對外合作組織與機構動態報導

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CHECKING THE GLOBAL PULSE FOR ELECTRIC VEHICLES

檢視全球電動車的脈動

May 25, 2018

A team of academic researchers is seeking clarity on predictive plug-in electric vehicle (PEV) models. An examination of more than three dozen studies is providing some meaningful insights.

"The value of the models is not in their predictive power, but in connecting 'important' factors in a way that enables us to construct some possible future based on what we know about consumer behavior and other factors," said Thomas Stephens, a researcher at the U.S.

報告摘要(KEY INFORMATION)

1. 現有市場模型的預測常出現不同的結果。有關應如何提高充電式電動車市場模型的預測準確度，阿岡實驗室研究團隊表示：模型的真正價值不在於預測結果，而在於各變因之間的連結，如車輛價格、能源價格、營運成本、可用基礎設施範圍及國別等。
2. 2002 年起，科學家啟動微中子推進器實驗(MiniBooNE)；最近，藉由解析八年前的數據資料，阿岡實驗室與費米加速器實驗室有了開創性的發現，他們找到了單能微中子(mono-energetic neutrinos)存在的第一個直接證據。
3. 對歐盟而言，確保穩定的天然氣供應乃是短中期至關重要之事。立陶宛已採取行動擴大進口美國天然氣；而荷蘭的格羅寧根氣田，因環境與安全考量已決定將從國內供應鏈退場。
4. 對俄國而言，與西方各國逐漸惡化的關係已開始影響其新興油氣與電力產業。德國總理要求烏克蘭澄清其作為北溪 2(Nord Stream 2)管線過境國的角色，否則不會允許管線的建造，北溪 2 的未來目前仍然充滿變數。
5. 史丹佛大學工程研究團隊，觀察鳥群、飛蟲如何在無法完全掌握其他個體動作的情形下，依然快速調整應變以避免碰撞並保持隊形，望能為無人機與無人車設計更安全的自控系統。

Department of Energy's (DOE) Argonne National Laboratory, who co-led the study.

To gain a better understanding of the PEV market, Argonne conducted a review of 40 automotive market diffusion studies from 16 countries, including the United States, Germany, China, South Korea, the United Kingdom and Ireland. These studies modeled the decision factors that drive consumers to purchase PEVs: vehicle and energy prices, operating costs, available charging infrastructure and range, among others.

These modeled considerations, and their order of importance, varied by country. For instance, many U.S. market penetration models considered vehicle price and operating costs to be very important, while German models listed energy prices and charging infrastructure as the primary considerations.

The studies that Stephens and co-authors reviewed provided vastly different projections of future PEV market shares, mainly in the U.S. and Germany. Estimates ranged from a few percent to more than 50 percent by 2030. This disparity results, in large part, from the models' diverse assumptions about market conditions, vehicle and fuel prices, and other factors.

"We found that many models handled factors very differently or even neglected some that seem to be important, so a wide range in market projections is not surprising," Stephens said.

The study focused on addressing the following specific questions:

- What are the projected market shares for a particular region?
- What are consumers' primary purchase considerations?
- What is the effect of rebates, tax credits, battery research and development and high-occupancy vehicle lane access?
- What is the potential effect of PEV sales on petroleum demand, emissions and demand for electricity?

Though researchers cannot predict if or when PEVs could reach a tipping point in the U.S., they can help identify factors that could speed or hinder the adoption process, according to Stephens.

Based on their study, the team offers several findings for future PEV models that address important considerations neglected by many of the models they reviewed: the limited range, available charging infrastructure and the technological and projected cost improvements of batteries over time.

Other contributors to the review, published in a report titled "What drives the market for plug-in electric vehicles? - A review of international PEV market diffusion models," were from the Fraunhofer Institute for Systems and Innovation Research ISI, DOE's Oak Ridge National

Laboratory and the German Aerospace Center, Institute of Vehicle Concepts.

DOE's Office of Energy Efficiency and Renewable Energy, Vehicle Technology Office, funded this research.

BLAST FROM THE PAST

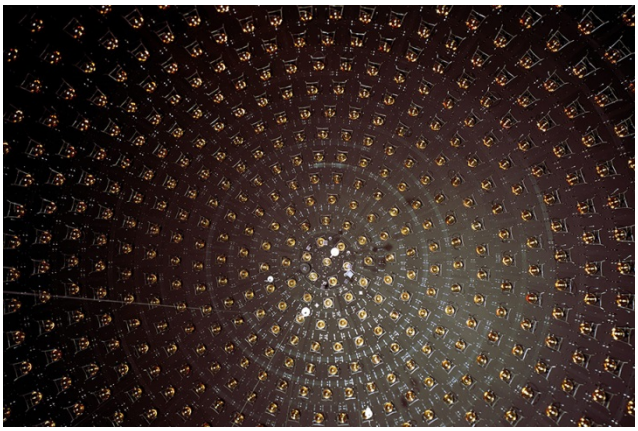
來自過去的衝擊

By Savannah MItchem · June 05, 2018

By analyzing data collected over eight years ago, scientists at the U.S. Department of Energy's (DOE) Argonne National Laboratory and Fermi National Accelerator Laboratory have made a potentially groundbreaking discovery.

In 2002, scientists began the Booster Neutrino Experiment, known as MiniBooNE, at Fermilab to learn more about how neutrinos — very light, neutral fundamental particles — interact with matter. Scientists recently reexamined data from the experiment taken between 2009 and 2011, and they found the first direct evidence of mono-energetic neutrinos, or neutrinos with definite energy, that are energetic enough to produce a muon.

Neutrinos are extremely light and are only influenced by the weak subatomic force, so they rarely interact with matter. In fact, they could travel through light-years of lead before interacting with it. The particles are very difficult to detect, but not difficult to create. Because of the neutrino's elusiveness, scientists have to work with beams composed of large numbers of the particles. They shoot the beams at nuclei in a detector, hoping for neutrinos to collide with the target material.



"One complication of using these large beams is that the energies of the neutrinos are widely varied and somewhat unpredictable," said Argonne physicist Joe Grange, one of the scientists that helped discover mono-energetic neutrinos. "This makes it difficult to fully interpret the data."

The new discovery could help experimentalists solve this problem. The scientists realized that mono-energetic neutrinos were being released from a nearby neutrino beamline at Fermilab, and they decided to look at the MiniBooNE data to see if any of these neutrinos were detected during that experiment.

Sure enough, analysis of the MiniBooNE data showed evidence of thousands of neutrino-nucleus collisions where the neutrinos all started out with the same energy, 236 mega-electron-volts (MeV). During the MiniBooNE experiment, particles called kaons created in a proton absorber of another experiment decayed into particles called muons and muon neutrinos. The muon neutrinos then traveled to the MiniBooNE detector. Because the kaons were at rest when they decayed, and because they decayed into only two particles, the neutrinos all had the same amount of starting energy before colliding with the nuclei in the MiniBooNE detector.

The decay of a kaon is a well-known reaction. "With this discovery, we can improve our understanding of how neutrinos interact with matter and also plan for future experiments that could leverage this interaction for the search for new physics processes," said Grange. Channeling this decay as a source of neutrinos for experiments would eliminate the uncertainty of the neutrino energies, making analyses simpler and potentially more illuminating.

In addition to inspiring future experimental setups, the data are also helping scientists to learn about the behavior of nuclei when bombarded with neutrinos and can help them refine models of the interactions. When a muon neutrino collides with a nucleus in a detector, a muon having one of a range of different energies can pop out. It is this spectrum of possible energies of the new muons that the scientists observed directly in this study, and it speaks to the way the neutrino transfers energy to the nucleus upon contact.

"A lot of work has been done shooting electrons at nuclei and seeing how they behave electromagnetically," said Grange. "But less work has been done to see how neutrinos interact weakly because of how difficult neutrinos are to work with."

The experimental aspect of this discovery could also help scientists search for the theorized sterile neutrino, a neutrino that only interacts through the gravitational force and not the weak force. A mid-1990s experiment at DOE's Los Alamos National Laboratory yielded neutrino data that were incompatible with data from a separate experiment at the European laboratory CERN, and that discrepancy might be explained by the existence of this "ghost" particle.

The original goal of the MiniBooNE experiment was to confirm or refute the existence of sterile neutrinos. Although the experiment may end up inconclusive, the new discovery from the depths of its data could help future experimentalists to detect their existence. Scientists are already working towards experiments that will use neutrinos from this specific kaon decay to search for sterile neutrinos.

"It's a nice story about how it was almost five years before we realized there was something important in the data," said Grange. "The moral of the story is to keep all the data and continue thinking about what other information is in there that you haven't yet extracted."

The results of the study were published in a paper titled "First Measurement of Monoenergetic Muon Neutrino Charged Current Interactions" in *Physical Review Letters*.

Other scientists that led the effort include Joshua Spitz, Rory Fitzpatrick and Johnathon Jordan from the University of Michigan.

This study was supported by the Department of Energy's Office of Science, Fermilab, the National Science Foundation and Los Alamos National Laboratory.

EU: DIVERSIFYING SOURCES OF NATURAL GAS SUPPLIES

歐盟觀察：天然氣供應來源的多樣化

By Kei Shimogori

The 4th EU Energy Summit was held on April 12. At the opening, Miguel Arias Canete, Commissioner for Climate Action & Energy, said that reducing the dependence of the EU economy on fossil fuel imports is key to its medium- to long-term energy resilience, and in particular, natural gas must be imported from various suppliers offering competitive prices in the short- to medium-term.

Several diversification initiatives were mentioned as positively affecting the EU's supply stability, including the Southern Gas Corridor which transports natural gas directly to Europe from the Caspian Sea and the cooperation with Egypt regarding the natural gas resource discovered in the eastern Mediterranean Sea, as well as the rapid expansion of the LNG market. The European Commission has particularly welcomed US LNG, with Spain, Portugal, and Lithuania importing US LNG in 2017. Incidentally, in Lithuania, Lietuvos Dujos Tiekimas (LDT), a member of the state-run Lietuvos Energija group, signed a memorandum with US Freeport LNG. LDT procured LNG from US Cheniere's Sabine Pass in 2017, and the memorandum signed with Freeport LNG paves the way for importing more American gas in the future.

There has been another major change in Europe regarding natural gas. In March, the Dutch government announced that it would eventually phase out gas production from its Groningen gas field, one of the largest in Europe. The government indicated plans to reduce production to 12 Bcm by October 2022, then to 7.5 Bcm, and eventually down to zero in the following few years. The government had already decided in November 2015 to limit annual output to 27 Bcm due to earthquake concerns, and made a further decision in June 2016 to reduce it to 24 Bcm over five years from October 2016. The current limit is 21.6 Bcm for an average year. The government's production

limit had been regarded as insufficient by local residents and environmental groups, and had led to lawsuits. Accordingly, the government considered that the consequences of gas exploration are no longer socially acceptable, and thus decided to eventually terminate production.

With this gas production cut, the Netherlands has been increasing pipeline imports from Norway and Russia, as well as LNG imports. Commissioner Canete commented that Russia will remain a valuable energy supplier for the EU in the short term, but it is important for Russian energy supplies to be exposed to competition with other suppliers. The EU's efforts to diversify supplies while ensuring supply stability must be closely monitored, together with the Gas Directive amendment currently being deliberated in the European Parliament and the Council of the EU.

RUSSIA: WORSENING RELATIONS WITH THE WEST EXTENDING TO GAS AND POWER

俄國觀察：與西方國家的關係惡化影響天然氣與電力產業

By Sanae Kurita

According to the IEA, Russia's oil production (oil and natural gas liquids: NGL, etc.) increased by 10,000 b/d from the previous month to 11.35 mb/d in March 2018. This was achieved by raising the production of natural gas in response to domestic gas demand and exports, which also pushed up NGL output, while oil output remained flat. While 50,000 b/d short of the target production cut of 300,000 b/d agreed with OPEC in December 2016, Russia remains inclined to reinforce diplomatic relationships, discussing long-term bilateral relationships and the establishment of an organization for OPEC and non-OPEC countries with Saudi Arabia while continuing to cut production with OPEC.

Meanwhile, the relationship between the West and Russia continues to deteriorate. On April 6, the US Treasury Department newly added 24 individuals and 14 oligarch (emerging business conglomerates) firms and other organizations to the Specially Designated Nationals And Blocked Persons List (SDN List) over Russia's involvement in the cyber-attack during the 2016 US presidential election, invasion of the Crimean Peninsula, and supporting the Assad administration. Among the 24 individuals on the SDN list are seven oligarchs, including President Vladimir Putin's close associate Oleg Deripaska, and senior government officials. This move is based on the Countering America's Adversaries Through Sanctions Act enacted last August, and includes a freeze on assets in the United States, a ban on traveling to the US, and prohibition of business transactions with the sanctioned individuals and organizations. The latest

additions to the SDN list include Alexey Miller, CEO of Gazprom, and Mr. Deripaska who owns energy-related company En+ and major aluminum company Rusal under it. Considering that Exxon Mobil was punished by the US Treasury Department in July 2017 for doing business with Rosneft President Igor Sechin (added to the list in 2014), Western companies will now be reluctant to do new business with the aforementioned Russian companies in the Gazprom-led Nord Stream 2 project and the transmission network initiative by En+.

At the end of March, 19 of the 28 EU countries commenced various types of sanctions, including evicting diplomats. Further, on April 10, German Chancellor Angela Merkel said in a joint press conference in Germany with Ukrainian Prime Minister Petro Poroshenko that the construction of Nord Stream 2 will not be allowed unless Ukraine's role as a transit country is clarified, toughening her stance. This was the first time for the German government, which thus far had denied any politics associated with Nord Stream 2 and maintained that the project is purely economic, to acknowledge the need for political consideration. Russia's Interfax reported that the Russian government had wrongly assumed that EU countries would never act upon the call for sanctions by Britain, which is due to leave the EU.

On April 14, President Putin condemned the US-UK-France airstrikes on Syria as a clear violation of international law. Further, in retaliation for the toughened US sanctions against Russia and the airstrikes on Syria, the Federal Assembly of Russia began to deliberate a bill to ban the import of designated goods and services from the US, deny designated US persons entry to Russia and limit their employment, restrict economic cooperation, and suspend US-Russia cooperation in nuclear energy. While the West and Russia drift further apart, a Japan-Russia Summit will be held at the end of May. The circumstances surrounding Russia must be closely watched.

COULD STUDYING SWARM BEHAVIORS TEACH US HOW TO HELP DRONES FLY SAFELY?

安全飛行的啟示：鳥群與無人機設計

By Tom Abate and Glen Martin · June 11, 2018

ENGINEERING

Anyone who's seen a flock of starlings twist and turn across the sky may have wondered: How do they maneuver in such close formation without colliding?

"Many types of animals swarm or flock or otherwise move in coordinated ways," says Nicholas Ouellette, an associate professor of civil and environmental

engineering at Stanford. “No individual animal knows what every other animal is doing, yet somehow they move cohesively as a group.”

Understanding precisely how they do this, Ouellette says, may be a key to helping engineers design “flocks” of aerial drones and driverless cars. Emulating animal swarms is attractive because they not only operate without central control but they’re also fault-tolerant, to use an engineering term, meaning they can adapt quickly and gracefully to sudden or unexpected conditions. Swarms are also resilient in that they can operate in dirty, disturbed environments.

So Ouellette and his team have embarked on a series of studies that explore how animal swarms develop the kind of self-organized and self-regulated systems that would allow devices such as drones and mobile sensors to operate safely and efficiently, without the sort of top-down controls that typify, for example, something like the air traffic control system.

Rather than examine starlings or other birds, which would be impractical to study in the lab because of the space they need to fly, Ouellette and his crew look at non-biting midges, a type of flying insect often found near water or in the shade of trees. Unlike starlings, whose graceful formations, called murmurations, make us stare up at the sky, midges buzz around in chaotic, cloud-like masses. But, says Ouellette, midge swarms still share common features with bird flocks and other animal groups, in that the swarms stay cohesive without any outside control or leadership.

“Midges are so small, they’re easy to keep in a lab,” Ouellette says. “They swarm at dusk and dawn and are easy to cue with lights.” In his lab, the midges live in a roughly 5-foot plastic cube, surrounded by high-speed cameras that he uses to reconstruct 3D trajectories for each insect — direction, acceleration — all the essential kinematic information needed to characterize swarm movements.

Working in the lab allows Ouellette’s team to run experiments to test different models. The team starts with observed data taken from the camera images. Then they use this data to test hypotheses about what sorts of rules might govern midge movements. But because natural swarm behavior does not provide enough information to distinguish between many hypotheses, the researchers also disrupt the swarm using light and sound to observe whether the real swarm is affected as their proposed rules had predicted.

Ouellette says it’s too early to design artificial systems that behave the same way as animal groups. But his team is developing the sort of experimental environment that other researchers may one day use to build and test high-tech systems based on the bottom-up wisdom of the swarms rather than the top-down rules that typify many technological undertakings.

“As engineers we like to control things,” Ouellette says. “But we have a lot to learn from insects and other animals that operate just fine without human command and control frameworks.”