對外合作組織與機構動態報導

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NEW EFFORT BY ARGONNE HELPS POWER UTILITIES AND OTHERS BETTER PLAN FOR THE FUTURE

阿岡實驗室為電力公司分析新建工程的未來變數，以利其周延規劃

By Carla Reiter • May 4, 2017

If you're an electric utility planning a new power plant by a river, it would be nice to know what that river will look like 20 years down the road. Will it be so high that it might flood the new facility? Will the

報告摘要(KEY INFORMATION)

1. 當電力公司將於河畔建設一座發電廠時，若能預先知道 20 年後的河川地貌，將有助於整體規畫：如河川水位是否可能上升、氾濫至發電廠的所在位址？或者水位將大幅下降導致無法供機組冷卻之用？
2. 當你用指尖輕觸平板時，螢幕能夠快速反應，是有賴壓電性材料組成的微型力度感應器與加速計。美國國家能源部與阿岡實驗室共同著手一項壓電性材料的研究計畫，利用急速 3-D X 光成像與電腦模擬技術，使我們更瞭解這類材料的性質與應用方式。
3. 阿海琺公司於 4 月 25 日宣布今年年度工程師獎得主。該獎項是為表揚在工程方面有卓越成就、對公司的工程專業領域及活動做出巨大貢獻者而設立。今年獎項得主馬克洛瑞，任職於維吉尼亞州，因帶領兩項非破壞性檢測技術之發展而獲獎。
4. 今年 3 月 15 日荷蘭國會大選，仍由原執政黨（自由民主人民黨）拿下最多席次。對新政府而言，有一能源政策的挑戰已迫在眼前：先前為減低地震風險而持續限縮格羅寧根天然氣田產量，之後又將如何妥為權衡安全、經濟，與電力結構等考量？
5. 為因應發電嚴重供過於求、電力公司表現持續惡化的問題，中國政府致力要減少燃煤發電，但燃煤發電的授權許可早在 2014 年已經由中央移轉給地方，故該目標的達成與否需視地方政府是否買單而定。

water be so low that it can't be used to cool the plant?

Generally, such projections have been based on records of past precipitation, temperature, flooding and other historical data. But in an era when temperature and precipitation are changing rapidly, historical patterns won't do you much good. That's where a new initiative by the U.S. Department of Energy's (DOE) Argonne National Laboratory, which combines climate data and analysis with infrastructure planning and decision support, promises real help.

"What we're doing is combining expertise and tools that are available only within Argonne to take something that is incredibly complex — understanding what's going on with climate — and distilling it down to something that is really actionable for the energy provider or the engineer," said John Harvey, a business development executive at Argonne who acts as a liaison between power utility companies and the Argonne research team.

"When you need to plan on time scales that span 30 or 40 years, you need to factor in all the things that are going to change." – Ushma Kriplani

The initiative offers power utilities and other customers access to extremely localized climate models run on supercomputers, as well as the expertise of the climate scientists who run them. Other experts include the lab's environmental modelers (who can, for example, model how changes in precipitation translate into changes in flooding) as well as infrastructure modelers and risk assessment experts (who can forecast how that flooding will affect electric infrastructure and the grid).

Together, they help utilities make informed decisions about how to improve infrastructure to avoid future outages. Advance planning can help utilities both protect themselves and take advantage of new opportunities.

" This really helps utilities plan for their infrastructure investments," said Ushma Kriplani, a business development executive who, like Harvey, helps customers work with the scientists and facilities at Argonne to ensure they get the information and advice they need to make more informed decisions. "Infrastructure investments are both huge in size and look out many years. When you need to plan on time scales that span 30 or 40 years, you need to factor in all the things that are going to change."

Power lines can sag if temperatures rise, for example, becoming weaker, less efficient and prone to failing. Changes in air temperature and humidity can also affect power plant cooling. "These things have a real impact on the operations of a plant," said Thomas Wall, an infrastructure and preparedness analyst in Argonne's Risk and Infrastructure Science Center and one of the co-leads of the new initiative. "Maybe in the future I can't generate as much power at that location because I can't cool it as effectively."

After an unusually intense rain flooded one of its substations a year or so ago, a utility in the northeast approached Wall and his colleagues. The substation provides power to one of the largest employers in the state; the utility wanted to know if it would be increasingly likely to flood in the future — and if so, how badly, and what could be done to mitigate it.

Wall's team did an analysis that took into account factors such as sea level rise and storm surge from a hurricane. They looked at the flood vulnerability of six nearby substations and used a model of the electric transmission grid to see what would happen if those six substations failed simultaneously. Would there be cascading failures across the grid that would cause a much larger problem in the region?

"The good news was the answer was no, there wouldn't," Wall said. But there would be local blackouts, and the substation that motivated the analysis would indeed be increasingly prone to flooding. The team recommended that the utility build a new substation on higher ground and steered them to locations in the area that would be less vulnerable.

Climate modeling has only lately developed to the point where these kinds of studies are realistic. The models dice the world into a grid of cells and calculate the state of every cell repeatedly through time. With supercomputers, researchers have the ability to model smaller cells and shorter time steps, resulting in finer resolution. And the finer the resolution, the more specific the model can be about what will happen at a given location.

At the Argonne Leadership Computing Facility, a DOE Office of Science User Facility, scientists can now simulate the climate at a resolution of a few kilometers. "It's a huge improvement," said Yan Feng, an Argonne climate scientist and the initiative's other co-lead. "So it becomes easier for the climate model output to be used for decision-making."

Feng and Argonne colleague John Krummel recently helped researchers from Nevada's Desert Research Institute develop a high-resolution fire hazard map. The project, funded by the California Public Utilities Commission, will help utilities manage and site overhead utility infrastructure.

"They came to us because they needed to model the regional climate — winds, relative humidity and temperature — as a function of time for 10 years at a resolution of two square kilometers," she said. "It's not affordable for them to do that on their own computers." The climate simulations used approximately 7 million core-hours on the Argonne Leadership Computing Facility's Mira supercomputer.

Both Wall's flood assessment project and the fire map effort would have been difficult to put together elsewhere, Wall said.

"There are lots of places that can do climate modeling or infrastructure modeling; there are places that have decision science and risk analysis capabilities. But what makes this unique is that we have all of these in one place and we're all talking with one another," he said.

John Harvey agrees: "The great thing about Argonne is we're a multi-disciplinary lab," he said. "Working together, we can provide a lot more value to utilities and become a wonderful resource for them. They really can't get this information in one place anywhere else."

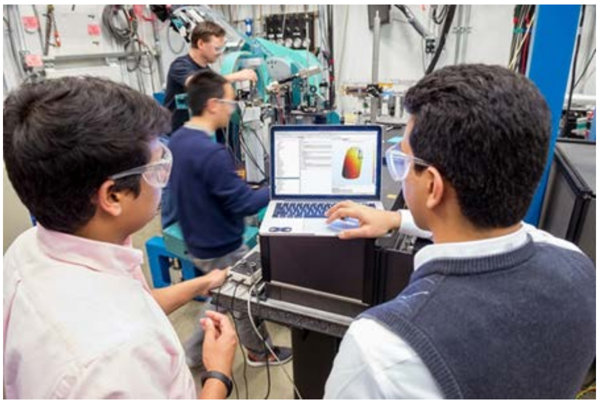
X-RAY IMAGING AND COMPUTER MODELING HELP MAP ELECTRIC PROPERTIES OF NANOMATERIALS

運用 X 光成像及電腦模擬技術，有助科學家掌握奈米材料的電性

By Joan Koka • May 4, 2017

With the tap of your finger, your tablet comes to life – thanks to tiny force sensors and accelerometers that contain piezoelectric materials.

These materials generate electricity whenever mechanical pressure is applied to them, and they've helped shape how we use and interact with technology today. Piezoelectric devices can be found everywhere, from consumer electronics like wearable fitness trackers and smart clothing, to medical devices and motors.



Now researchers at the U.S. Department of Energy's (DOE) Argonne National Laboratory have developed a new approach for studying piezoelectric materials by using ultrafast 3-D X-ray imaging and computer modeling. Their integrated approach, reported in Nano Letters, can help us better understand material behavior and engineer more powerful and energy-efficient technologies.

"By integrating theory and modeling with experiments, we're providing a more complete picture of the material behavior."

"Our approach reveals a wealth of information about the underlying mechanisms that regulate the transfer of energy in such materials, as well as how stable these materials are under extreme conditions," said Argonne computational scientist and co-author Subramanian Sankaranarayanan.

"Using experimental data, we make informed models which in turn make predictions at space and time scales that experiments cannot reach," said Mathew Cherukara, the lead author of the study.

The researchers applied their new approach to the study of zinc oxide, a material that can generate electricity when twisted, bent or deformed in other ways. With its desirable piezoelectric and semiconducting properties, zinc oxide has emerged as a promising material for generating electricity in small-scale devices.

In their experimental approach, known as ultrafast X-ray coherent imaging, researchers took a nanocrystal of zinc oxide and exposed it to intense, short X-ray and optical laser pulses at Argonne's Advanced Photon Source, a DOE Office of Science User Facility. The ultrafast laser pulses excited the crystal, and the X-ray pulses imaged the crystal structure as it changed over time. This enabled researchers to capture very small changes in the material at a high resolution in both time and space.

"Unlike an optical microscope, which enables you to see an object but doesn't allow you to see what's happening inside of it, X-ray coherent diffractive imaging lets us see inside materials as they're bending, twisting and deforming, in full 3-D," said Argonne physicist and co-author Ross Harder. This is the first time such a time-resolved study has been performed at a synchrotron source.

Researchers identified the deformation modes – meaning new ways in which the material could bend, twist, rotate, etc. – from this experimental approach, and used this insight to build a model that would describe the behavior of the nanocrystal.

"By integrating theory and modeling with experiments, we're providing a more complete picture of the material behavior," said Argonne postdoctoral researcher and lead theory author Kiran Sasikumar. "Modeling provides additional insight into the problem – insights that experiments alone cannot probe."

With this model, researchers discovered additional twisting modes that can generate 50 percent more electricity than the bending modes of the crystal.

"Now we can use this information to create devices that exploit these twisting modes," Cherukara said. "This additional insight generated from the theory demonstrates how experimentation and theory together can enable us to make more accurate and useful predictions."

Combining modeling and experimental approaches can also help researchers explore various other material systems and processes, such as corrosion and heat management across thermal devices. Such work will also be advanced with the upgrade of the Advanced Photon Source, which will increase the flux of the facility's high-energy coherent X-ray beams by one hundred fifty-fold, the researchers said.

"With this upgrade, we'll be able to apply coherent imaging techniques to a wider class of materials, with less data acquisition time and even higher spatial resolution," said Argonne physicist and co-author Haidan Wen.

The study, titled "Ultrafast Three-Dimensional X-ray Imaging of Deformation Modes in ZnO Nanocrystals" was published in Nano Letters.

This work was supported by Argonne's Laboratory-Directed Research and Development program. Computer time was awarded through the DOE Office of Science-supported Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program. The study used resources at the Advanced Photon Source, the Center for Nanoscale Materials and the Argonne Leadership Computing Facility, all DOE Office of Science User Facilities.

AREVA NAMES 2017 ENGINEER OF THE YEAR AWARD RECIPIENTS

阿海琺宣布 2017 年度工程師獎得主

Charlotte, N.C., April 25, 2017

AREVA NP today announced the recipients of its annual Engineer of the Year awards. These company-wide awards honor AREVA NP employees who achieved engineering excellence through significant contributions to the engineering profession and AREVA NP's engineering activities.

Mark Lowry, based in Lynchburg, Va., was selected as AREVA NP's 2017 Engineer of the Year for his work leading the development of two major non-destructive examination (NDE) techniques: AREVA NP's new VIPOR video inspection crawler tool and an innovative Combustion Engineering Material Reliability Program inspection process for core shrouds that enables remote, underwater enhanced visual exams.

In addition to the overall Engineer of the Year, AREVA NP recognizes Engineers of the Year in each business unit.

Installed Base Business Unit

- Mark Lowry
- Suzanne Palmer, based at AREVA NP's Marlborough, Mass., facility

Fuel Business Unit

- Mike Merholz, based at AREVA NP's Lynchburg, Va., facility
- Dan Tinkler, based at AREVA NP's Richland, Wash., facility

"Our people are proud and passionate about what they do, and are focused on creating and implementing solutions that consistently put our customers first," said Gary Mignogna, president and CEO of AREVA Inc. "With their technical innovations and accomplishments, our 2017 Engineers of the Year embody AREVA's culture of invention. The forward-thinking solutions imagined and implemented by people like Mark, Mike, Dan and Suzanne sustain and advance nuclear energy around the world."

AREVA NP's Engineers of the Year are nominated by their peers. From those nominations, business unit management and an independent internal committee representing all operations select finalists and the Engineers of the Year. Nominees are evaluated based on their contributions to their business unit during the year and how well they exemplify operational excellence through their commitment to safety, quality, performance, delivery, innovation and community involvement.

EU: POLICY CHALLENGES OVER THE NETHERLANDS' CAP ON DOMESTIC GAS OUTPUT

歐盟觀察：荷蘭天然氣產量上限對能源政策造成的挑戰

Kei Shimogori, Researcher
Nuclear Energy Group, Strategy Research Unit

On March 15, the Netherlands held a national election which could have affected the political situation in other EU member states. In April 2016, the Netherlands had voted against the EU-Ukraine Association Agreement, which sought to strengthen ties between the EU and Ukraine, in a referendum, apparently indicating the spread of domestic skepticism and criticism of the EU, and the focus in the national election was support for the ultra-right party. As it turned out, the ruling party (People's Party for Freedom and Democracy) led by Prime Minister Mark Rutte retained power with 33 seats, while the ultra-right Party for Freedom gained 20 seats, adding only 5 seats from the 2012 election, despite predictions of winning many more. The Prime Minister declared victory, commenting that "The Netherlands stopped populism", receiving praise from French President Francois Hollande who himself faces a presidential election next month.

However, despite winning the election, the Dutch ruling party is facing challenges in energy policy. The Netherlands has a relatively high ratio of natural gas in its primary energy supply and energy mix (39% for the former and 44% for the latter in 2015). Regarding the energy mix in particular, domestic natural gas is dominant. While expanding renewable power sources, the Netherlands also seeks to maintain production of domestic natural gas and enhance the country's role as a transit hub in northwestern Europe in view of its energy security and strategic position in Europe.

In March 2017, Dutch gas company GasTerra (owned 50% by the Dutch government and 25% each by Shell and ExxonMobil), released its 2016 annual report, announcing a drop in both gas sales and profits. Gas sales decreased 10% year-on-year in 2016 to 63.9 Bcm, while profits dropped to 9.9 billion euros, approx. 70% of the previous year's levels. Behind this decline is the government-imposed output limit on the Groningen gas field, the largest in Europe. The government capped the annual output from this field to 27 Bcm in November 2015 due to concern about the risk of inducing earthquakes, and in June 2016, decided to further cut annual production to 24 Bcm for five years starting from October 2016. As a result of this cut, the Netherlands is increasing LNG imports and pipeline gas imports from Norway and Russia.

Yet, the cap on output is being criticized as inadequate by local residents and environmental groups demanding tougher limits. In November 2016, the government's decision to cap annual output at 24 Bcm faced 25 lawsuits from regional governments and others. In January 2017, the Court ruled to support the government, and in line with this decision, the Council of State expressed that immediate further production cuts are not necessary. Nevertheless, the residents of Groningen who have actually experienced earthquakes remain fiercely opposed and are demanding that production be capped at 12 Bcm.

The win by Prime Minister Rutte's ruling party is a positive development for political stability in the whole of Europe. However, in terms of the Netherlands' future energy policies and energy security, the party will face difficult decisions on its domestic gas fields that are of utmost importance to policy.

CHINA: DIFFICULT CHALLENGES IN REDUCING COAL-FIRED THERMAL CAPACITY

中國觀察：如何減少燃煤發電，是一艱鉅挑戰

Li Zhidong, Visiting Researcher Professor at Graduate School,
Nagaoka University of Technology

Supply-side structure reforms centered on removing excess production capacity are an urgent challenge for the Xi Jinping-Li Keqiang leadership which aims to achieve "stable development" by improving the quality and efficiency of growth. Structural reforms in the power supply area are no exception. As an overall target, the 13th Electricity Development Five-Year Plan aims to expand the installed capacity of non-fossil fuels to 770 GW in 2020, up 250 GW from 2015 levels, and raise its ratio in the overall generation capacity by four points to 39% and in overall electricity output to 31% from 27.4%, reflecting the target increase in operating time of renewable power sources. On the contrary, for coal-fired thermal power which holds the key, the Plan aims to decrease the installed capacity to 1,100 GW or lower in 2020 (900 GW as of 2015) and reduce its ratio in the overall power generation capacity to 55% from 58.84%. As specific reduction measures, it set targets of canceling and postponing at least 150 GW of licensed construction projects in five years and to close around 20 GW of existing low-efficiency capacity.

However, a look at the state of progress shows that the reforms are not going smoothly.

According to the China Electricity Council, in 2016, the installed capacity of coal power increased to 943 GW while its ratio of all power sources decreased to 57.27% in terms of capacity, down 1.56 points year-on-year, and to 65.2% in output, down 2.5 points, suggesting that progress has been made in reducing coal power. Meanwhile, in terms of supply and demand for electricity, installed capacity has increased by as much as 8.2% to 1,646 GW while consumption only increased 5.0% to 5.92 TWh. Due to this substantial overcapacity of electricity, the average operating time dropped by 203 hours to 3,785 hours for all power sources and by 162 hours to 4,144 hours for coal power, thus reducing the availability and undermining the business of power companies. Further, according to a final report by the Electric Power Engineering Quality Supervision Station which oversees the construction of power capacity, 77.69 GW of new thermal power capacity was constructed in 2016, while as of January 2017, a total of 188 GW is being constructed. Although no details are given, most of the capacity is believed to be coal power. If all these capacities are completed, they will not only worsen the overcapacity of coal power and hamper the decarbonization of the energy mix, but could further hit the performance of the entire power industry for a long time.

Concerned by the situation, the government set out to reduce coal power capacity in earnest. Prime Minister Li's Report on the Work of the Government for 2017 adopted at the National People's Congress in March mentioned closing, or canceling or postponing the construction of more than 50 GW of coal power capacity this year. As for the breakdown, Director Nur Bekri of the National Energy Administration announced that 5 GW of low-efficiency existing capacity will be closed, 38 GW of ongoing constructions will be canceled for regulatory violations, and 7 GW of new constructions will be postponed.

Deciding which projects to cancel or postpone will be very tough: the National Energy Authority had transferred the authority to license coal power to regional governments in the administrative reforms of 2014, and is now without effective means to prevent overcapacity.

The success of the reforms will depend on whether the regional governments, which back the power companies, can be persuaded. The expertise and leadership of the National Energy Administration, the National Development and Reform Commission, and the State Council will be put to the test.