016

Leadership: WPI, MIT, Nuvera Fuel Cells

TECHNOLOGY

TRL 6:

"Capable of delivering up to 5 kg/day of hydrogen to vehicles at pressures up to 700 bar (10,000 psi). 5 kg is enough to fully fuel one fuel cell electric vehicle (FCEV) for 300-360 miles… demonstrated [the] system by conducting a fueling of a Hyundai Tucson FCEV."
- Department of Energy H2 Refuel H-Prize website

Deployments: one

http://myemail.constantcontact.com/Fuel-Cell-and-Hydrogen-Energy-Connection---January-2017.html?soid=1104412315763&aid=dHrd5ozlyNc

CASE STUDY:
Ivys Energy Solutions

Hydrogen refueling station for fuel cell electric vehicles

YEAR FOUNDED :: 2016

Leadership: WPI, MIT, Nuvera Fuel Cells

TECHNOLOGY

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- Department of Energy H2 Refuel H-Prize website

Deployments: one

STRATEGY AND MARKETS

Funding & Partners: $1 million H2 Refuel H-Prize award from the Department of Energy (2017)

 # employees: five (LinkedIn)

Patents: N/A

Business model: N/A

Target markets: fuel cell electric vehicles (FCEVs)

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CASE STUDY:
Baseload Renewables

Lithium-sulfur chemistry in a semi-solid flow cell

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YEAR FOUNDED :: 2017

Leadership: Ted Wiley (Aquion co-founder), Dr. Yet-Ming Chiang (A123 Systems co-founder, 24M Chief Scientist)

TECHNOLOGY

TRL 3 or 4:

Li, Z., et al. 2013. Aqueous semi-solid flow cell: demonstration and analysis. Physical Chemistry Chemical Physics. 15 (38): 15833-15839.

Deployments: none

https://www.engine.xyz/founders/baseload/

CASE STUDY:
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Lithium-sulfur chemistry in a semi-solid flow cell

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Li, Z., et al. 2013. Aqueous semi-solid flow cell: demonstration and analysis. Physical Chemistry Chemical Physics. 15 (38): 15833-15839.

Deployments: none

STRATEGY AND MARKETS

Funding & Partners: $2 million in equity financing from MIT's The Engine

 # employees: at least two

Patents: most likely exclusively licensed from MIT

Business model: N/A

Target markets: utilities

WHAT NEXT?

How to get involved

Events:

- CIC Venture Cafe
- Cleantech Open Northeast Regional (CTONE) Finals
- Greentown Energy Bar
- MIT Clean Energy Prize
- MIT Energy Hackathon
- MIT Energy Night
- New England Clean Energy Center (NECEC) Green Tie Gala
- New England Water Innovation Network (NEWIN) Water Pitch Night

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How to get involved

Jobs and Internships:

- AngelList
- Greentown Jobs Board
- MassCEC* Internship Program
- MassCEC* Jobs Board

Corporate Cleantech Jobs:

- Enel Green Power
- GE / GE Current
- Schneider Electric
- Shell Techworks

**Massachusetts Clean Energy Center*

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- GE / GE Current
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- Shell Techworks

**Massachusetts Clean Energy Center*

How to get involved

Pitching Competitions:

- MassChallenge Minute to Pitch It
- MIT 100K Entrepreneurship Competition
- MIT Clean Energy Prize
- MIT Water Night
- NEWIN Water Pitch Night
- Tufts 100K New Ventures Competition

Energy Conferences:

MIT | Northeastern | Tufts

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Energy Conferences:

MIT | Northeastern | **Tufts**

How to stay up to date

News:

- Boston Business Journal
- Crunchbase
- Google Alerts
- Green Car Congress
- Greentech Media (GTM)
- MIT Technology Review

Podcasts:

- GTM Energy Gang
- GTM The Interchange
- Talk Clean To Me

Battery Newsletters:

- Energy Storage News
- Joe Lowry's LinkedIn page
- NAATBatt Weekly
- Shmuel De Leon Energy

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QUESTIONS

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