Cleantech.org Research Brief
Energy Storage
Venture Capital Investment and Valuation Analysis
2001-2009

Executive Summary of Analysis

The sectors covered were venture backed energy storage technology companies. While not exhaustive, we found 23 companies who reported adequate numbers of private venture capital investment rounds and round amounts over 10 years to create a trends analysis of investment round levels, values and dilutions. There are a number of missing energy storage companies that secured significant venture investment, but did not report publicly.

- Total companies 23
- Total investment round observations 74
- Total valuation observations 31
- Total capital tracked $1.1 Bil
- Total number of investors 122

The analysis provides a unique perspective on the sector:

- We normalized the investment and valuation observations to the chronology of investment rounds, not date.
- We tracked from round to round changes in sizes, valuation levels, dilution, and valuation relative prior capital raised, as well as time between rounds, and implied burn time and burn levels.

The objective was to enable an analyst to answer a range of questions including:

- What is the typical size of investment in energy storage at various venture investment rounds?
- How much does a company typically give up in dilution, and how does that change from round to round?
- What is the typical trend in valuation levels at each round?
- How far apart are the typical rounds, and is that relative to capital raised?

Significant Conclusions

While the distribution of data is fairly varied, we have identified a number of "rules of thumb" that are consistent trends displayed across rounds and companies over the last 10 years.

- Post Money Valuations for rounds 1 to 4 tend to increase roughly 2-3x per round.
- Pre-money valuation as a multiple of prior capital invested ranges consistently from 2-5x per round, with broader distribution in the early rounds than later rounds. Median/median and average/average pre-money to prior capital tends to be more tightly grouped from 2.5x-3.5x for the first three rounds.
- Burn rate – measured as mean or median time between rounds, consistently comes in at between 1.5 to 2 years across all rounds. Burn rate tends to average less than $1 mm/month through round 4. Round to round annual burn rate changes tend to be on the order of 2x, 1.5x, and 1.25x in the first 4 rounds.
- Round sizes tend to start in the low single digits and increase roughly 100% in the first two rounds, declining to a c. 50% increase in size in subsequent rounds.
- Dilution % tends to fall in a smooth curve roughly one-third every other round, and ranges broadly from one third to two-thirds in early rounds.

We believe there is a significant survivor's bias in the available data, hence the appropriate comparable measure to use these multiples with are venture backed energy storage companies achieving investment milestones, and a significant discount should likely be applied to the average when looking at cases where milestones are not being met. We did note that in companies with outlier, either low or high valuation or round size observations where multiple rounds occurred, subsequent rounds tended to see significant opposite movements in the relevant measure for that company, ie, extremely high valuation/low dilution in an earlier round for a company tended to be balanced by a lower valuation/higher dilution in a subsequent round. Exemplars include an extremely high Series A valuation for Solicore at the tail end of the boom in 2001 balanced by an extremely low reported Series B, and higher end valuations for A123 in early rounds balanced by a 50% down round pre-IPO (though the IPO later could be argued to have justified the original mezzanine valuation levels).

Issues in Battery Commercialization

Above and beyond the numbers, there are a number of commonalities related to the commercialization and venture financing life cycle of battery technologies that seem to differ to some degree from other venture investments in IT or even other energy technologies, and the authors felt worth noteworthy enough to make qualitative comments on as follows:

Timing – Battery technology commercializations have historically tended to be one of the slower commercialization cycles from lab stage to market. Startups and investors in batteries have a long history of underestimating both the development cycle, capital required, and the commercialization cycle, as well as underestimating the competitiveness of the market.

Special chemistry risk – There is significant risk in launching a technology in newer battery chemistry. There have been only a limited number of new chemistries succeed, and when they do, as in the case of NiMH and Energy Conversion Devices, they are typically either co-opted by larger competitors obviating a first mover advantage (that advantage is typically much weaker in this field than others) or requiring expensive patent suits. Also as in the case of NiMH, there is no guarantee the chemistry will have legs (just when it is hitting its stride, NiMH is already becoming eclipsed by Li-On. This risk has proven to be especially high for new chemistries (like Zn type) that are not as widely researched, as the supply chain development does not keep pace. In addition, the battery field is highly crowded, and research is old enough that and despite new chemistry in most cases truly defensible patent positions are extremely hard to come by, or provide only discrete advantages (ability to supply a range of quality product cheaply in high volumes (or with value add to the product) seems to be the primary competitive advantage). Few battery technologies of any chemistry end up their commercialization cycle with anywhere near as sustained an advantage as their inventors expected.

High capital costs – In any case, almost all battery startups will require extremely large amounts of capital (on the order of US$50 to 100 mm+) to achieve commercialization (much higher for real manufacturing scale), and the end product margins tend not to be particularly high. Even with stage gate, a very large portion of this investment (US$10-50 mm+), is generally required to be spent while the risk of technical and economic failure is still high. In addition, during the manufacturing scale up phase post R&D, capital investment required per $1 of revenue growth tends to be linear, making these technologies capital intensive to grow.

Degradation of initial technical advantage – In many technology areas one can expect the performance of the final manufactured product to improve over the performance in initial lab results, In part because of the low cost target, high reliability, high volume requirements of this product type however, promising battery technologies, are often forced to make compromises in the scale up, manufacturing, and commercialization stages that mean the performance of actual product might be expected to fall from levels or rates seen in lab scale experiments (though cost may go the other way). At the same time, battery performance of standard technologies, while mature, is a moving target, and during the time frame for commercialization, will often improve enough to obviate the need for the remaining technical advantages.

Size matters – Most battery products (whether batteries or components like anode or cathode materials or electrolyte), are sold to large customers with very large volume requirements, and highly competitive quality and performance requirements. As a result, breaking into new markets generally is extremely hard to do in niche markets, and means a battery startup must prove itself and its technology farther and for a longer period of time than other technology areas (see capital costs, timing and down rounds). Many battery components technology developers as a result will be relegated for early adopters to emerging customers with high risks in their own commercialization path.

Lack of superior economics from licensing – As a result of these size, capital cost, timing, and commercialization risk issues most battery technologies will command much lower and more short-lived economics than anticipated from licensing (or require expensive patent lawsuits to achieve), and will require almost as late a stage of development (ie manufacturing operating at scale with proof of volume customers) and commensurate capital requirements, as taking the product to market directly.

Propensity for down rounds – In addition, battery technology companies tend to have down rounds in much larger numbers in the post A rounds (Series B through D+) than other venture investment areas, as these challenges catch-up to investors and management teams who overestimated the scope of work, capital and timing required in the seed, A and B rounds. In particular, battery investors have tended to invest in seed, A and B stage battery technologies (pre-scaled up manufacturing process or even lab and prototype scale) with expectations of typical venture style timing and economics. Quite often instead, it is the B, C, or D investor group that post cram-down rounds achieve the Series A economics (even when the technology IS successful), and the seed, A and B investors suffer losses or subpar IRRs.

Investment and Valuation Statistics

Observations

Infinite Power Solutions	*Power Paper Ltd*	*Golden Gate Technology*	*Revolt*
Oxis Energy	*Powergenix, Ltd*	*Altraverda*	*Sakti3*
A123 Systems	*Boston Power, Inc.*	*Nanosys*	*Carbon Micro Battery*
Thin Battery Technologies	*Power Precise Solutions*	*Nanotecture*	*Nexeon*
FireFly Energy	*Zinc Matrix Power*	*Solicore*	*Planar Energy Device*
Nanogram	*Deeya Energy*	*ApNano Materials*	

Calculation Defination

Investment Round Amount=Sum(Round1+…+Round 7)
Pre-Money Valuation=Post-Money-Invested Round Amount
Dilution=Pre-Money/Cumulative Capital Invested
Est Years of Burn=[Date of Round(n+1) - Date of Round n]/365
Est Annual Burn= Invested Amount/Est Years of Burn

Summary Statistics

$ mms

Summary Statistics	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Total
Post Money Valuation	**Round 1**	**Round 2**	**Round 3**	**Round 4**	**Round 5**	**Round 6**	**Round 7**	**Total**
No. of Observations	8	9	7	2	1	2	1	30
Median	$ 7.5	$ 18.0	$ 40.0	$ 109.0	$ 373.4	$ 562.0	$ 577.2	
Average	$ 9.8	$ 21.1	$ 48.1	$ 109.0	$ 373.4	$ 562.0	$ 577.2	
Investment Round Amount	**Round 1**	**Round 2**	**Round 3**	**Round 4**	**Round 5**	**Round 6**	**Round 7**	**Total**
No. of Observations	21	20	15	10	4	2	1	73
Total Amount	$ 86.3	$ 173.8	$ 234.4	$ 219.3	$ 137.9	$ 132.0	$ 99.9	$ 1,083.6
Median	$ 3.8	$ 7.5	$ 15.0	$ 20.3	$ 31.5	$ 66.0	$ 99.9	
Average	$ 4.1	$ 8.4	$ 15.8	$ 21.9	$ 34.5	$ 66.0	$ 99.9	
Pre-Money Valuation	**Round 1**	**Round 2**	**Round 3**	**Round 4**	**Round 5**	**Round 6**	**Round 7**	**Total**
No. of Observations	8	9	7	2	1	2	1	30
Median	$ 3.3	$ 12.0	$ 31.4	$ 84.3	$ 303.5	$ 496.0	$ 477.3	
Average	$ 6.0	$ 15.0	$ 32.1	$ 84.3	$ 303.5	$ 496.0	$ 477.3	
Median/Median	$ 3.8	$ 10.6	$ 25.0	$ 88.7	$ 341.9	$ 496.0	$ 477.3	
Average/Average	$ 5.7	$ 12.7	$ 32.3	$ 87.0	$ 338.9	$ 496.0	$ 477.3	
Dilution	**Round 1**	**Round 2**	**Round 3**	**Round 4**	**Round 5**	**Round 6**	**Round 7**	**Total**
No. of Observations	8	9	7	2	1	2	1	30
Median	42.4%	31.0%	26.0%	25.0%	18.7%	24.2%	17.3%	
Average	47.8%	33.1%	35.1%	25.0%	18.7%	24.2%	17.3%	
Median/Median	50.0%	41.4%	37.5%	18.6%	8.4%	11.7%	17.3%	
Average/Average	41.8%	40.0%	32.8%	20.1%	9.2%	11.7%	17.3%	
Cum Capital Invested Prior to Round	**Round 1**	**Round 2**	**Round 3**	**Round 4**	**Round 5**	**Round 6**	**Round 7**	**Total**
No. of Observations		21	21	14	10	4	2	72
Total Amount		$ 86.3	$ 252.3	$ 385.2	$ 463.6	$ 311.8	$ 303.5	
Median		$ 3.8	$ 10.0	$ 25.4	$ 50.0	$ 73.2	$ 151.7	
Average		$ 4.1	$ 12.0	$ 27.5	$ 46.4	$ 77.9	$ 151.7	
Pre-Money/ Capital Invested	**Round 1**	**Round 2**	**Round 3**	**Round 4**	**Round 5**	**Round 6**	**Round 7**	**Total**
No. of Observations		8	7	2	1	2	1	21
Median		4.86x	4.44x	3.40x	4.81x	4.17x	2.03x	
Average		5.22x	8.06x	3.40x	4.81x	4.17x	2.03x	
Median/Median		2.81x	2.50x	3.50x	6.84x	6.78x	3.15x	
Average/Average		3.08x	2.69x	3.16x	7.31x	6.36x	3.15x	
Est Years of Burn	**Round 1**	**Round 2**	**Round 3**	**Round 4**	**Round 5**	**Round 6**	**Round 7**	**Total**
No. of Observations	19	15	10	4	2	1		51
Median	1.61	1.44	1.74	1.46	1.00	1.00		
Average	2.07	1.44	1.86	1.59	1.00	1.00		
Est Annual Burn	**Round 1**	**Round 2**	**Round 3**	**Round 4**	**Round 5**	**Round 6**	**Round 7**	**Total**
No. of Observations	17	15	10	4	2	1		49
Median	$ 3.0	$ 4.9	$ 8.6	$ 6.8	$ 29.7	$ 102.3		
Average	$ 3.2	$ 7.7	$ 10.4	$ 12.0	$ 29.7	$ 102.3		

Pre-Money Multiplier	R2/R1	R3/R2	R4/R3	R5/R4	R6/R5	R7/R6	Total
No. of Observations	7	5	2	1	1	1	17
Median	2.31x	2.09x	1.81x	2.41x	3.11x	0.51x	
Average	4.02x	8.99x	1.81x	2.41x	3.11x	0.51x	

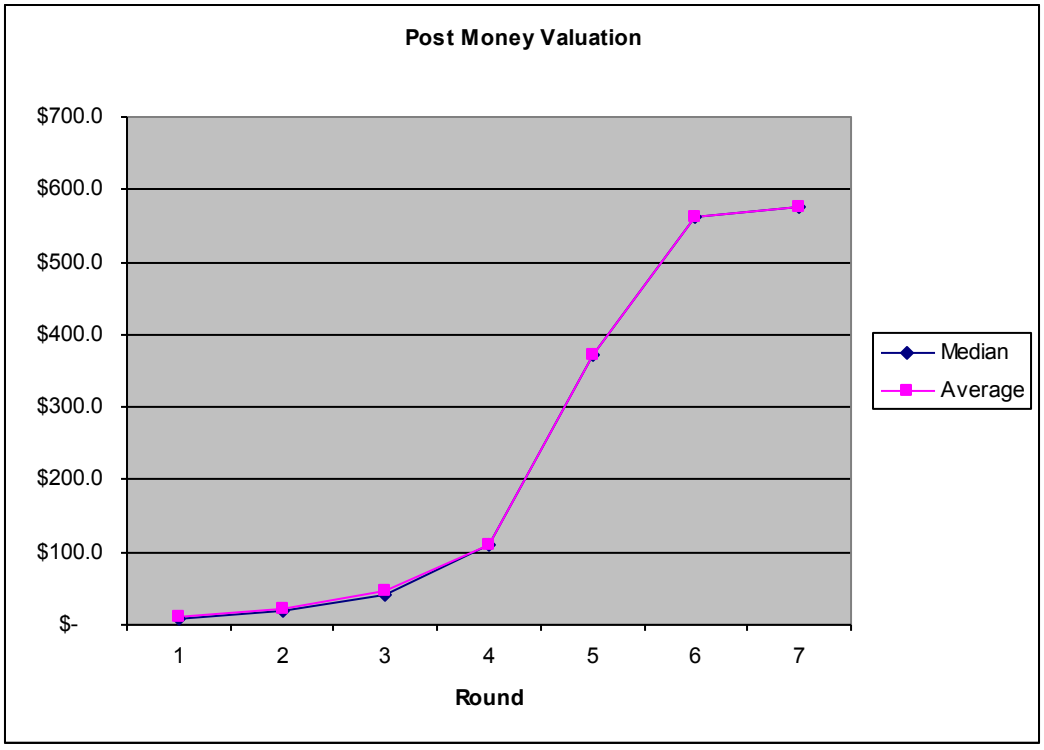
Post Money Multiplier	R2/R1	R3/R2	R4/R3	R5/R4	R6/R5	R7/R6	Total
No. of Observations	6	5	2	1	1	1	16
Median	2.00x	2.19x	1.78x	2.39x	2.80x	0.55x	
Average	3.35x	6.69x	1.92x	2.09x	2.60x	1.68x	

Investment Amount Multiplier	R2/R1	R3/R2	R4/R3	R5/R4	R6/R5	R7/R6	Total
No. of Observations	18	16	10	4	2	1	51
Median	2.15x	2.07x	1.74x	1.90x	3.73x	0.98x	
Average	2.79x	2.81x	1.84x	3.63x	3.73x	0.98x	

Valuation Levels

Post Money Valuation	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Total
No. of Observations	8	9	7	2	1	2	1	30
Median	$ 7.5	$ 18.0	$ 40.0	$ 109.0	$ 373.4	$ 562.0	$ 577.2	
Average	$ 9.8	$ 21.1	$ 48.1	$ 109.0	$ 373.4	$ 562.0	$ 577.2	

Note: The later rounds 4-7 are dominated by one company observations, A123.



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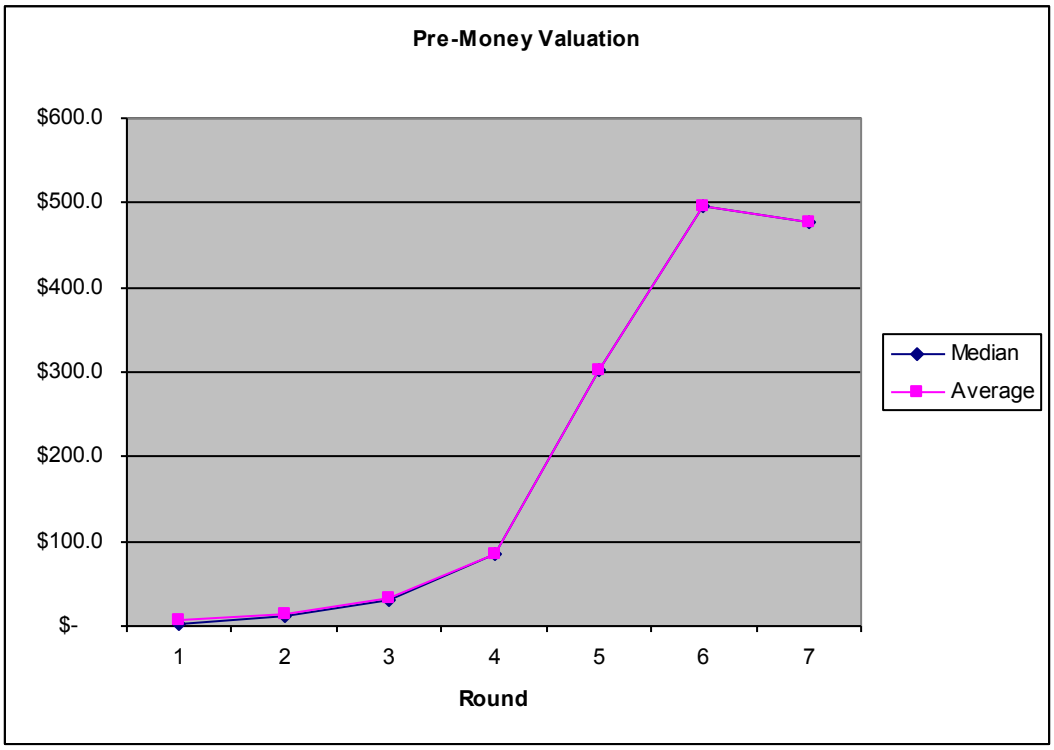
Average/Average	$ 5.7	$ 12.7	$ 32.3	$ 87.0	$ 338.9	$ 496.0	$ 477.3	

Note: The significant run-up and subsequent drop off in rounds 5-7 is dominated by large late stage investment, and subsequent down round of A123. Round 1 observations tended to have wider variation in valuation than rounds 2-4.



Investment Round Analysis

Round Size

Investment Round Amount	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Total
No. of Observations	21	20	15	10	4	2	1	73
Total Amount	$ 86.3	$ 173.8	$ 234.4	$ 219.3	$ 137.9	$ 132.0	$ 99.9	$ 1,083.6
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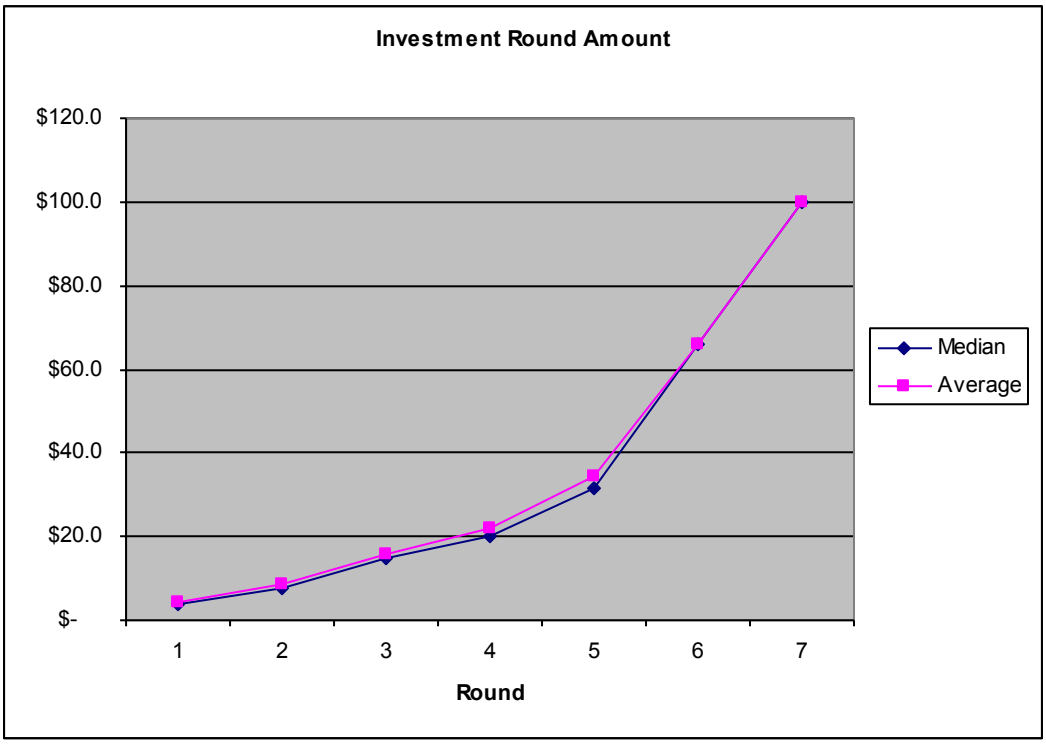

Cum Capital Invested Prior to Round	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Total
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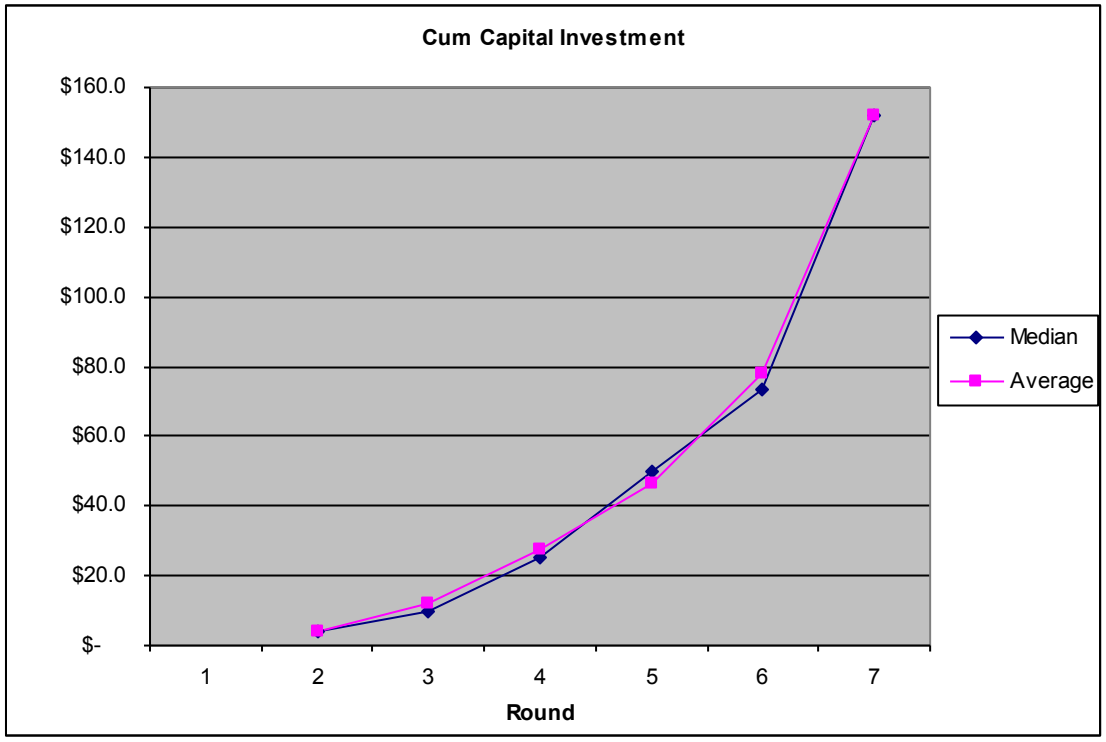
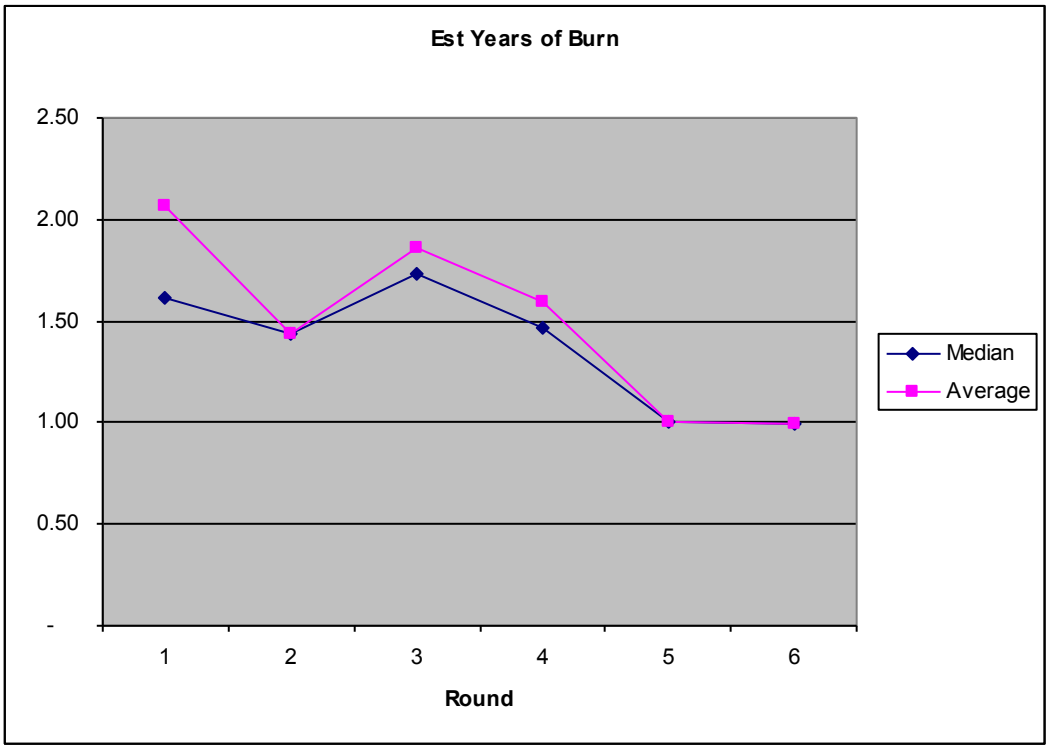
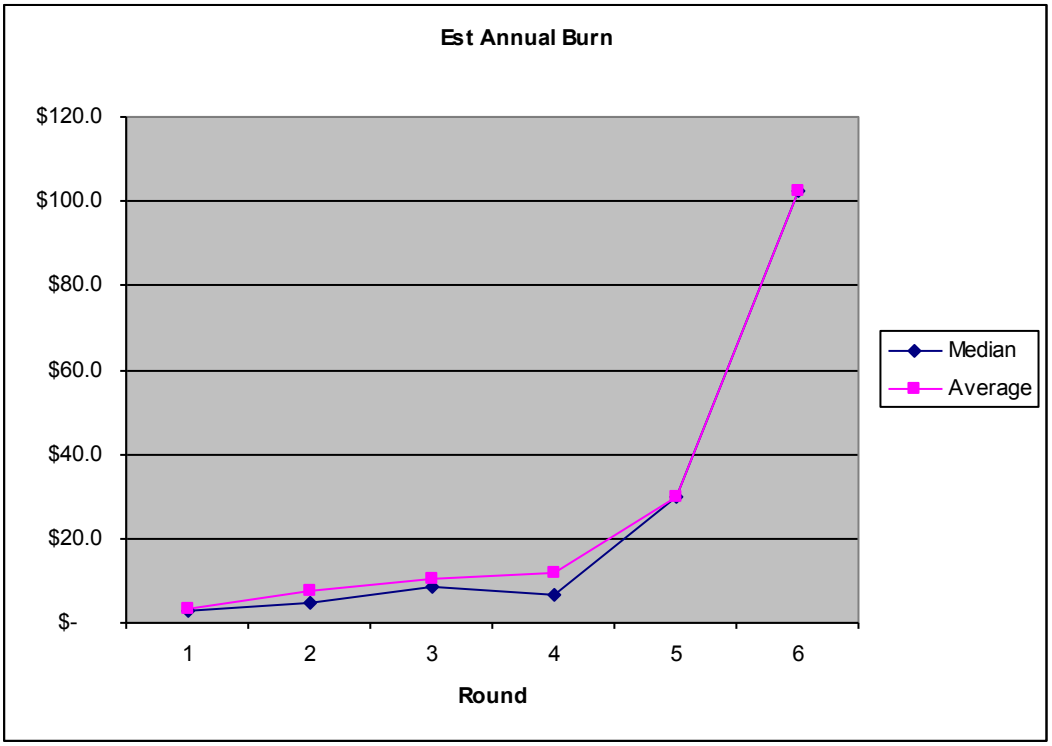


Burn Rate Analysis

Est Years of Burn	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Total
No. of Observations	19	15	10	4	2	1		51
Median	1.61	1.44	1.74	1.46	1.00	1.00		
Average	2.07	1.44	1.86	1.59	1.00	1.00		

Est Annual Burn	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Total
No. of Observations	17	15	10	4	2	1		49
Median	$ 3.0	$ 4.9	$ 8.6	$ 6.8	$ 29.7	$ 102.3		
Average	$ 3.2	$ 7.7	$ 10.4	$ 12.0	$ 29.7	$ 102.3		





Valuation Analysis

Dilution Analysis

Dilution	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Total
No. of Observations	8	9	7	2	1	2	1	30
Median	42.4%	31.0%	26.0%	25.0%	18.7%	24.2%	17.3%	
Average	47.8%	33.1%	35.1%	25.0%	18.7%	24.2%	17.3%	
Median/Median	50.0%	41.4%	37.5%	18.6%	8.4%	11.7%	17.3%	
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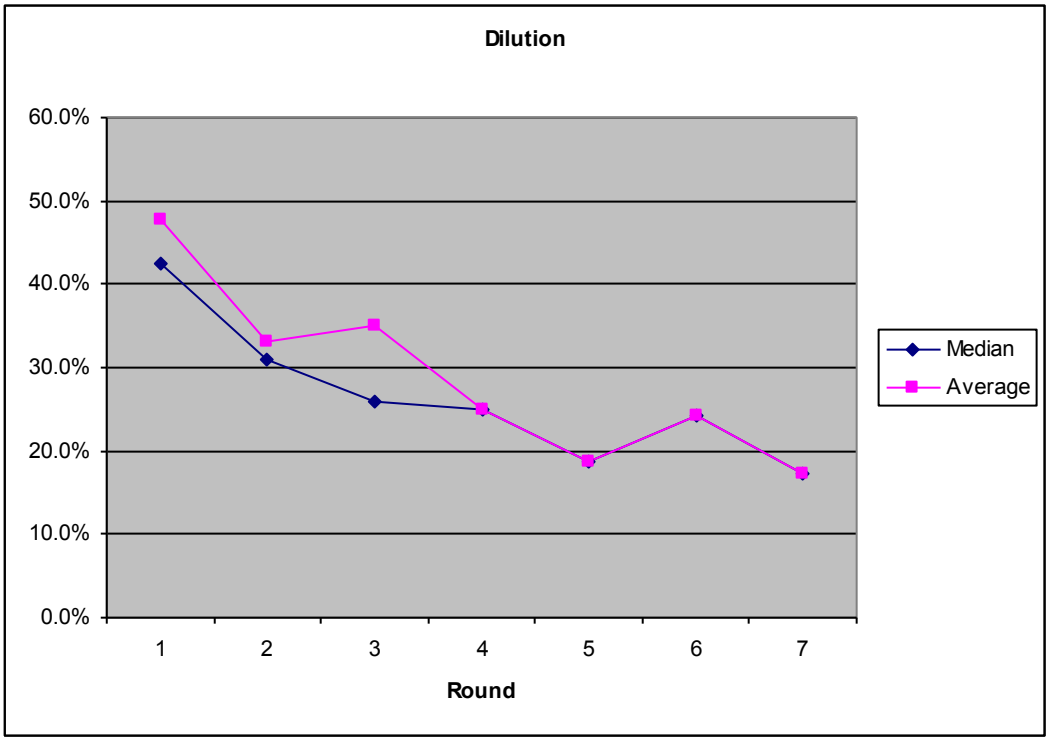
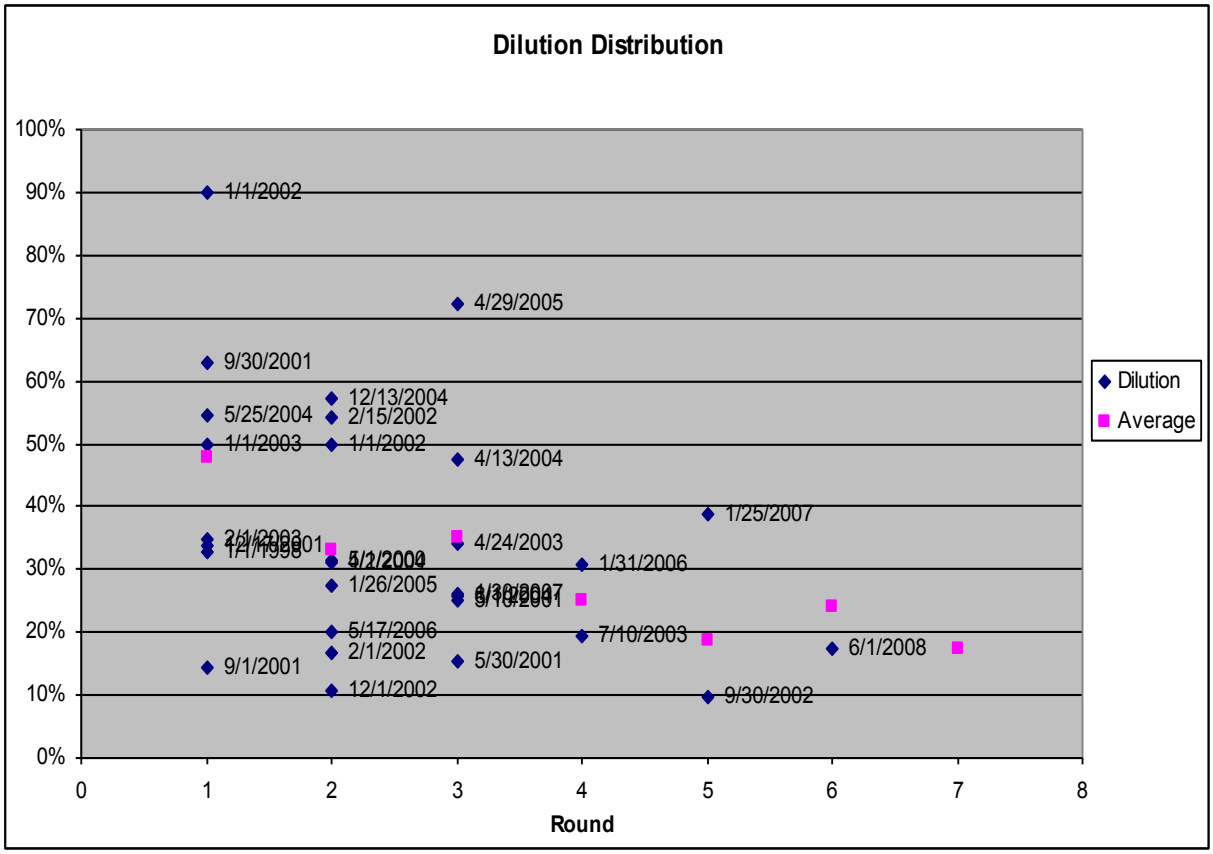


Dilution Distribution

Round	Dilution	Date
1	50%	1-Jan-03
1	33%	1-Jan-98
1	34%	17-Dec-01
1	55%	25-May-04
1	90%	1-Jan-02
1	63%	30-Sep-01
1	35%	1-Feb-03
1	14%	1-Sep-01
2	31%	1-May-00
2	11%	1-Dec-02
2	20%	17-May-06
2	50%	13-Apr-04
2	57%	13-Dec-04
2	54%	15-Feb-02
2	31%	2-Apr-04
2	27%	26-Jan-05
2	17%	1-Feb-02
3	15%	30-May-01
3	26%	1-Jun-04
3	25%	10-May-01
3	26%	30-Jan-07
3	48%	24-Apr-03
3	34%	29-Apr-05
3	72%	10-Jul-03
4	19%	31-Jan-06
4	31%	30-Sep-02
5	10%	1-Jun-08
5	39%	8-Nov-05
6	17%	31-May-09



Pre-Money Valuation/Cum Prior Capital Invested

Pre-Money/ Capital Invested	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7	Total
No. of Observations		8	7	2	1	2	1	21
Median		4.86x	4.02x	3.40x	4.81x	4.17x	2.03x	
Average		5.22x	4.14x	3.40x	4.81x	4.17x	2.03x	
Median/Median		2.81x	2.50x	3.50x	6.84x	6.78x	3.15x	
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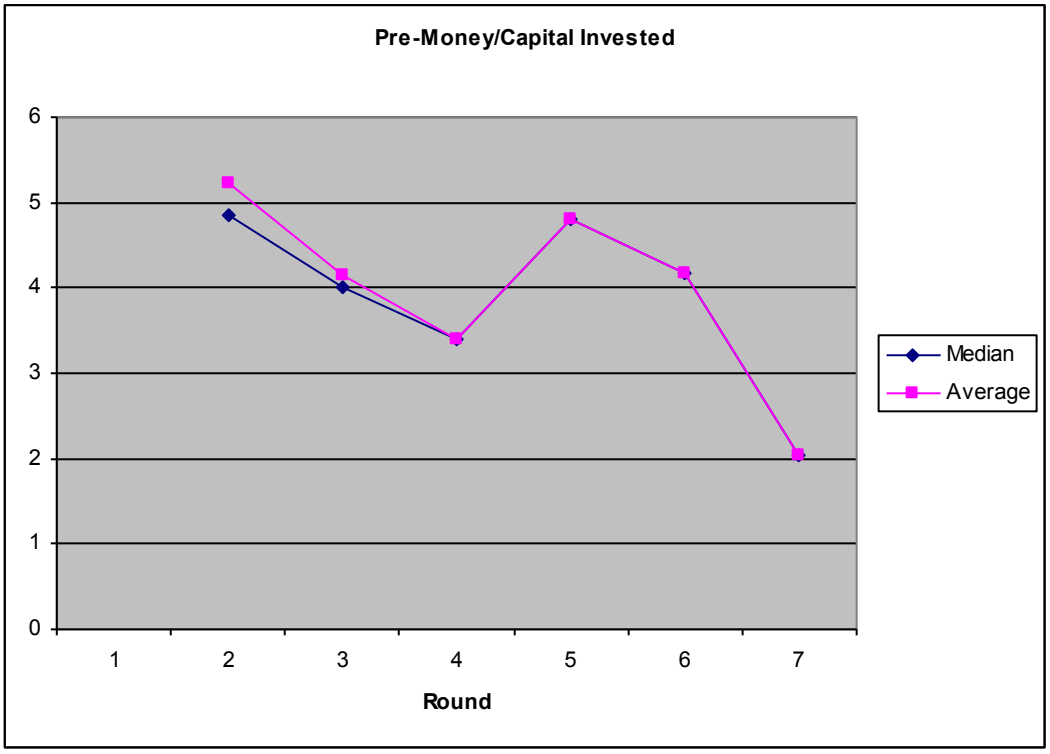
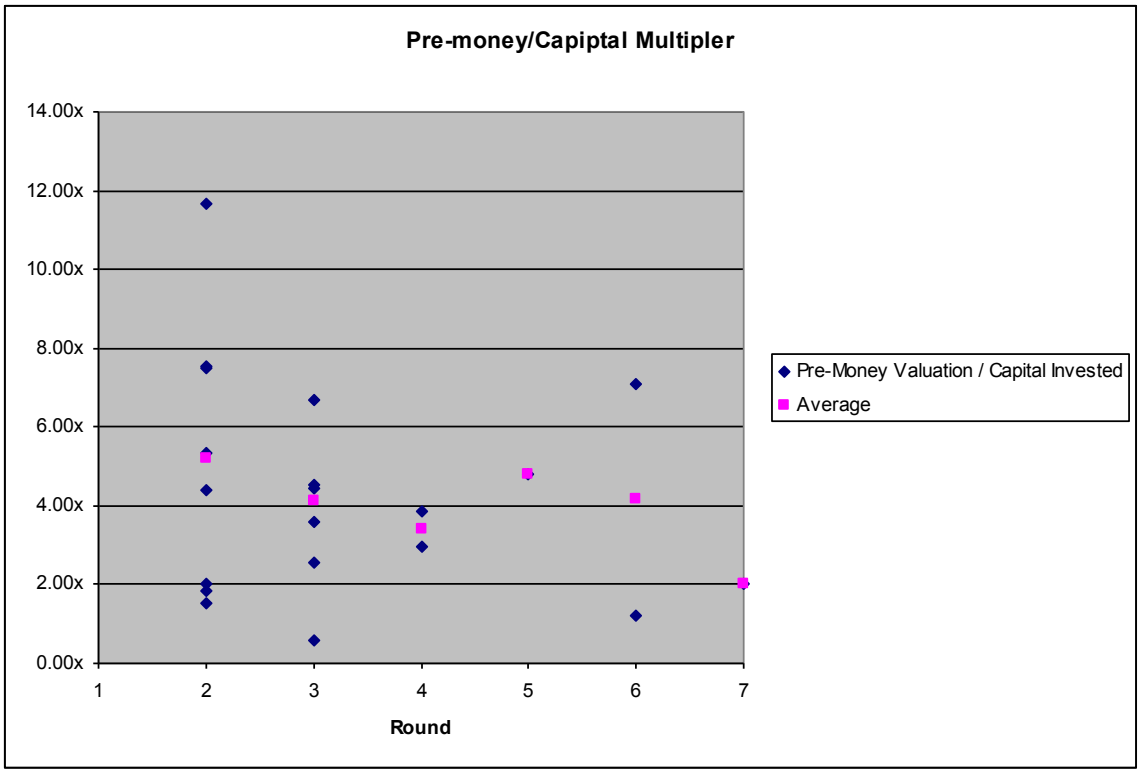


Note: Oxis Energy's round 3 (34.1X) is not included.

Pre-money/Capital Multiplier

Round	Pre-Money Valuation / Capital Invested
2	1.54x
2	4.39x
2	2.00x
2	1.82x
2	7.51x
2	7.55x
2	5.33x
2	11.67x
3	4.51x
3	6.67x
3	4.44x
3	2.55x
3	3.60x
3	0.58x
4	3.84x
4	2.97x
5	4.81x
6	7.10x
6	1.23x
7	2.03x



Pre/Post-Money & Round Size Multiplier

Pre-Money Multiplier	R2/R1	R3/R2	R4/R3	R5/R4	R6/R5	R7/R6	Total
No. of Observations	7	5	2	1	1	1	17
Median	2.31x	2.09x	1.81x	2.41x	3.11x	0.51x	
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Post Money Multiplier	R2/R1	R3/R2	R4/R3	R5/R4	R6/R5	R7/R6	Total
No. of Observations	6	5	2	1	1	1	16
Median	2.00x	2.19x	1.78x	2.39x	2.80x	0.55x	
Average	3.35x	6.69x	1.92x	2.09x	2.60x	1.68x	

Investment Amount Multiplier	R2/R1	R3/R2	R4/R3	R5/R4	R6/R5	R7/R6	Total
No. of Observations	18	16	10	4	2	1	51
Median	2.15x	2.07x	1.74x	1.90x	3.73x	0.98x	
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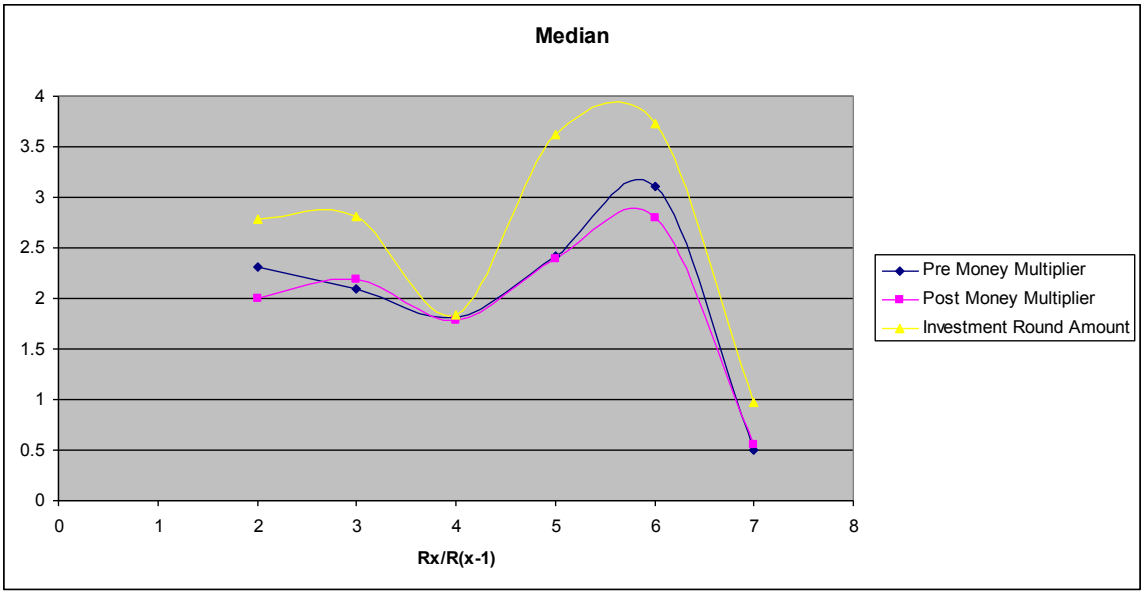

Company Summaries

Infinite Power Solutions

A privately-held venture backed technology company headquartered near the foothills of the Rocky Mountains in Littleton, Colorado, is the global leader in designing, manufacturing, and marketing thin film batteries (TFB) for micro-electronic applications. These flexible, rechargeable, solid-state lithium batteries, offered under the brand, are unrivaled in thinness, re-chargeability, and power performance, and operate over extreme temperature conditions.

Oxis Energy

Oxis Energy Ltd is pioneering a novel Lithium-Sulphide electrochemistry to produce a superior performance low-weight rechargeable battery.
Its unique approach is based on proprietary, highly stable cathode and electrolyte systems which are optimised for performance with different anodes including lithium-metal. Lithium-sulphide technology is proprietary to Oxis Energy and represents a significant improvement over lithium-sulphur (Li-S) electrochemistry.

A123 Systems

Based on new, highly active nanoscale material initially developed at MIT, A123 Systems' low impedance Nanophosphate electrode technology provides a competitive advantage over alternative high power technologies. A123's cell and electrode designs lower cost/watt and cost/watt-hour. They have higher voltage than other long-life systems, enabling lower pack cost. Their long life leads to reduced lifecycle and system costs resulting in greater overall price-performance.

Power Paper, Ltd

Power Paper, Ltd. provides micro-power source technology. It offers cosmetics skincare products for aging, wrinkled, hyper-pigmented or photo-damaged. The company also provides battery-assisted, passive RFID systems for use in the third party logistics, newspaper and media publishing, and aerospace industries, including UHF-based battery-assisted, passive Power ID labels, and Power ID readers. It markets its products in the United States, Europe, and Asia. The company was founded in 1997 and is headquartered in Petah Tikva, Israel.

Power Precise Solutions

PowerPrecise Solutions, Inc., a fabless mixed-signal semiconductor company, develops and supplies battery management integrated circuits for portable consumer, commercial, and military applications. Its products include state-of-charge indicator IC's and modules, single chip battery management, off the shelf energy management IC architecture, and

measurement/monitoring/analysis software suite. PowerPrecise Solutions, Inc. was founded in 2002 and is based in Herndon, Virginia with additional offices in Taipei, Taiwan and San Jose, California. As of October 9, 2007, PowerPrecise Solutions, Inc. operates as a subsidiary of Texas Instruments, Inc.

Powergenix, Ltd
PowerGenix, Inc. develops and manufactures nickel-zinc rechargeable batteries. The company's products are used for applications in power tools, UPS systems, electric scooters, hybrid electric vehicles, military and medical devices, and personal mobility devices, such as scooters and wheel chairs, as well as in consumer batteries. It has a manufacturing facility in San Diego, California; and a technology and product development facility in Shenzhen, China. The company was founded in 2000 and is headquartered in San Diego, California.

Boston Power, Inc.
Boston-Power, led by a team of industry veterans, is fueled by the unwavering mission of bringing dependable power to everyday applications. By creating a next-generation lithium-ion battery technology platform, leveraging insights by researchers over the last 30 years and lessons learned from the commercialization of lithium-ion solutions, we are bringing to market batteries that deliver on the promise of long life, mobility, safety and environmental sustainability.

Golden Gate Technology
Golden Gate Technology, Inc. provides power reduction solutions to wireless and high-performance chip designers to extend the battery life for portable and wireless devices. It provides tools that enhance existing design flows from electronic design automation vendors to reduce chip power consumption without impacting timing, signal integrity, and electro migration. The company was founded in 2000 and is headquartered in San Jose, California.

Atraverda
Atraverda is an advanced material company that owns the intellectual property rights to a conductive ceramic known worldwide through its trademark, Ebonex®. The Ebonex® material is a platform technology and has a range of commercial CleanTech applications in the power storage, water treatment and construction markets. Atraverda's current focus is in the multi-billion dollar power storage market where its technology is utilised in the production of batteries that are smaller, lighter and more reliable.

Nanosys
Founded in 2001 by an experienced business team and world renowned nanotechnology leaders, Nanosys is an industry leading nanotechnology

company developing products based on a technology platform incorporating high performance inorganic nanostructures. Its technology is covered by over 500 patent and patent applications and is currently being applied to address opportunities in multiple industries including energy, defense, electronics, computing and life science. Its partners include Bruker, Intel, In-Q-Tel, NTT DoCoMo, Rockwell Collins, two collaborations with Sharp Corporation and multiple collaborations with United States government agencies.

Nanotecture

Nanotecture, the Energy Technology Company, is focused on providing solutions to the power and energy requirements of the portable electronic and automotive markets. The Company can do this as it has developed a unique approach to fabricating nanoporous battery electrodes utilising self-assembled liquid crystal templates. The nanostructured material can significantly improve power density when integrated into a battery, or be used to produce supercapacitors (ultracapacitors) with both high energy and power capabilities. The microbatteries and supercapacitors can be fabricated to less than one square centimetre in area and 200 microns in thickness for miniature electronic applications and to larger sizes appropriate for electric car and truck engine applications.

Nanogram

NanoGram Corporation develops and licenses process technology for the manufacture of nanoscale compositions for optical, electronic, and energy applications. In addition, it offers nano particle manufacturing and laser reaction deposition processes. Further, the company's licensing package includes materials production process, surface modification and dispersion technologies, process transfer expertise, and ongoing support. The company was founded in 2002 and is headquartered in Milpitas, California with additional offices in Shinjuku, Japan and Seoul, Korea. NanoGram Corporation is a former subsidiary of NeoPhotonics Corporation.

ApNano Materials

ApNano Materials is a private nanotechnology company founded in 2002 and incorporated in the US and is headquartered in New York, USA. Its fully-owned Israeli subsidiary - NanoMaterials, Ltd., is located in the high tech science park in Ness Ziona, Israel. The company was granted an exclusive license by Yeda Research and Development Co. Ltd, the commercial arm of the Weizmann Institute of Science, Israel, to manufacture, commercialize and sell a new class of nanomaterials based on inorganic compounds that were discovered at the Institute. The shareholders of ApNano Materials, besides the founders, are Newton Technology VC Fund, Yeda Research and Development Co. LTD. (the commercial arm of the Weizmann Institute of Science), AYYT Technological

Applications and Date Update LTD. (the commercial arm of Holon Institute of Technology (HIT), Israel), and private European investors.

Zinc Matrix Power
Zinc Matrix Power was formed to develop high-performance rechargeable alkaline battery technology for commercial and military markets. Zinc Matrix Power batteries offer an extremely high ratio of energy to volume (Wh/l) in applications such as notebook computers, cell phones, and on-body power for military electronics. ZMP batteries provide up to 2X the runtime of lithium containing battery packs of the same size.

Deeya Energy
Founded in 2006 in the heart of Silicon Valley, Deeya Energy is a cleantech company dedicated to developing and manufacturing electrical energy storage systems. Deeya Energy's innovation, the L-Cell, is based on a novel battery technology originally developed by NASA in the early 70's as a potential energy storage method for long term space flights. Deeya Energy is backed by leading Silicon Valley venture firms including NEA, BlueRun, DFJ and Element Partners. Deeya Energy's management team is comprised of veterans from the fields of industrial power, energy storage, telecommunications, semiconductors and chemical industries.

Solicore
Solicore is a worldwide leader of embedded power solutions, offering its Flexion product portfolio of advanced ultra-thin, flexible, lithium polymer batteries for powered cards, RFID, and micro medical devices. Solicore has developed an advanced battery technology that is ultra-thin, flexible, safe, and environmentally friendly, which significantly enhances the capabilities of lithium-based batteries. The company’s patented and proprietary technology is based on polyimide chemistry that has created a truly solid-state electrolyte.

Carbon Micro Battery
Carbon Micro Battery, LLC is a company focused on the delivery of micro-power for devices that require high capacity energy sources. Its unique technology enables batteries which are longer lasting, have shorter charging times, and can be more flexibly configured. Its method for delivering micro-power is low risk to investors and customers in that it utilizes and leverages existing manufacturing processes and is an evolutionary Li-ion platform. The company was founded in 2006 based on this technology. The company is based in California and has been incorporated in Delaware.

Nexeon

Nexeon is developing advanced Li-ion rechargeable battery technology. It has developed a number of proprietary processes and machines for producing the material and for making electrodes. Nexeon has developed a number of proprietary processes and machines for producing the material and for making electrodes. The company is targeting an already-busy sector of cleantech as companies aim to develop longer-lasting and more powerful rechargeable batteries for consumer devices and vehicles.

Planar Energy Device

Planar Energy Devices develops, manufactures and markets metallic-lithium solid state battery products for automotive to off-grid energy storage. Bringing together innovative technologies from several research organization, Planar, an NREL spin-out with an extensive patent portfolio, has developed a platform for fabricating, in a scalable, low-capital-cost environment, a high energy density, safe and rechargeable battery.

Revolt

Founded in 2004, ReVolt Technology AS is a spin-off of SINTEF, Norway, one of the largest contract research institutes in Europe. Today's mobile electronic devices are already loaded with applications and services that consume more energy than conventional battery technology can provide, whilst manufacturers, operators and content providers ramp up their technology and service offers to keep up with consumer demand. ReVolt's high-performance, rechargeable battery technology is a critical breakthrough for today's consumer electronics devices and for the hi-tech growth markets of tomorrow; it is a real solution to a very real problem, and the potential for business development is immeasurable.

Sakti3

Sakti3, a start-up company that specializes in high-powered batteries tough enough for the everyday car.Sakti3 is awarded the Michigan Economic Development Corporation.

Thin Battery Technology

Blue Spark Technologies is the world's leading producer of thin, flexible printed battery solutions. Our technology can help you generate new and creative product designs or improve the cost structure and energize the performance of your existing products. Welcome to Blue Spark Technologies, the world's leading producer of thin, flexible printed battery solutions. This is the place if you are looking for an innovative, eco-friendly and cost effective printed power source. Our technology can help you generate new and creative product designs or improve the cost structure and energize the performance of your existing products.

FireFly Energy

Firefly Energy was founded in 2003 to develop and market breakthrough technology that takes batteries to new levels of performance. The Microcell foam grid technology developed by Firefly can be incorporated into existing lead acid manufacturing without requiring major investment in new equipment and processes.

Table of Included Venture Capital Investors

Coampany	1	2	3	4	5	6
Infinite Power Solutions	Applied Ventures	Core Capital	D. E. Shaw Ventures	In-Q-Tel	Polaris Venture Partners	
Oxis Energy	The Oxford Technology Venture Capital Trusts					
A123 Systems	Alliance Bernstein	Braemar Energy Ventures	CMEA Ventures	FA Technology Ventures	General Electric	Massachusetts Institute of Technology
Thin Battery Technologies	Key Capital Corporation (KCC)	SunBridge Partners	Early Stage Partners	ORIX Capital	Interlaken LLC	
FireFly Energy	Stark Investments	LP	Caterpillar,	KB Partners	he Illinois Finance Authority	the Tri-County Venture Capital Fund
Power Paper Ltd	Apax Partners	Infinity Venture Capital Fund		Amadeus Capital Partners	Bank of America Capital Partners	
Powergenix, Ltd	Bessemer Venture Partners	Advent International	Angeleno Group	Braemar Energy Ventures	Granite Ventures	OnPoint Technologies and Technology Partners
Boston Power, Inc.	Foundation Asset Management	Oak Investment Partners		Venrock	GGV Capital™	Gabriel Venture Partners®
Power Precise Solutions	Asset Acceptance	Bank of America	Deere Credit Services	Federal Reserve Bank		
Golden Gate Technology	Lightspeed Venture Partners	Horizon Ventures				
Altraverda	SEP, Scottish Equity Partners	Chord Capital	Onpoint Technologies, USA	Enertech, USA	Finance Wales	Bankinvest
Nanosys	ARCH Venture Partners	CW Group	Polaris Venture Partners	Venrock Associates	Prospect Venture Partners	Alexandria Real Estate Equities
Nanotecture	Foresight Venture Partners	IP2IPO	Artemis	East Hill Management	Quester	
Nanogram	ATA Ventures	Bay Partners	Global Cleantech Capital	Harris & Harris Group, Inc	Institutional Venture Capital	Masdar
ApNano Materials	Newton Technology VC Fund	AYYT LTD	Yeda Research and Development Co. LTD.			
Zinc Matrix Power	Intel Capital	OnPoint Technologies	PowerVentures			
Deeya Energy	Technology Partners	BlueRun Venture	Draper Fisher Jurvetson	DFJ Element	NEA	
Solicore	Draper Fisher Jurvetson	RHO	Emerald Techonology Ventures	CapiTech	Braemar Energy Ventures	Air Products
Carbon Micro Battery	Draper Fisher Jurvetson	Mission Ventures				
Nexeon	Imperial Innovations	Invesco Perpetual	PUK Ventures			
Planar Energy Device	Battelle Ventures, L.P.	Innovation Valley Partners (IVP)				
Revolt	Northzone Ventures	RWE Innogy	Sinvent	Sofinnova Partners	TVM Capital	Verdane Capital
Sakti3	NA					

Company	7	8	9	10	11	12	13	14	15
Infinite Power Solutions									
Oxis Energy									
A123 Systems	Motorola	North Bridge Venture Partners	OnPoint	Procter and Gamble	Qualcomm	Sequoia Capital	YankeeTek		
Thin Battery Technologies									
FireFly Energy									
Power Paper Ltd									
Powergenix, Ltd									
Boston Power, Inc.									
Power Precise Solutions	G.E. Capital								
Golden Gate Technology									
Altraverda	Espirito Santo Ventures								
Nanosys	CDIB BioScience Ventures	Lux Capital	SAIC Venture Capital						
Nanotecture									
Nanogram	Mitsui Venture	Nagase&Co., Ltd	Nano Start Investment	Nth Power	RockPort Capital	SBV Venture Partners	Technology Partners	7EL	Yasuda
ApNano Materials									
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Deeya Energy									
Solicore	FireLake Capital Management								
Carbon Micro Battery									
Nexeon									
Planar Energy Device									
Revolt	Viking Venture								
Sakti3									

Authors Biographies

Neal Dikeman is a partner at Jane Capital Partners LLC, a specialty merchant banking firm focused on cleantech. He is a cofounder of multiple companies in cleantech, including Carbonflow, Inc., Fideris, Inc., and Zenergy Power plc (AIN:ZEN), and has been a longtime advisor to the technology and alternative energy arms of ConocoPhillips and Meridian Energy Ltd. He is the Chairman of Cleantech.org, and the founding contributor of the Cleantech Blog, one of the original blogs in cleantech. He writes the column "A Capital Idea" for *Sustainable Industries* Magazine, formerly published the AltEnergy Review, blogged on cleantech for CNET/News.com, and has written for Cleantech.com and AltEnergyStocks.com. He has been quoted in every major mainstream and cleantech media source on cleantech.

He previously served as Director of Business Development and head of M&A for the parent company of Yellowpages.com, and as an associate at private equity fund manager Doyle & Boissiere. He began his career in energy investment banking at Bankers Trust (now Deutsche Bank), and has BA in Economics from Texas A&M University.

Jill Xu is an analyst at Jane Capital Partners LLC, a specialty merchant banking firm focused on cleantech. She formerly worked as an auditor for KPMG in Shanghai, China, auditing Fortune 500 clients to IFRS. She holds a Bachelor of Economics, in International Economics and Trade from East China University of Science and Technology (ECUST). She is currently completing an MBA at University of San Francisco, in San Francisco, CA.