

## Summary:

For the February 13<sup>th</sup> issue of NAATBatt's Advanced Battery Weekly, in addition to sector highlights, we have included an interview with Deputy General Director Alex Peng of the Industrial Technology Research Institute (ITRI). The ITRI introduced SToba, a material to enhance the safety of lithium-ion (Li-ion) batteries in late-2009.

For the week ending 2/8/10, the NAATBatt Index and the U.S. Battery Index were relatively flat while the Asia Battery Index declined 6.2%. The S&P 500 and the Russell 2000 both declined 3.0% and 3.7%, respectively.

## Key Highlights:

- **Hertz** will be adding **Nissan's** electric vehicle to its lineup next year in the U.S. and Europe. The Leaf will be available at select Hertz rental sites -- the company did not specify where.
- **Ford's** first "all electric" Transit Connect vehicle will hit streets later this year. The all-EV has an expected range of 80 miles from a 28 kWh lithium ion battery pack made by **Johnson Controls**.
- **Eco City Vehicles** (London-based) will begin trials later this year of the Mercedes Electric eVito Taxi. The eVito will be powered by a 38 kilowatt-hour battery pack produced by **Valence Technology** and should be able to travel 120 miles before a recharge is required.
- **Peugeot** has indicated that London as the 'natural next step' to introduce the Mu -- the French automaker's hire scheme that allows customers to load 'mobility points' onto a card before using them to borrow from a fleet of vehicles ranging from electric bicycles to vans. The Peugeot i-On electric city car is expected to be available for rent as part of the Mu scheme.
- **Electrovaya** has announced is participating in a utility demonstration project led by CEATI International Inc. According CEO Sankar DasGupta, industry experts have stated spending on the global energy storage market is expected to exceed \$600 billion over the next 10-12 years.
- Singapore electric vehicle (EV) charger technology developer **Zeco Systems** has launched EV charging solutions marketed under the trademark, **Greenlots**. The technology enables network operators to leverage the existing electricity and parking infrastructure with limited incremental cost to operate a commercial network of charging points.
- A closer look at **Federal Aviation Administration** data (by Computerworld) highlights in-flight incidents involving batteries have been both rare and, apart from one catastrophe, relatively benign. Less than two documented injuries per year have been reported -- all of them minor and most of them involving loading dock workers, and not passengers or in-flight aircrew.

## A Few More Details:

Hertz will be adding Nissan's electric vehicle to its lineup next year in the U.S. and Europe. The world's largest car rental agency is planning to use the all-EV Nissan Leaf (see **Exhibit 1**), which can seat five adults and is designed to travel up to 100 miles on a single charge. The lithium-ion battery is a 24 kilowatt-hour (kWh) pack from Nissan JV AESC. The Leaf will be available at select Hertz rental sites, though the company did not specify where.

Source: Associated Press

### Exhibit 1: The Nissan Leaf



Source: New York Times

Ford's first "all electric" Transit Connect vehicle (see **Exhibit 2**) will hit streets later this year. The all-EV is designed for urban areas like Detroit and Chicago. The electric Transit Connect has an expected range of 80 miles from a 28 kWh lithium ion battery pack made by Johnson Controls. The EV is designed to be recharged from a 120 volt or a 240 volt charging (requiring 6-8 hours).

### Exhibit 2: The Transit Connect



Source: Ford

Eco City Vehicles (London-based) will begin trials later this year of the Mercedes Electric eVito Taxi. The eVito will be powered by a 38 kWh pack produced by Valence Technology and should be able to travel 120 miles before a recharged is required. The vehicle has a top speed of up to 75 miles per-hour. However, it is unlikely the EV will appear on London's roads for public use in 2011, at the earliest.

Source: *Telegraph.co.uk*

Peugeot has indicated that London as the 'natural next step' to introduce the Mu -- the French automaker's hire scheme that allows customers to load 'mobility points' onto a card before using them to borrow from a fleet of vehicles ranging from electric bicycles to vans. Mu has enjoyed success in cities across France and is now ready to be rolled out across Europe. Peugeot dealers have been participating Mu as it enables them to profit from vehicles that would otherwise be sitting in car lots waiting to be sold. The Peugeot i-ON electric city car (see **Exhibit 3**), priced at £20,000 (or ~\$27,250) is expected to be available for rent as part of the Mu scheme.

Source: *ETA*

### Exhibit 3: The Peugeot i-ON



Source: *Peugot*

Electrovaya has announced is participating in a utility demonstration project led by CEATI International Inc., headquartered in Montreal. Other partners include major utilities and universities. The project has been conditionally approved for partial funding support from the Government of Canada's Clean Energy Fund. The total project cost is estimated at \$7.5 million. According CEO Sankar DasGupta, industry experts have stated spending on the global energy storage market is expected to exceed \$600 billion over the next 10-12 years.

Source: *Electrovaya*

Singapore electric vehicle (EV) charger technology developer Zeco Systems has launched EV charging solutions marketed under the trademark, Greenlots. The solutions are based on usage patterns of EV drivers and tap into the existing grid infrastructure. The technology enables network operators to leverage the existing electricity and parking infrastructure with limited incremental cost to operate a commercial network of charging points. Greenlots has already begun installation of charging points at various locations throughout Singapore. The company currently has partners in Austria, China, Germany, and Hong Kong, and is in discussion with other potential partners worldwide.

Source: *NewNet*

A closer look at Federal Aviation Administration data (by Computerworld) highlights in-flight incidents involving batteries have been both rare and, apart from one catastrophe, relatively benign. There have been a total of 109 incidents globally (between 3/91 and 9/09) involving batteries that exploded, caught fire, or emitted smoke, according to FAA data. The incidents resulted in 51 injuries and one death. Many came from a single August 1999 disaster, in which one passenger died, 13 suffered critical injuries, and 14 had minor injuries, after a Taiwanese passenger jet exploded upon landing. However, an investigation determined that gasoline from a leaky canister carried in an overhead passenger bin was ignited by sparks from a nearby 12-volt motorcycle battery. Excluding that horrific disaster, fewer than two documented injuries per year have been reported -- all of them minor and most of them involving loading dock workers, and not passengers or in-flight aircrew.

*Source: Computerworld*



## Interview with Deputy General Director Alex Peng of the Industrial Technology Research Institute (ITRI):

### Please describe ITRI.

The Industrial Technology Research Institute (ITRI) based in Taiwan is a nonprofit R&D organization engaging in applied research and technical services. Founded in 1973, ITRI has played a vital role in transforming Taiwan's economy from a labor-intensive industry to a high-tech industry. The areas of focus include Electronics and Optoelectronics; Material, Chemical and Nanotechnologies; and Energy and Environment. The institute employs 5,800 personnel, including 1,112 who hold Ph.D.s and 3,206 with master's degrees, resulting in an average of five patents produced every day. Well-known high-tech companies in Taiwan such as TSMC and UMC can trace their origins to ITRI.

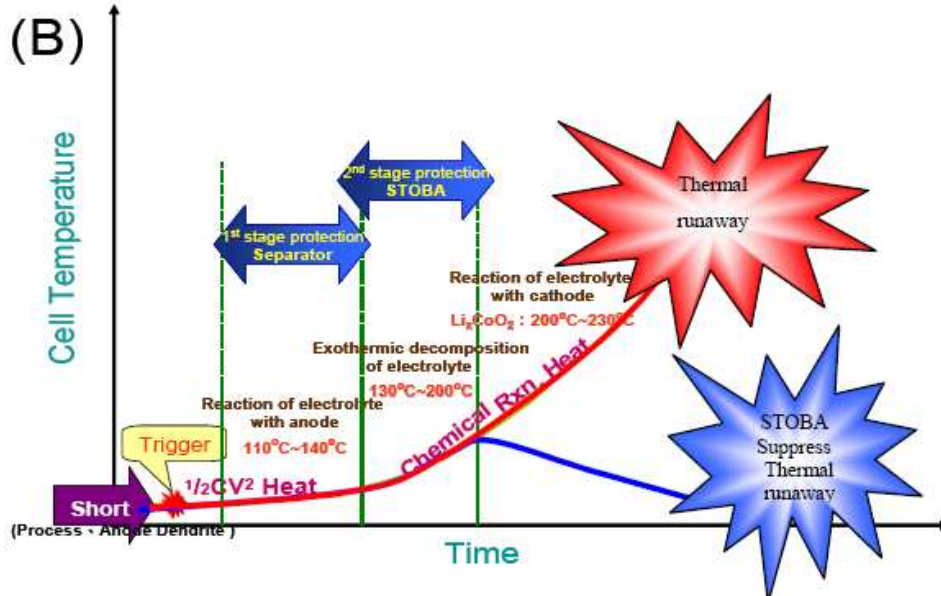
### What is the difference between STOBA and separator material?

Commercially available separator is a good ionic conductor and also electric insulator, which could thermal seal the pores to prevent internal short-circuit. However, the separator could not resist puncture or impact in some severe conditions that arising from crash and some typical internal short-circuit. STOBA (self-terminated oligomers with hyper-branched architecture) is a material that would be used in conjunction with the commonly used separator material in lithium-ion batteries. The major difference is separators primarily operate at micron scale to prevent electric current flow between anode and cathode. Whereas, STOBA is active down to the nanoscale level that could insulate penetrating or protruding "nail" and dendrite resulting from process contamination or severe impact and nail penetration.

(Note: 1 meter = 1,000,000 microns and 1 meter – 1,000,000,000 nanometers)

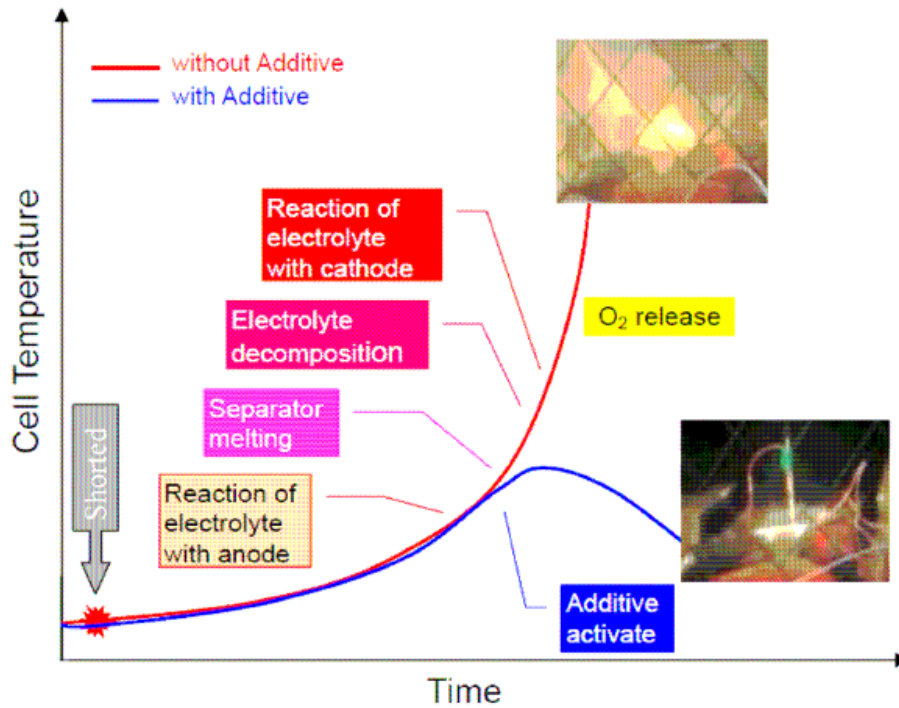
STOBA R&D began in 2004. The nano-grade material is heat-resistant and fundamentally resolves the safety issue by generating a 'locking mechanism' when the internal temperature of the battery rises to dangerous levels (i.e. 130-200 degrees centigrade). The nano-grade high-molecular polymer forms a protective film (and prevents explosions) when the battery temperature becomes excessive -- caused by an external impact or piercing that interrupts the electrical and chemical reaction (reference **Exhibits 4 and 5**). This in turn could lead to short-circuiting that generates excessive heat with traditional membranes.

Exhibit 4: The Impact of STOBA in Preventing Thermal Runaway



Source: ITRI

Exhibit 5: STOBA Interrupts the Chemical Reaction



Source: ITRI

**Discuss the shortcoming(s) of separator materials currently used in the marketplace.**

Commercially available separators are likely to be deformed or breakdown under high temperature or mechanical impact. Separators currently have a lower temperature tolerance range and could begin to melt at a temperature of 150-170 degrees centigrade. This would lead to shorting and to a 'thermal runaway' or battery fires. Commonly used batteries operate at a 6 sigma failure rate (3-4 failures out of 1 million). Using STOBA would enhance the failure rate to a 10 to 12 sigma level (or a millionth of a millionth rate).

**How would thermal runaway be prevented by STOBA?**

STOBA transitions into a film (from a porous material) at 130-200 degrees centigrade to stop reactions that could lead to 'thermal runaway' or overheating. The film is not necessarily a physical reinforcement barrier, but could serve or help minimize the potential for dendrite puncture. Dendrites could possible begin to form on after a couple hundreds cycles or in abuse condition in the current lithium-cobalt system.

**Exhibit 6: Nail Penetration Test – With (Left) and Without (Right) STOBA**



Source: ITRI

**Does reducing the potential for 'thermal runaway', also reduce the reliance on specific lithium-ion chemistry systems,**

There is no clear evidence for side effect of STOBA though it could increase few % of cell resistance. This is in an acceptable level and could be minimized by cell design and new structure of STOBA. Apart from lithium-cobalt system, STOBA could effectively eliminate many potential risks of lithium-manganese (Li-Mn) cells too

**What additional stress and/or validation tests remain?**

STOBA has passed mandatory shorting and piercing experiments conducted in 2008 and 2009 by battery manufacturers in Japan and Taiwan. The intensive nail penetration and impact tests have confirmed STOBA's effectiveness in preventing internal shorting and overheating in lithium-ion (li-ion) batteries. Pilot and mass production of STOBA battery is ongoing.

**When will the material be available for the commercial market?**

Scale up of STOBA as chemical is ready now and “STOBA inside” battery will be market available in Q2 of 2010 by Taiwan battery makers first. Our go to market strategy is to partner with integrators to develop the battery system. The full benefits of STOBA could be further realized with cell and module and system integrators such as NB and EV makers. We believe battery and power system could be over-designed to prevent failure modes. Using STOBA would enable larger format and thus simplify and maximize design efficiency and also reduce cost.

**How much incremental cost will STOBA add to the battery material cost?**

Separators currently comprise about 15% of material cost. STOBA would add 3-5% to the cell cost. However, we believe the integration of STOBA in the battery system design will simplify the overall design. Thereby driving cost lower, as batteries for electric vehicles are being ‘over loaded’ with small cells and many redundant safety features that are adding to the overall cost.

**What are the target markets? Where has the material garnered the most interest?**

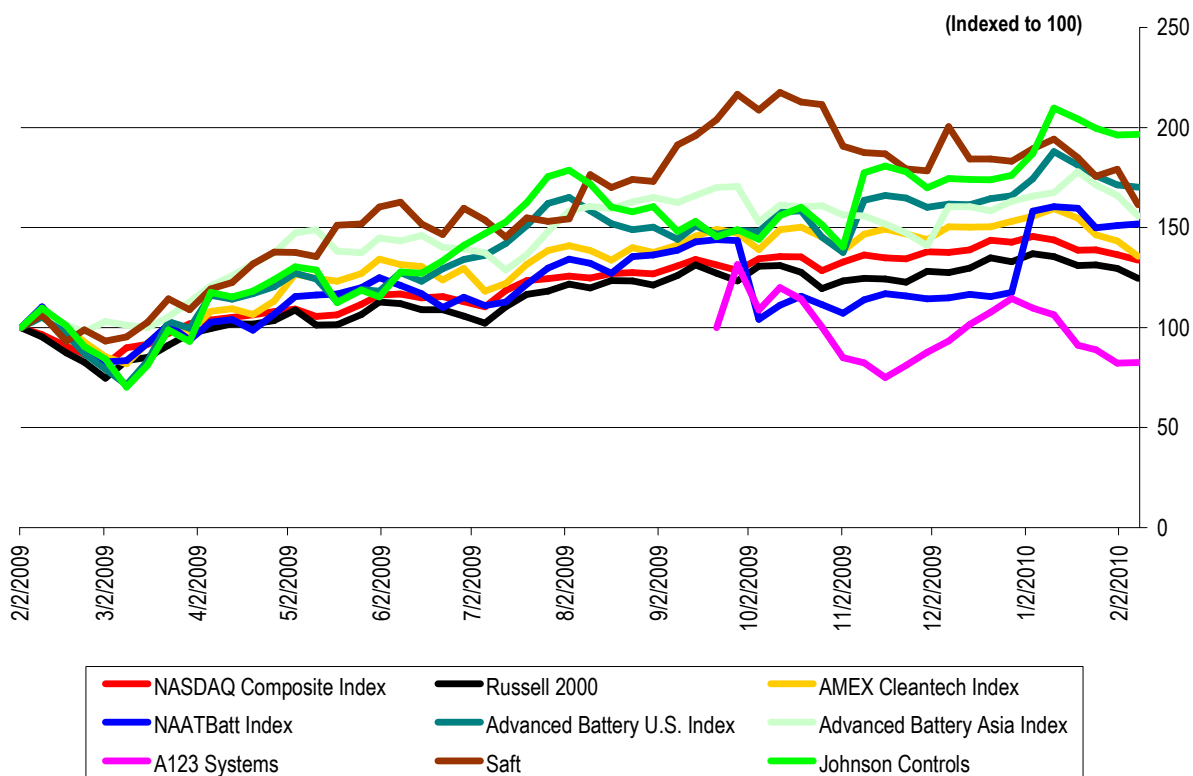
STOBA has garnered interest from multiple markets including consumer electronics. We have formed a “STOBA inside Application Platform”, inviting global companies of system’s module and cell makers to apply this innovative material to the battery. Battery makers in Taiwan, including E-One Moli Energy would explore ways to make lithium-ion batteries for consumer electronics as well as hybrid cars and electric cars safer and more efficient. The 5-year partnership was made to take advantage of government incentives to promote green transportation projects such as e-scooter and EV and to take advantage of new technology for lithium-ion batteries.

E-one is providing Li-ion batteries for BMW Mini E, an electric car that uses lithium-ion batteries. E-One’s latest electric car battery prototype currently gives car a range of 120-150 miles (190-240-kilometers) before needing a recharge, charges in two to five hours and accelerates from 0 to 60 miles per hour in 7 seconds. The battery contains around 5,000 cells, compared to the 3 to 8 cells found in common laptop batteries.

**How the nanomaterial manufactured and what is is the current capacity?**

We prepare STOBA material into a solution form. Production capability is presently not a problem, as we can manufacture 3 tons per month or enough for 10 million standard cells (18650s) per month to start. This would be enough material for roughly 2,500 battery electric or 6,000 plug-in hybrid electric vehicles.

**Exhibit 7: Indices Performance  
(From February 2, 2009)**

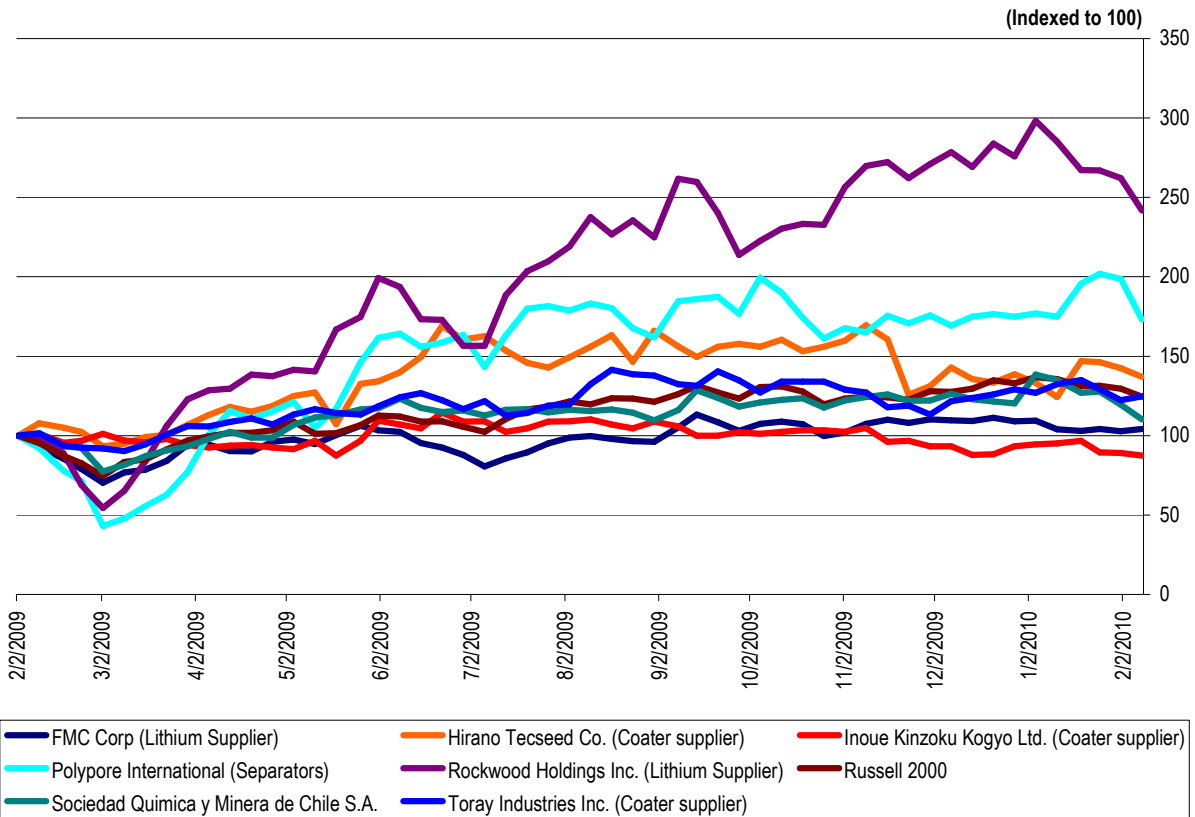


Index	Close on 2/8/2010	52-Wk High	% of 52-Wk High	Performance		
				LTM	YTD	Week
Dow	9,908.4	10,767.2	92.0%	(6.7%)	(5.0%)	(2.7%)
S&P 500	1,056.7	1,150.5	91.9%	(7.7%)	(5.4%)	(3.0%)
NASDAQ	2,126.1	2,326.3	91.4%	(8.2%)	(7.3%)	(2.1%)
Russell 2000	586.5	649.2	90.3%	(9.0%)	(6.6%)	(3.7%)
AMEX Cleantech Index	942.2	1,112.5	84.7%	(14.4%)	(11.7%)	(5.4%)

Source: Bloomberg and ThomsonOne

Note: The select NAATBatt Index is a market-value-weighted average and includes ALTI, BASF, COP, ENS and XIDE. The Advanced Battery U.S. Index is a market-value-weighted average and includes HEV, MGA, MXWL, UQM and VLNC. The Advanced Battery China Index is a market-value-weighted average and includes BYD, CBAK, GS Yuasa, LG Chem and Panasonic.

**Exhibit 8: Supplier Performance**  
(From February 2, 2009)



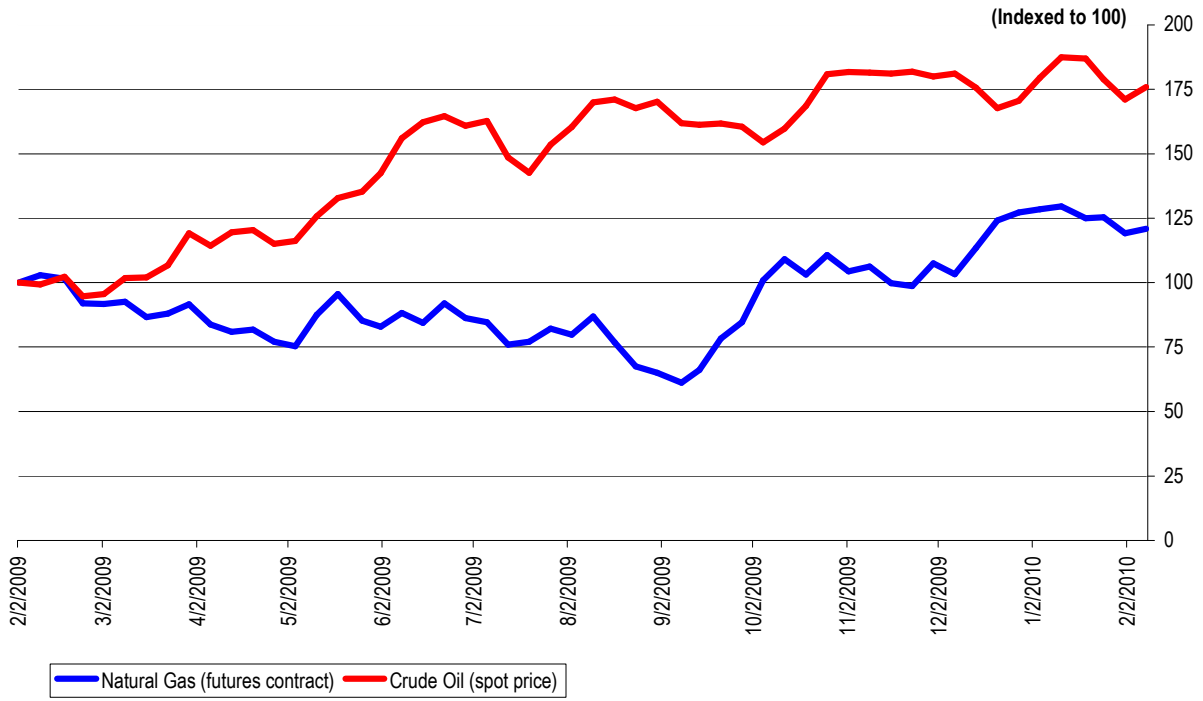
Source: Bloomberg

**Exhibit 9: Commodity Prices**

Commodity	Price on 2/8/2010	Price on 2/1/2010	Price on 1/8/2010	1 Week Change	1 Month Change
LME Nickel (Cash, \$ per tonne)	17,030	18,000	18,100	(5.4%)	(5.9%)
LME Lead (cash, \$ per tonne)	1,930	2,000	2,524	(3.5%)	(23.5%)

Source: LME

**Exhibit 10: Natural Gas and Crude Oil**  
 (From February 2, 2009)



Source: EIA



### WEBINAR PROGRAM SET FOR LAUNCH

As noted in this week's NAATBatt Bulletin, on Monday, March 1, 2010, NAATBatt will launch its new Webinar series with a program entitled "Reducing Waste in the Manufacture of Li-Ion Cells and Electrodes". John Dispennette of Arcotronics and Mohit Uberoi of MEGTEC Systems will talk about best practices for reducing waste and increasing efficiency in the manufacture of Li-Ion battery cells and electrodes. Instructions on how to register for the March 1 Webinar will be posted shortly on NAATBatt's Web site ([www.naatbatt.org](http://www.naatbatt.org)) and in future issues of the NAATBatt Advanced Battery Weekly.

NAATBatt's core mission is reducing the cost of Li-Ion cells, so the subject of waste reduction in battery manufacturing is an important one. Reducing waste in the manufacture of cells and electrodes may be the lowest hanging fruit in the battle for cost reduction. John and Mohit will share their observations about how manufacturers can address this issue. I hope you will find their discussion informative and helpful in establishing best practices for cell and electrode manufacturing.

As well as encouraging best practices in manufacturing, NAATBatt wants to establish a best practice for providing information to the advanced battery industry. Traditional conferences are useful but cost thousands of dollars for members to attend—the cost of which must be recovered by the price of Li-Ion cells. We think we have a better way. NAATBatt's bi-monthly Webinars will provide conference-quality information in a condensed, 45 minute format at a price to NAATBatt corporate members that literally cannot be beat. I hope you will enjoy them and find them to be an outstanding value proposition.

All of us at NAATBatt thank our members for their continuing support. To those companies that have not yet joined, please join soon. We are building an industry and need your help to do it.



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