

North America

Alternative Energy | Electric Vehicles

Multi-State ZEV Action Plan: Driving the Zero-Emission Vehicle Market Forward

ZEV Plan Aims to Leverage Eight-State Market to Set Standards, Pool and Share Resources, and Create Market Demand

July 14, 2014

Policy Brief

Authors

Erin Carson
Senior Research Analyst

Eric Davis
Research Manager

Contact

(212) 537.4797
info@enerknol.com

Key Takeaways:

- The Multi-State ZEV Action Plan is based on California's ZEV strategic planning and connects state and regional efforts to create a substantial and viable ZEV market
- Standardizing ZEV technology and leveraging economies of scale will induce consumer adoption through streamlined experience and lower ZEV costs
- Public sector participation is key to moving the ZEV market to a self-sustaining scale

Entities Mentioned:

- Department of Energy
- Federal Highway Administration
- Eight signatory state governments: Connecticut, California, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont
- Major ZEV automakers: Tesla, Honda, Hyundai, Toyota, BMW, Mercedes-Benz, and others
- Northeast States for Coordinated Air Use Management
- Transportation and Climate Initiative

Related Research

[Federal Regulations and Tax Credits Support Diesel and Natural Gas Vehicle Adoption](#)

[New York Green Bank to Transform Clean Energy Markets](#)

Eight States Aim to Boost ZEV Sales and Infrastructure through Collaborative Initiative

Zero-emission vehicles (ZEV) are an emerging class of automobile technology that play a significant role in reducing transportation sector greenhouse gas (GHG) emissions. These vehicles, which include battery electric vehicles (BEV) and hydrogen fuel cell electric vehicles (FCEV), can also be cost-effective, since charging vehicles with electricity usually costs about one-third as much as refueling a car with gasoline or diesel.

Eight states – Connecticut, California, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont – signed a Memorandum of Understanding (MOU) in October 2013 to deploy at least 3.3 million ZEVs (or approximately 15 percent of projected new vehicles sold in 2025) along with adequate fueling infrastructure by 2025. A ZEV Program Implementation Task Force was subsequently formed by the eight states to develop a plan of action to reach its deployment goal, which was published in May 2014. The signatory states are committed to implementing eleven action steps outlined in the Multi-State ZEV Action Plan, which revolve around building the ZEV market, providing consistent standards and tracking, improving the consumer experience, and identifying research and partnership opportunities.

Public sector participation is key to moving the ZEV market to a self-sustaining scale. In addition to federal and state incentives, programs should address infrastructure codes and standards, and consumer benefits of preferred ZEV parking and high-occupancy vehicle (HOV) lane access. These programs will increase the potential for wide-scale industry expansion, consumer education, and technology adoption.

Committed States are Already ZEV Market Leaders

The Multi-State ZEV Action Plan builds off a number of existing state and regional initiatives, many of which the eight signatory states have participated in and led. California was an early mover in adopting ZEV targets through its 1990 ZEV Rule and its recent 2013 ZEV Action Plan, which set a similar 2025 ZEV target for California vehicle sales and which served as the foundation for the eight-state plan. The other signatory states have also been at the forefront of setting ZEV deployment targets and building the ZEV market, mostly through rebate and tax credit programs for ZEV purchases and leases, grants and subsidies to build charging infrastructure, and consumer education and information support initiatives.

Some states have joined together to collaborate at a regional level to coordinate their individual efforts. In a similar vein to the eight-state plan, the Transportation and Climate Initiative (TCI) was established by 11 Northeast and Mid-Atlantic states in 2011. The TCI Northeast Electric Vehicle Network was funded by a \$994,500 DOE grant in 2011 to provide a blueprint for EV deployment and infrastructure standards. Given the similarities in role and

The ZEV Action Plan focuses on building the ZEV market, providing consistent standards and tracking, improving the consumer experience, and identifying research and partnership opportunities.

California's efforts serve as the foundation for the eight-state ZEV plan.

mission, Maryland Governor Martin O'Malley suggested that the eight-state plan has the potential to complement TCI's existing work. At the federal level, support often comes in the form of research and development grants, direct transportation project funding, tax credits, and educational campaigns.

Multi-State ZEV Action Plan Improves Upon Existing State and Regional Initiatives

While these previous efforts have driven down ZEV costs to early adopters, the Multi-State ZEV Action Plan aims to expand ZEV commercialization by also addressing infrastructure standardization, industry collaboration, and hydrogen fuel cell technology.

Infrastructure Standardization

The current U.S. ZEV market has a fragmented charging infrastructure. Different ZEV and charging station manufacturers each have their own proprietary standard for communication and electric vehicle (EV) supply equipment (EVSE). This inconsistency has raised infrastructure development costs, prevented economies of scale, and adversely affected consumer experience. This is in part due to federal infrastructure grants that allowed network providers to choose their own protocol. For example, Nissan Leaf drivers must use a CHAdeMO standard station; Chevrolet Spark EV or BMW i3 drivers must use SAE Combo stations; and Tesla drivers must use Tesla's own proprietary Supercharger network.

The Multi-State ZEV Action Plan outlines several action steps to address the issue of infrastructure standardization. In an effort to remove barriers to charging station installation, the signatory states committed to establishing consistent signage, codes, and standards for ZEV infrastructure, including building codes, permitting, utility demand charges, and interconnection fees. To ensure access and compatibility of the charging network, the eight states agreed to National Institute of Standards and Technology (NIST) standards for EVSE operability and the Open Charge Point Protocol (OCPP) communication standard. With the OCPP standard, charging station software developers would only need to design functionality for one type of operating system rather than for multiple systems, and site owners would no longer have to undertake expensive retrofits if a charging station manufacturer ceased to exist. Meanwhile, a universal standard for charging stations would enhance ZEV driver appeal by not being limited to a specific vendor's station.

Industry Collaboration

Similar to the standardization steps, the Multi-State ZEV Action Plan emphasizes collaboration with industry to a greater degree than any existing state or regional ZEV initiative. Public-private collaboration is crucial to developing the ZEV market because of high technology and infrastructure costs, and requires the involvement of multiple sectors, ranging from manufacturers, dealers, EVSE suppliers, and utilities. The plan calls for states to

Inconsistent BEV charging infrastructure raises industry costs and negatively impacts consumer experience.

Established codes and standards are needed for wide-scale infrastructure deployment.

work with utilities and public commissions to ensure transparent retail electricity pricing and enroll EV drivers into off-peak charging programs.

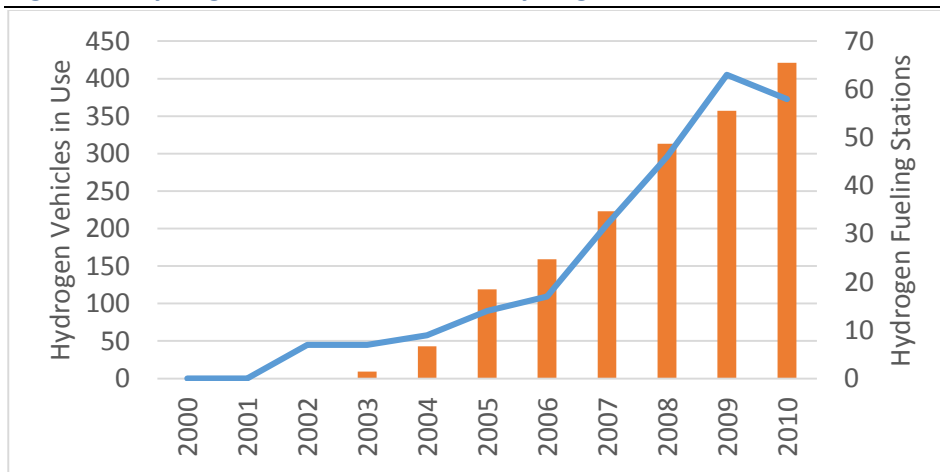
Industry recognizes the need to collaborate through this plan. Tesla recently announced that they will open their innovations to other companies and not initiate patent lawsuits for their technologies. Its open source announcement has led Nissan and BMW – which along with Tesla account for 80 percent of the world’s BEV sales – to begin collaboration talks on charging networks and standards. Rather than compete for an exclusive share of the BEV market, the three leading EV automakers are collaborating to increase EV popularity, which leads to further charging infrastructure development.

Hydrogen Fuel Cell Technology Development

The final differentiating point is the Multi-State ZEV Action Plan’s aim to develop hydrogen fuel cell technologies, which has been largely absent in other state and regional initiatives outside of California. California is the only U.S. state with a hydrogen fuel cell vehicle (FCV) industry – it has nine operating public hydrogen fueling stations and 16 stations in development. California also offers the same \$2,500 rebate for FCEV purchases as it does for BEVs through its Clean Vehicle Rebate Program. At the same time, the isolated California hydrogen-powered vehicle industry growth is the product of FCEV manufacturers – such as Honda and Toyota – focusing efforts in a limited area to develop and demonstrate FCEV technology before fully commercializing. Only 10 hydrogen FCEVs were sold in 2013 (Figure 1).

The hydrogen fuel cell vehicle industry is in its early stages, yet supported by the multi-state plan.

Figure 1 – Hydrogen Vehicles in Use and Hydrogen Infrastructure, 2000-2010



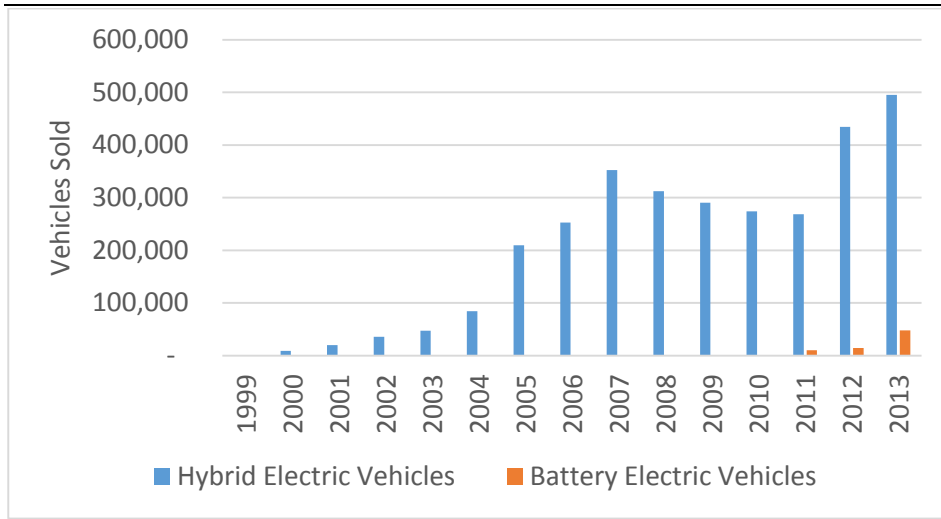
Source: AFDC

The Multi-State ZEV Action Plan aims to explore resource partnerships to develop hydrogen charging infrastructure beyond California. According to the Fuel Cell and Hydrogen Energy Association, in addition to the eight ZEV states, states with existing hydrogen infrastructure serving other industries, such as wind generation and petrochemicals production, are potential targets for hydrogen ZEV expansion. Hydrogen is a byproduct or feedstock for these ancillary industries.

Initial BEV Sales Mirror Early Hybrid Electric Vehicle Market Growth

The ZEV market has grown rapidly since the first EV model, the Tesla Roadster, was offered to US customers in 2008. The sale of battery electric vehicles (BEV) have soared from just 19 BEVs in 2010 to 47,694 in 2013, while hybrid electric vehicle (HEV) sales have risen from 274,210 to 495,529 over the same time period (Figure 2). Of total vehicle sales, BEVs and HEVs represent 0.31 percent and 3.19 percent shares in 2013.

Figure 2 – Hybrid Electric and Battery Electric Vehicle Sales, 1999-2013

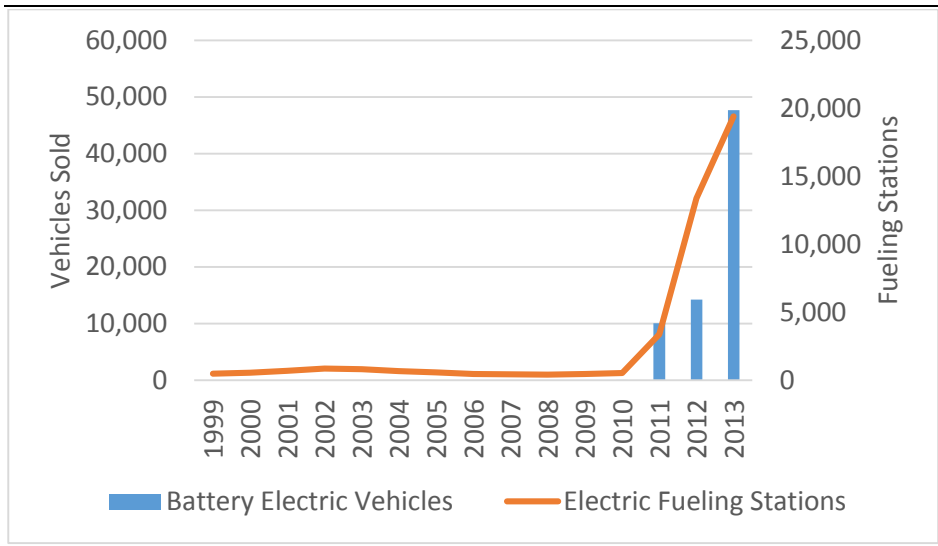


Source: AFDC

At first glance, the significant growth trajectories of BEVs and HEVs look very similar. On average, BEV sales grew by 1,259 percent annually during the first four years on the market from 2010-2013. By comparison, with the introduction of the Honda Insight in 1999 and Toyota Prius in 2000, the HEV market grew by 1,184 percent in its first four years on the market from 1999-2002. But upon closer examination, the significant BEV sales growth was achieved despite requiring corresponding electric charging infrastructure expansion. By contrast, HEVs do not require charging infrastructure because regenerative braking charges the vehicle battery. The rapid BEV sales growth therefore was assisted by a significant electric charging infrastructure expansion, which rose from 541 electric fueling stations in 2010 to 19,410 in 2013 (Figure 3) – an approximate 230 percent compounded annual growth rate.

BEV charging infrastructure growth mirrors BEV sales growth.

Figure 3 – Battery Electric Vehicle Sales and Electric Fueling Stations, 1999-2013



Source: AFDC

Public policy catalyzed growth of both the HEV and BEV markets. Federal policy in particular played a key role in the accelerated HEV sales growth in 2005 with the passage of the Energy Policy Act of 2005, which established an income tax credit of up to \$3,400 for the purchase of new hybrid vehicles. Similarly, the BEV market benefited from the implementation of the Qualified Plug-in Electric Drive Motor Vehicles Tax Credit (Internal Revenue Code Section 30D), a federal tax credit of up to \$7,500 enacted by the Energy Improvement and Extension Act of 2008. Select companies like Tesla also benefited from the Advanced Technology Vehicle (ATV) Manufacturing Incentives Program, which provided direct federal loans for up to 30 percent of capital costs for facilities manufacturing HEVs and BEVs. However, other than the EV Project, which provided nearly \$100 million in DOE grants to deploy EV chargers in nine states, critical financial support for EV infrastructure has come from states.

Federal HEV and BEV tax credits instrumental in lowering sales barriers.

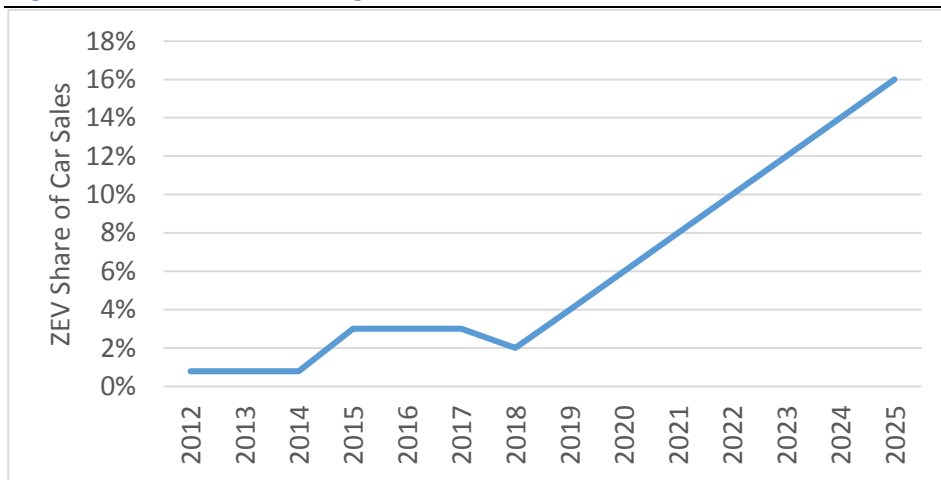
States like California, Maryland, and Connecticut have established tax credit and grant programs to fund EV infrastructure development, while other ZEV states have taken a targeted approach in funding specific, high-traffic corridors. Leading states like California have pushed BEV growth through the Zero Emission Vehicle (ZEV) Program, which is managed and designed by the California Air Resources Board (ARB) and serves as a prologue and foundation to the Multi-State ZEV Action Plan. This program mandates major vehicle manufacturers to attain a certain number of ZEV credits depending on the production and sales of vehicles within the state, which rewards manufacturers for transitioning model offerings to more ZEVs and forces others to pay for their failure to comply. Nine other states – including all eight states from the Multi-State ZEV Action Plan – have joined California’s ZEV credits program.

ZEV credit programs set minimum ZEV sales metrics for automakers.

Early Adopters Benefit from ZEV Credits Program

The California ZEV Program has set a 15 percent ZEV mandate by 2025, similar to the Multi-State ZEV Action Plan. Each year, the program has set a number of ZEV credits that each automaker selling in the state must attain, which are rewarded based on the level of emissions of the produced vehicle. Hybrids, for example, receive partial credits while the all-electric Tesla Model S receives the full 7 credits available. Starting in 2018, the “minimum ZEV floor” begins to escalate as Transitional Zero Emissions Vehicles (TZEV) and Partial Zero Emission Vehicles (PZEV) no longer count for ZEV credits (Figure 4). Nine other states have adopted this program, including Connecticut, District of Columbia, Maine, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island and Vermont.

Figure 4 – California ZEV Program: Minimum ZEV Floor, 2012-2025



Source: California Air Resources Board

Tesla has been the big winner since California started its ZEV Program. As an early mover in the ZEV industry, Tesla has amassed ZEV credits and sold them other automakers to offset ZEV production deficits, and to Nissan to offset their cost of development for the Nissan Leaf. According to CARB, Tesla sold 1,311 ZEV credits in 2012, more than double the next highest seller, yet still had 276 banked credits.

ZEV Initiative’s Goal Appears Ambitious Compared to Market Forecasts

While the ZEV market is projected to grow significantly through 2025, many of these forecasts do not account for the impact of the Multi-State ZEV Action Plan, which should improve estimates of future ZEV sales and adoption. Without taking these into account, many studies and models underestimate growth for the ZEV market and suggest that the ZEV states will not meet the plan’s mandated 15 percent of total vehicle sales, or 3.3 million ZEVs deployed. For example, Navigant Research provides an estimate of 416,000 plug-in electric vehicles (PEV) by 2022, amounting to just 2.3 percent of total vehicle sales and a compounded annual growth rate of 18.6 percent from 2013 to 2022. California and New York lead the way in PEV sales from 2013-2022,

ZEV market forecasts are well below ZEV Action Plan goals.

according to Navigant's estimates. In its Annual Energy Outlook 2014, the International Energy Agency (IEA) has an even more pessimistic outlook for EVs and fuel cell hydrogen vehicles. By 2025, the IEA predicts that ZEVs will constitute just 0.38 percent of new car sales, up slightly from 0.23 percent in 2012.

Leading by Example and Size toward ZEV Market Tipping Point

As repeatedly stated in the Multi-State ZEV Action Plan, the success of this collaborative effort stems from the large share of the vehicle market that the eight-state population represents. According to the Federal Highway Administration, the eight signatory states constituted 23.6 percent of total automobile registrations in 2012, a share that could create a demand-pull effect on growing the ZEV market. In addition to capturing a large consumer market, states can leverage governmental buying power to increase the number of public fleet ZEVs and thereby create an early and large ZEV product demand. All of the committed states had ZEVs constituting less than 3 percent of their government fleets, which represents an immediate opportunity to create downstream ZEV demand.

Participating states' high national vehicle market share key to ZEV sales growth.

The eight-state plan will also be instrumental in improving mainstream ZEV awareness and reducing GHG emissions. Studies have demonstrated that potential ZEV customers have little knowledge or experience with ZEVs, which has caused dealers to shy away from selling ZEVs that require more sales and marketing resources. At the same time, dealership salespeople have not been as knowledgeable on ZEV battery life, warranties, tax incentives, and charging needs. To address these awareness and knowledge gaps, the eight states are pooling resources and coordinating the best outreach and education approaches to inform its large driving population.

Meanwhile, with the Obama Administration increasing federal fuel economy standards in August 2012 to 54.5 miles per gallon (mpg) by 2025, automakers in the committed states will be ahead of this mandate considering some of the most popular ZEVs today, like the Tesla Model S, have a combined mpg of 95. In meeting the ambitious goals from the Multi-State ZEV Action Plan, automakers will more easily comply with the federal fuel economy standards.

ZEV market growth will help automakers meet future fuel economy standards.

Grid Management Solutions Needed With Large-Scale ZEV Deployment

With the onboarding of more than 3.3 million ZEVs in 2025, the impact on the electric grid will be substantial and will require grid management technologies and policies. A recent analysis of Opower customer data revealed that households with EVs generally had more intensive grid electricity use throughout the day compared to typical households without EVs and as much as three times more intensive during the off-peak hours from midnight to 7 am. Notably, EV households without solar installations used 58 percent more grid electricity than the typical household, while EV households with solar installations consumed similar levels of grid electricity as typical households.

Increased BEV sales will lead to increased grid strain.

Given such high consumption patterns of electricity by EV drivers, the increasing uptake of EVs could potentially strain the grid.

At the same time, this study highlights the importance of off-peak charging incentives and time-of-use pricing that would encourage drivers to charge their energy-hungry EVs during off-peak hours. The integration of solar energy with its excess generation capacity is shown through the study as an important energy technology in managing energy consumption levels during the waking hours of an enlarging class of EV drivers. In addition to off-peak charging and solar energy, energy efficiency and energy storage solutions will be critical to managing electricity demand coming from future EV drivers. While the Multi-State ZEV Action Plan highlights the need to work with utilities and other industry stakeholders, the signatory states may also need to explore incentives, policies, and mandates to support the influx of EVs charging on the grid.

ZEV Initiative Has the Potential to Cover One Third of the Auto Market

Following the Multi-Action ZEV Action Plan release, each signatory state will begin developing state-specific plans and strategies that incorporate many of the larger plan's action steps. A year from now, states will begin reporting progress using agreed upon metrics and information that allows for comparative analysis among the eight states. Collaboration with other signatory states and industry partners will be ongoing as well.

Going forward, other states are encouraged to consider similar actions and are allowed to join this eight-state plan. There is strong potential for states like Delaware, Maine, New Hampshire, New Jersey, and Pennsylvania to join, which are members of the Transportation and Climate Initiative but are not signatories of the Multi-State ZEV Action Plan. Maine and New Jersey are also among nine other states to have adopted California's Zero-Emission Vehicle Program. Washington, which is following California's Low Emission Vehicle (LEV) Program and has existing EV-related initiatives with Oregon, could potentially join as well. Combined, the non-member TCI states and Washington constitute 11.5 percent of total automobile registrations in 2012, potentially increasing the driving population market share to 35.1 percent from the current 23.5 percent.

Combining the states of Transportation and Climate Initiative and ZEV Action Plan would increase coverage to more than 35 percent of U.S. drivers.

Disclosures Section

RESEARCH RISKS

Regulatory and Legislative agendas are subject to change.

AUTHOR CERTIFICATION

By issuing this research report, Erin Carson as author of this research report, certifies that the recommendations and opinions expressed accurately reflect her personal views discussed herein and no part of the author's compensation was, is, or will be, directly or indirectly, related to the specific recommendations or views expressed in this report.

IMPORTANT DISCLOSURES

This report is for industry information only and we make no investment recommendations whatsoever with respect to any of the companies cited, mentioned, or discussed herein. EnerKnol, Inc. is not a broker-dealer or registered investment advisor.

Information contained herein has been derived from sources believed to be reliable but is not guaranteed as to accuracy and does not purport to be a complete analysis of the company, industry or security involved in this report. This report is not to be construed as an offer to sell or a solicitation of an offer to buy any security or to engage in or refrain from engaging in any transaction. Opinions expressed are subject to change without notice. The information herein is for persons residing in the United States only and is not intended for any person in any other jurisdiction.

This report has been prepared for the general use of the wholesale clients of the EnerKnol, Inc. and must not be copied, either in whole or in part, or distributed to any other person. If you are not the intended recipient you must not use or disclose the information in this report in any way. If you received it in error, please tell us immediately by return e-mail to info@enerknol.com and delete the document. We do not guarantee the integrity of any e-mails or attached files and are not responsible for any changes made to them by any other person. In preparing this report, we did not take into account your investment objectives, financial situation or particular needs. Before making an investment decision on the basis of this (or any) report, you need to consider, with or without the assistance of an adviser, whether the advice is appropriate in light of your particular investment needs, objectives and financial circumstances. We accept no obligation to correct or update the information or opinions in it. No member of EnerKnol Inc. accepts any liability whatsoever for any direct, indirect, consequential or other loss arising from any use of this report and/or further communication in relation to this report. For additional information, please visit enerknol.com or contact management at (212) 537-4797.

Copyright 2014 EnerKnol, Inc. All rights reserved. No part of this report may be redistributed or copied in any form without the prior written consent of EnerKnol, Inc.