

## Summary:

For the May 7<sup>th</sup> issue of NAATBatt's Advanced Battery Weekly, we highlight the ongoing sector activities. On June 2<sup>nd</sup>, we will be hosting a webinar on "*Addressing The Challenges of Lithium Air Technology*".

The Battery Indices all exhibited gains with the NAATBatt Index increasing 3.5%, the U.S. Battery Index up 2.7% and the Asia Battery Index growing 2.5%. The S&P500 and Russell 2000 were down modestly.

## Key Highlights:

- **Applied Materials** was a recipient of an **Advanced Research Projects Agency-Energy (ARPA-E)** award (\$4.4 million) for a project to develop a low cost lithium-ion (li-ion) battery manufacturing process. The company's efforts are focused on integrating high energy cathodes with anodes that could help establish U.S. manufacturing leadership in advanced li-ion batteries.
- The **Singapore Government** is seeking proposals from vendors for a network of charging stations to be ready by the end of November. The **Energy Market Authority (EMA)**, which is the lead agency of an ongoing electric vehicle (EV) trial is looking to build up to 63 charging stations across the island with 3 of them having quick charging capability -- within 30 minutes.
- The **European Commission** is planning to institute a rule to have warning sounds emitted by zero-emission vehicles. Each manufacturer would be responsible for its own "signature tune" with a minimum volume requirement to prevent pedestrians, cyclists and the blind from stepping into the path of an EV.
- The **Telekom Austria Group (TAG)** announced the launch of the first prototype of a telephone boots with an integrated charging station. By year-end, 30 charging stations are expected to be operational.
- **Sanyo Electric Company** is planning to increase spending on rechargeable batteries and solar cells to about 200 billion yen (or about \$2.1 billion) over the next 3 years,
- South Korea plans to develop a commercially viable, high-performance electric motorbike by 2013. A local consortium, led by **Daelim Motor Co.** will lead the efforts and will receive a government fund of 7.84 billion won (or ~\$7.0 million) for research and development over the next 3-years.
- **Magna International** is forming a new group, "Magna E-car System". The unit will encompass its current all-EV project with **Ford** and will also develop the battery system technologies for the hybrid and all-EVs.
- **CT&T** (South Korea-based) announced plans to build an assembly plant in **Hawaii** that will eventually produce 10,000 EVs. The facility would produce 2-seat EVs that could reach speeds up to 40 MPH.

## A Few More Details:

Applied Materials was a recipient of an Advanced Research Projects Agency-Energy (ARPA-E) award (\$4.4 million) for a project to develop a low cost lithium-ion (li-ion) battery manufacturing process. The company's efforts are focused on integrating high energy cathodes with anodes that could help establish U.S. manufacturing leadership in advanced li-ion batteries. The Department of Energy is giving out 37 awards totaling \$106 million for projects that could change the way the country uses and produces energy. See **Exhibit 3** at the end of this section for the complete list.

Source: *Advanced Research Projects Agency Energy*

The Singapore Government is seeking proposals from vendors for a network of charging stations to be ready by the end of November. The Energy Market Authority (EMA), which is the lead agency of an ongoing electric vehicle (EV) trial is looking to build up to 63 charging stations across the island with 3 of them having quick charging capability -- within 30 minutes. The typical charging time at a kiosk charging station (see **Exhibit 1**) would take about 6 to 12 hours. The EMA is targeting to have 20 standard stations and quick-charge station in operation by December.

Source: *Straights Times*

### Exhibit 1: A Kiosk Charging Station



Photo: ST

The European Commission is planning to institute a rule to have warning sounds emitted by zero-emission vehicles. Each manufacturer would be responsible for its own "signature tune" with a minimum volume requirement to prevent pedestrians, cyclists and the blind from stepping into the path of an EV. The potential warning sounds could vary from the traditional engine noise to the similar sounds of a spacecraft from a "Star Wars" movie.

Source: *UK Times*

The Telekom Austria Group (TAG) announced the launch of the first prototype of telephone booths with an integrated charging station. TAG is a member of the Austrian Mobile Power (AMP), the country's largest E-mobility platform. The company's charging stations will leverage the existing infrastructure, as TAG operates about 13,500 telephone booths countrywide, of which 700 are multimedia stations. By year-end, 30 charging stations are expected to be operational.

Source: *Telekom Austria Group*

Sanyo Electric Company is planning to increase spending on rechargeable batteries and solar cells to about 200 billion yen (or about \$2.1 billion) over the next 3 years. The company is expected to start mass production of li-ion batteries for plug-in hybrids and electric cars by fiscal 2012.

Source: *Nikkei*

---

South Korea plans to develop a commercially viable, high-performance electric motorbike by 2013. A local consortium, led by Daelim Motor Co. will lead the efforts and will receive a government fund of 7.84 billion won (or ~\$7.0 million) for research and development over the next 3-years. The vehicle could help riders save 740,000 won (US\$661) in fuel costs every year and reduce CO<sub>2</sub> emissions by around 736 kilograms (or 1,622 lbs). The electric bike is projected to weigh 140 kilograms (or 309 lbs) and have a top speed of 80 kilometers per hour (or 50 MPH) and travel 70 kilometers (or 43 miles) on a single charge. The recharge time is targeted for 20 minutes.

*Source: Malaysian National News Agency*

---

Magna International is forming a new group, "Magna E-car System". The unit is designing and developing a platform packed with electronic components and technology to automakers to serve as the base for their EVs. Magna E-car Systems will encompass its current all-EV project with Ford and will also develop the battery system technologies for the hybrid and all-EVs.

*Source: The Globe and Mail*

---

CT&T (South Korea-based) announced plans to build an assembly plant in Hawaii that will eventually produce 10,000 EVs. The facility would produce 2-seat EVs (see **Exhibit 2**) that could reach speeds up to 40 MPH. The batteries would last for 30 to 60 miles depending on the model (with a cost ranging from \$8,000 to \$20,000) and could be recharged at stations that are planned to be built by the end of the year.

*Source: The Honolulu Advertiser*

#### Exhibit 2: CT&T Two Seater



*Source: The Honolulu Advertiser*

### Exhibit 3: ARPA-E Project Selections

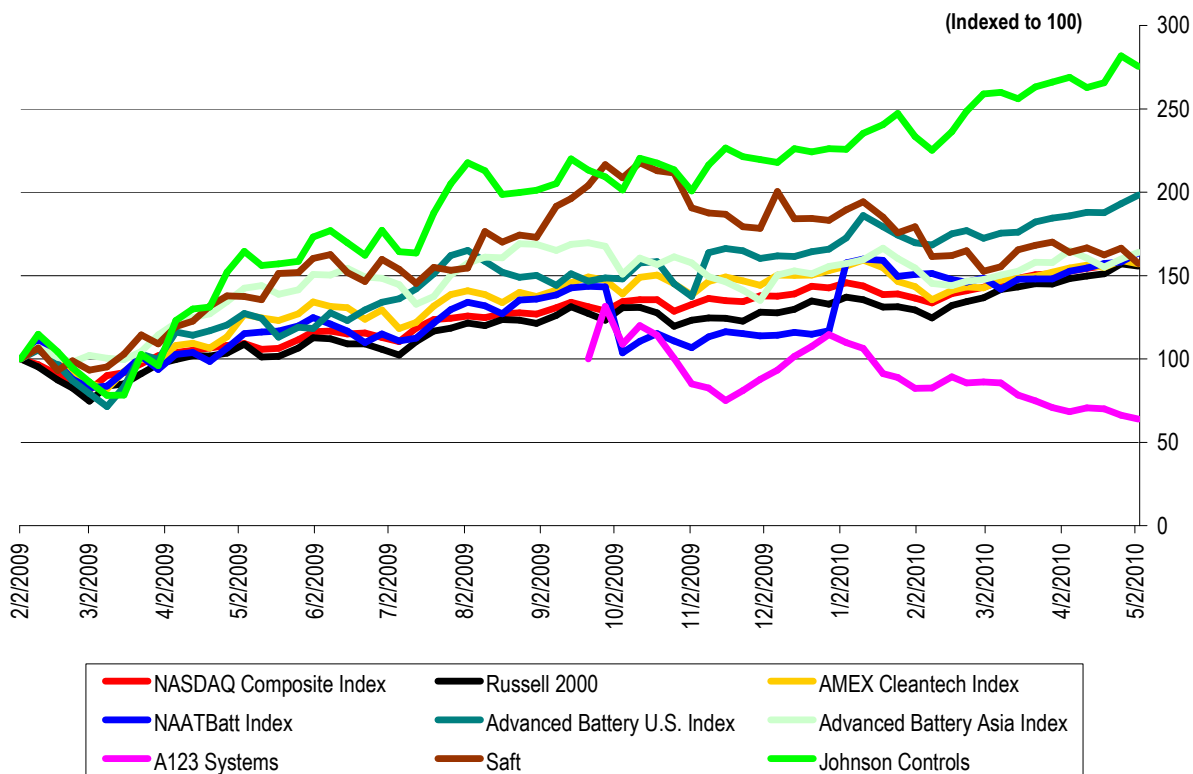
Lead Research Organization (Partner Organizations)	Amount	Lead Organization Location (City, State)	Project Description
<b>1) Electrofuels</b>			
<b>University of Massachusetts Amherst</b>  (University of California San Diego, Genomatica)	\$1,000,000	Amherst, MA	<i>Electron Source – Electric Current:</i> This project will develop a “microbial electrosynthesis” process in which microorganisms use electric current to convert water and carbon dioxide into butanol at much higher efficiency than traditional photosynthesis and without need for arable land.
<b>Pennsylvania State University</b>  (University of Kentucky)	\$1,500,000	University Park, PA	<i>Electron Source – Solar Hydrogen:</i> Hydrogen consuming bacteria that usually derives its energy from residual light and organic waste at the bottom of ponds will be “rewired” to use electricity. The organism will be able to convert hydrogen and carbon dioxide into a bio-oil that can be refined into gasoline.
<b>The Ohio State University</b>  (Battelle Memorial Institute)	\$3,977,349	Columbus, OH	<i>Electron Source – Hydrogen:</i> An industrially scalable bioreactor approach to incorporate genetically engineered bacteria that metabolize carbon dioxide, oxygen, and hydrogen to produce butanol. The team anticipates at least a twofold productivity improvement over current levels and a cost that can be competitive with gasoline.
<b>Massachusetts Institute of Technology</b>  (Michigan State University)	\$1,771,404	Cambridge, MA	<i>Electron Source – Hydrogen:</i> A bacterium capable of consuming hydrogen and carbon dioxide will be engineered to produce butanol, which could be used as a motor fuel.
<b>Ginkgo BioWorks</b>  (University of California Berkeley, University of Washington)	\$6,000,000	Boston, MA	<i>Electron Source – Electric Current:</i> The project will engineer a well-studied bacterium, <i>E. coli</i> , to harness electric current to convert carbon dioxide and water into isooctane, an important component of gasoline.
<b>Harvard Medical School-Wyss Institute</b>	\$4,194,125	Boston, MA	<i>Electron Source – Electric Current:</i> This project will engineer a bacterium to be able to use electricity (which could come from renewable sources like solar or wind) to convert carbon dioxide into octanol, an energy-dense liquid fuel.
<b>Massachusetts Institute of Technology</b>  (Harvard University, University of Delaware)	\$3,195,563	Cambridge, MA	<i>Electron Source – Hydrogen and/or Direct Current:</i> This project will engineer two microbes, working together, to convert carbon dioxide and hydrogen into oil, which could be refined into biodiesel.
<b>North Carolina State University</b>  (University of Georgia)	\$2,729,976	Raleigh, NC	<i>Electron Source – Hydrogen:</i> The project will engineer a novel pathway into a high-temperature organism to use hydrogen gas to convert carbon dioxide into precursor compounds that can be used to produce biofuels such as butanol.
<b>OPX Biotechnologies Inc.</b>  (National Renewable Energy Laboratory, Johnson Matthey Catalysts Inc.)	\$6,000,000	Boulder, CO	<i>Electron Source – Hydrogen:</i> Microorganisms will be engineered to use renewable hydrogen and carbon dioxide inputs to produce a biodiesel-equivalent fuel at low cost. Catalysts will be explored to convert the microbial fuel into jet fuel.

Lead Research Organization (Partner Organizations)	Amount	Lead Organization Location (City, State)	Project Description
<b>University of California Los Angeles</b>  (Easel Biotechnologies LLC, University of California Davis)	\$4,000,000	Los Angeles, CA	<i>Electron Source – Electric Current:</i> The project will use synthetic biology and metabolic engineering techniques to allow microorganisms to use electricity instead of sunlight for converting carbon dioxide into alcohol fuels that can be high octane gasoline substitutes.
<b>Medical University of South Carolina</b>  (Clemson University, University of South Carolina)	\$2,342,602	Charleston, SC	<i>Electron Source – Electric Current:</i> The project will leverage microbial fuel cell technology to develop a microbial system that uses electricity to convert carbon dioxide into butanol or other alcohol fuels.
<b>Columbia University</b>	\$543,394	New York, NY	<i>Electron Source – Ammonia:</i> The project will genetically engineer ammonia-consuming bacteria to produce isobutanol from carbon dioxide and electricity.
<b>Lawrence Berkeley National Laboratory</b>  (University of California Berkeley, Logos Technologies Inc.)	\$3,948,493	Berkeley, CA	<i>Electron Source – Hydrogen:</i> A common soil bacterium will be engineered to produce butanol and hydrocarbons from carbon dioxide and hydrogen. The organism would be able to produce its own hydrogen by splitting water in the presence of electricity.
<b>2) Batteries for Electrical Energy Storage in Transportation (“BEEST”)</b>			
<b>Sion Power Corporation</b>  (BASF, Lawrence Berkeley National Laboratory, Pacific Northwest National Laboratory)	\$5,000,000	Tucson, AZ	<i>Lithium-Sulfur (Li-S) Battery:</i> The project seeks to develop an ultra-high energy Li-S battery that can power electric vehicles for more than 300 miles between charges. The approach uses new manufacturing processes and six physical barrier layers to address cycle life and safety.
<b>ReVolt Technology LLC</b>	\$5,000,335	Portland, OR	<i>Zinc Flow Air Battery:</i> A large, high-energy zinc-air flow battery will be developed to enable long range plug-in hybrid and all-electric vehicles. Zinc, suspended as a slurry, is stored in a tank and transported through tubes to charge and discharge the battery.
<b>PolyPlus Battery Company</b>  (Corning Inc.)	\$4,996,311	Berkeley, CA	<i>Lithium-Air Battery:</i> Rechargeable Li-Air batteries for electric vehicle applications will be developed using protected Lithium metal cathodes. This approach has a clear path to scaling commercially, and the batteries may rival the energy density of gasoline.
<b>Pellion Technologies, Inc.</b>  (Massachusetts Institute of Technology, Bar-Ilan University)	\$3,204,080	Menlo Park, CA	<i>Magnesium-Ion Battery:</i> The project will develop an inexpensive, rechargeable magnesium-ion battery for electric and hybrid-electric vehicle applications. Computational methods and accelerated chemical synthesis will be used to develop new materials and chemistries. If successful, this project will develop the first commercial magnesium-ion battery and establish U.S. technology leadership in a new field.
<b>Applied Materials, Inc.</b>  (A123 Systems, Inc., Lawrence Berkeley National Laboratory)	\$4,373,990	Santa Clara, CA	<i>Advanced Lithium-Ion Battery Manufacturing:</i> Low-cost, ultra-high energy lithium-ion batteries will be developed using an innovative manufacturing process. High energy cathodes will be integrated with new anodes and prototype manufacturing will be demonstrated that could achieve an extremely low cost. If successful, this project will establish U.S. leadership in the manufacturing of high energy, low cost advanced lithium-ion batteries.

Lead Research Organization (Partner Organizations)	Amount	Lead Organization Location (City, State)	Project Description
<b>Massachusetts Institute of Technology</b>  (A123 Systems, Inc., Rutgers University)	\$4,973,724	Cambridge, MA	<i>Novel Semi-Solid Rechargeable Flow Battery:</i> This is a new battery concept that combines the best aspects of rechargeable batteries and fuel cells. It could enable batteries for electric vehicles that are much lighter and smaller - and cheaper - than today's batteries. This flow battery potentially could cost less than one-eighth of today's batteries, which could lead to widespread adoption of affordable electric vehicles.
<b>Planar Energy Devices, Inc.</b>  (National Renewable Energy Laboratory, UC San Diego, University of Central Florida, University of Colorado - Boulder, University of Florida, University of South Florida)	\$4,025,373	Orlando, FL	<i>Solid State Lithium Battery:</i> This project seeks to develop an ultra high energy, long cycle life all solid-state lithium battery that can be manufactured using low cost techniques. Pilot-scale manufacturing of the batteries will be demonstrated using all inorganic materials and solid state electrolytes whose properties are similar to existing liquid electrolytes.
<b>Stanford University</b>  (Honda, Applied Materials, Inc.)	\$1,000,000	Stanford, CA	<i>Novel All-Electron Battery:</i> Researchers will seek to develop an "All-Electron Battery", a completely new class of electrical energy storage devices for electric vehicles. The new battery stores energy by moving electrons rather than ions and uses a novel architecture that has potential for very high energy density.
<b>Recapping, Inc.</b>  (Penn State University)	\$1,000,000	University Park, PA Menlo Park, CA	<i>Capacitive Storage:</i> The project will develop a novel energy storage device – a high energy density capacitor – based on a 3D nanocomposite structure. The approach combines the benefits of high cycling ability, high power density, and low cost.
<b>Missouri University of Science &amp; Technology</b>  (Brookhaven National Laboratory, MaxPower Inc., NanoLab Inc.)	\$999,997	Rolla, MO	<i>Lithium-Air Battery:</i> A new high energy air cathode will be created to enable the successful development of ultra-high energy Lithium-Air batteries. The project will seek to dramatically improve cathode performance through the development of a new electrode structure and improved catalysts.
<b>3) Innovative Materials &amp; Processes for Advanced Carbon Capture Technologies ("IMPACCT")</b>			
<b>Codexis Inc.</b>  (Nexant Inc.)	\$4,657,045	Redwood City, CA	<i>Solvents / Catalysts:</i> Applying biology to the problem of carbon capture, this project will use low-cost carbonic anhydrase enzymes and a novel directed evolution process to increase reactivity to capture CO <sub>2</sub> and ability to resist degradation in the harsh flue gases of coal-fired power plants.
<b>Texas A&amp;M</b>	\$1,019,874	College Station, TX	<i>Sorbents:</i> Metal organic frameworks (MOFs), new compounds that show great promise for CO <sub>2</sub> capture, will have their mesh size finely controlled to improve the selectivity of adsorbing CO <sub>2</sub> and to reduce the energy required.
<b>Massachusetts Institute of Technology</b>  (Siemens)	\$1,000,000	Cambridge, MA	<i>Sorbents:</i> A new method known as electrochemically mediated separation (ECMS) will be developed that will lower the energy required to capture CO <sub>2</sub> and allow for simpler retrofitting to existing coal-fired power plants.
<b>University of Kentucky-Center for Applied Energy Research</b>	\$1,955,078	Lexington, KY	<i>Membranes / Solvents:</i> A hybrid process for CO <sub>2</sub> capture will be developed that combines nanoscale separation with catalysis to reduce the amount of energy diverted from the power plant to remove CO <sub>2</sub> from flue gas.

Source: ARPA-E

**Exhibit 4: Indices Performance**  
(From February 2, 2009)

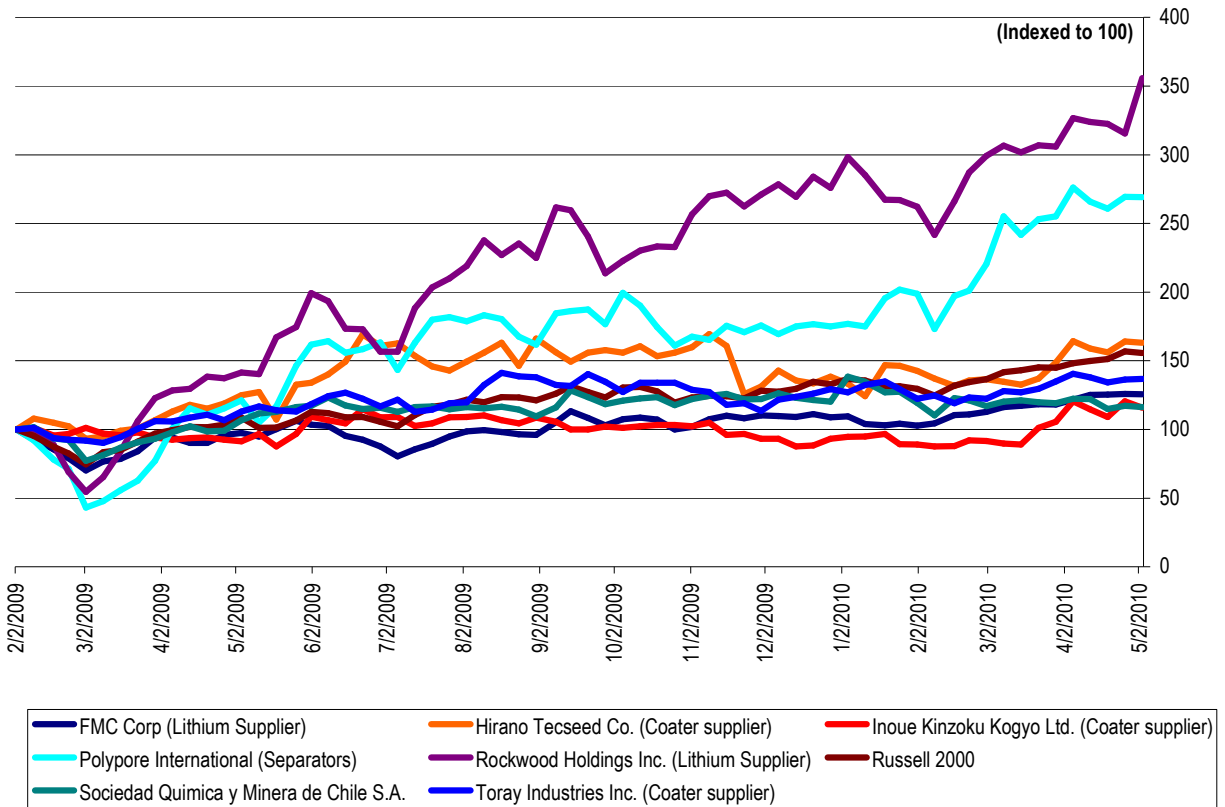


Index	Close on 5/3/2010	52-Wk High	% of 52-Wk High	Performance		
				LTM	YTD	Week
Dow	11,151.8	11,309.0	98.6%	35.8%	6.9%	(0.5%)
S&P 500	1,202.3	1,219.8	98.6%	36.7%	7.7%	(0.8%)
NASDAQ	2,498.7	2,535.3	98.6%	44.1%	8.9%	(1.0%)
Russell 2000	732.8	746.0	98.2%	49.6%	16.7%	(0.8%)
AMEX Cleantech Index	1,089.8	1,112.5	98.0%	29.2%	2.1%	(1.4%)

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 5: Supplier Performance**  
(From February 2, 2009)



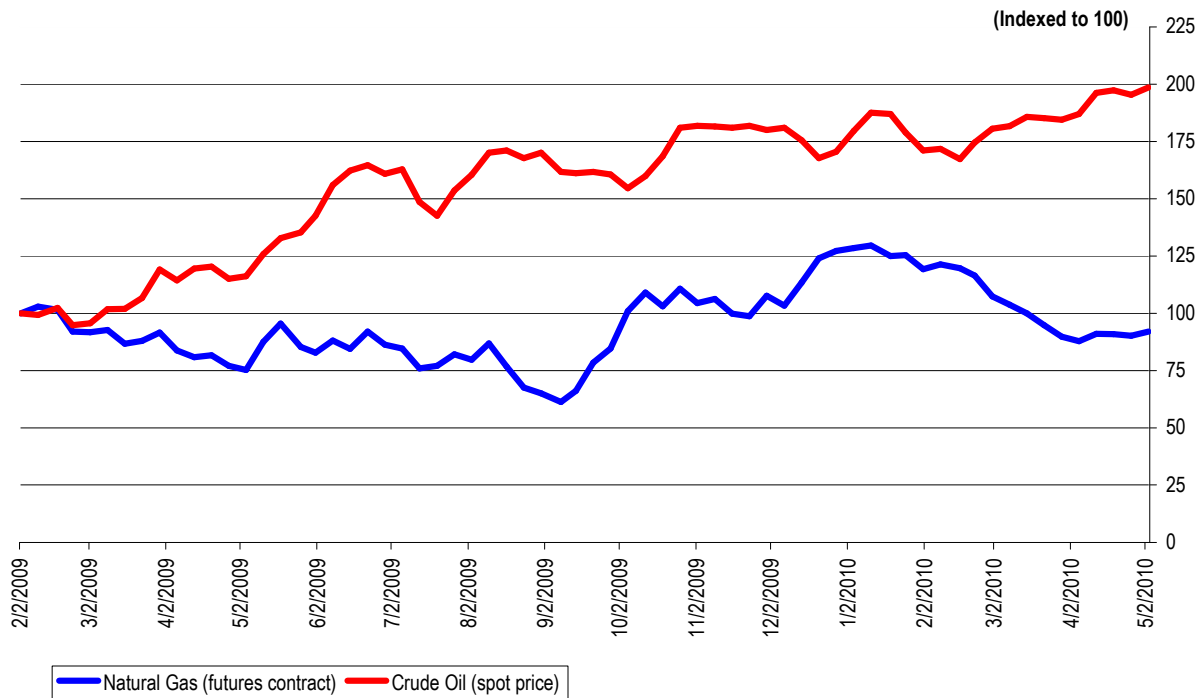
Source: Bloomberg

**Exhibit 6: Commodity Prices**

Commodity	Price on 5/4/2010	Price on 4/26/2010	Price on 4/6/2010	1 Week Change	1 Month Change
LME Nickel (Cash, \$ per tonne)	25,635	27,305	24,540	(6.1%)	4.5%
LME Lead (cash, \$ per tonne)	2,129	2,310	2,228	(7.8%)	(4.4%)

Source: LME

**Exhibit 7: Natural Gas and Crude Oil**  
 (From February 2, 2009)



Source: EIA

## Executive Director's Notes



### THE POWER OF ORGANIZING AN INDUSTRY

Earlier this week, the leading members of the German lithium-ion battery industry came together to form the Kompetenznetzwerk Lithium-Ionen-Batterien (KLiB), an industry association dedicated to strengthening the advanced battery value chain, from development through production to the marketing of lithium-ion batteries. According to the press announcement, KLiB will strive to build and exploit a common infrastructure for research and development, manufacturing and testing, encourage the development of uniform standards, provide an industry platform for public relations and a means for exchange of information. In short, the German advanced battery industry has just formed its own NAATBatt. We wish KLiB great success.

The formation of KLiB by the German advanced battery business community is an example of industry leaders coming together and working cooperatively to build a new market. Although KLiB consists of some of the largest industrial companies in Germany, including BASF, Continental, Süd-Chemie AG, and Merck KGaA, all of those players understand that a whole new industry focused on electrified vehicles cannot be created simply by having companies compete against each other for market share. To build a new industry, and particularly one with great and urgent social utility, companies must band together and cooperate in setting standards, advancing core technologies and selling the general public on the short term benefits of a new product that will in the long run help the whole world.

Industry consortia have a long and successful history in opening new markets and developing core technologies that can eventually be developed into commercial products. SEMATECH was the inspiration for NAATBatt, and many of the leading U.S. semiconductor and computer hardware companies in the world today owe their market position at least in part to its efforts. The KLiB members are undoubtedly aware of this success story and wish to duplicate it.

The U.S. advanced battery industry and its related supply chain should take renewed dedication to building a market for advanced energy storage in the United States from the efforts of our German colleagues. Major industry players in advanced energy storage are organizing by region all around the world for the same purpose. Whether the United States remains a leader or becomes a backwater in advanced energy storage technology will turn in large part on the collective dedication of its industry.



James J. Greenberger  
Executive Director

## Industry Announcements and Calendar:

- **Next Webinar Program: Lithium Air** The NAATBatt bi-monthly Webinar series continues on Wednesday, June 2, 2010, with a program entitled “*Addressing the Challenges of Lithium Air Technology*”. Lithium air is the next generation battery technology with, perhaps, the greatest potential, offering theoretical energy densities of more than ten times that of lithium-ion. But lithium air faces great challenges and its commercialization is highly uncertain. NAATBatt will take a look at this exciting if problematic technology and provide an honest assessment of where it is, how far it needs to go, and what it will take to get there. The speakers on June 2 will be Dr. Winfried Wilcke, Program Director at IBM’s Almaden Research Center, and Dr. Lonnie Johnson, President and CEO of Excellatron Solid State LLC. The program will begin at 2:00 p.m., EDT and last approximately 60 minutes. To register, please contact Suzanne Schnitzer at [suzanne@mccloudcommunications.com](mailto:suzanne@mccloudcommunications.com). Registration for the June 2 program is complimentary.
- **AABC Conference in Orlando:** The 10<sup>th</sup> Annual International Advanced Automotive Battery Conference & Symposia will run from May 17-21, 2010, in Orlando, Florida. Information and registration for the conference is at: <http://www.advancedautobat.com/AABC/index.html>.
- **Southern Growth Policy Center Conference:** A conference of Southern governors, automobile executives and economic development officials outlining strategies for continuing the development of the automobile industry in the South will be held in Lexington, KY on June 7-8, 2010. NAATBatt is a supporting organization of the conference. For more information about the program, entitled *Driving the Next 20 Years: Creating the New Southern Automotive Industry*, visit: <http://www.southerngrowth.com/conference/conf.html>.
- **The 15<sup>th</sup> International Meeting on Lithium Batteries:** The 15<sup>th</sup> International Meeting on Lithium Batteries will be held in Montreal, Canada on June 27-July 2, 2010. The meeting will honor Prof. John Goodenough of the University of Texas. Information about the meeting and registration information can be found at: <http://www.imlb.org/#>
- **Storage Week 2010:** Storage Week 2010, sponsored by Infocast, will be held on July 12-15, 2010 in San Diego. The conference will focus on grid level storage with separate tracks on bulk storage and grid services. Information about the conference can be found at: <http://www.infocastinc.com/index.php/conference/storage10>.
- **The Battery Show 2010:** The Battery Show, a conference and exposition focused on multiple battery chemistries and applications will be held in San Jose, California on October 5-7, 2010. Information about the show can be found at: <http://www.thebatteryshow.com/index.php>
- **Battery Power 2010 Conference:** Battery Power 2010 will be held in Dallas, Texas on October 19-20, 2010. NAATBatt is a supporting organization of the conference. Information about the conference and registration for it may be found at: [http://www.batterypoweronline.com/bppt-conf10/bp10\\_supportingorg.php](http://www.batterypoweronline.com/bppt-conf10/bp10_supportingorg.php)
- **NAATBatt Membership Information.** NAATBatt is now taking applications for 2010 membership from well qualified industry participants and supporters. Membership in NAATBatt is a great way to keep abreast of developments in advanced technology batteries and to support the growth of a market for products that could change the world. Your support for NAATBatt



programs, newsletters, committees and the upcoming roadmap project is essential to the success of our organization and our industry. To inquire about membership, please complete the following inquiry form: <http://naatbatt.org/membership-inquiry/>. NAATBatt will respond with additional information about membership.



## Contact Information:

**National Alliance for Advanced Technology Batteries**  
122 South Michigan Avenue, Suite 1700  
Chicago, Illinois 60603  
(312) 588-0477

[www.naatbatt.org](http://www.naatbatt.org)

### Officers

Randy Moore  
*Chairman*  
[rmoore@naatbatt.org](mailto:rmoore@naatbatt.org)

Jim Greenberger  
*Executive Director*  
[jgreenberger@naatbatt.org](mailto:jgreenberger@naatbatt.org)

Michael Lew  
*Head of Business Development*  
[mlew@naatbatt.org](mailto:mlew@naatbatt.org)

Ralph Brodd  
*Chief Technology Officer*  
[rbrodd@naatbatt.org](mailto:rbrodd@naatbatt.org)

Sandy Kane  
*Chief Financial Officer*  
[skane@naatbatt.org](mailto:skane@naatbatt.org)