House bill seeks to secure energy critical elements

The Securing Energy Critical Elements and American Jobs Act of 2015 (H.R. 2687) was introduced by US Representative Eric Swalwell (D-Calif.) on June 8, 2015. Co-sponsored by a fellow Californian, Representative Alan Lowenthal (D-Calif.), the bill seeks to authorize an energy critical elements (ECEs) program within the United States. Defined within the bill, an *energy critical element* is "any of a class of chemical elements that have a high risk of supply disruption and are critical to one or more new, energy-related technologies such that a shortage of such element would significantly inhibit large-scale deployment of technologies that produce, transmit, store, or conserve energy."

ECEs are a subset of critical materials, which have long been an area of concern for both the government and the materials community. Critical materials are used for a broad range of existing and emerging technologies, do not currently have viable substitutes, and are subject to price and availability fluctuations that are highly dependent on international political relationships. For the past several decades China has dominated production of ECEs, which is a driving factor behind the recent congressional and executive attempts to develop a domestic supply chain, implement a recycling program, and identify possible substitute materials (See *MRS Bulletin*, March 2015).

The joint Materials Research Society (MRS)/American Physical Society (APS) report *Energy Critical Elements: Securing Materials for Emerging Technologies* was published in 2011, and has been used in the policy arena to educate lawmakers on the challenges surrounding ECEs. According to Alan Hurd, Executive Advisor at Los Alamos National Laboratory and an MRS Past President, MRS has made a concerted effort to participate in physical science-related policymaking which "has paid off in tangible legislation, support for research funding in difficult times, and respect for MRS in science policy circles." Indeed, many critical materials bills introduced over the last several sessions of Congress have incorporated information and recommendations both from interactions with MRS members and from the MRS/APS report.

MRS facilitates annual congressional visits between members, legislators, and government agencies, which "led to a request for MRS support of the Securing Energy Critical Elements and American Jobs Act from Rep. Swalwell's office," says Damon Dozier, MRS Director of Government Affairs. The MRS Government Affairs Committee and executive leadership reviewed the bill to determine its possible impacts on the materials community and approved support for the bill.

The Securing Energy Critical Elements and American Jobs Act authorizes a research, development, demonstration, and commercialization program within the US Department of Energy (DOE) with the intent to provide a sustainable supply of ECEs for the United States. The program is meant to focus on ECE issues not likely to be tackled by the private sector—specifically improvements in extraction, processing, recovery, and recycling of ECEs as well as methods to minimize ECE usage and develop viable substitutes. Collaboration on ECE issues, both multidisciplinary (including opportunities for university students), and international, are included in the proposed program. The bill authorizes $25 million per year for a five-year period starting in 2016 and also directs the US Secretary of Energy to submit an updated implementation plan to Congress every two years.

A Critical Materials Energy Innovation Hub within the DOE would be established by this bill and tasked with carrying out the ECEs program as well as creating a Critical Materials Information Center to store and distribute information on ECEs. Furthermore, the bill directs the president to coordinate the actions of federal agencies with respect to securing the supply of ECEs, to identify and model possible supply issues for ECEs, to evaluate ECE-based federal programs and coordinate with other domestic and international efforts, and to encourage the private sector within the United States to develop a domestic supply chain for ECEs.

"I am proud that MRS endorsed H.R. 2687," Hurd says; "It will obligate materials researchers in several positive ways." The bill includes education, recycling, and substitution research, ECE policies that according to Hurd "will serve the nation best."

While the ECEs program within H.R. 2687 aligns well with MRS goals, it is by no means the only bill before Congress that attempts to address ECEs and other critical materials. On the Senate side, Senator Lisa Murkowski (R-Alaska) has introduced the American Mineral Security Act of 2015 (S. 883). Murkowski's bill is a slightly updated version of the Critical Minerals Policy Act of 2013 that was introduced in the 113th session of Congress and reported on in the February 2014 issue of *MRS Bulletin*. While MRS has not officially endorsed Senator Murkowski's bill, it is "very comprehensive and worth MRS attention," Hurd says. S. 883 has been fully included

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Congressional bills
H.R. 2687: https://www.congress.gov/bill/114th-co ngress/house-bill/2687/text
H.R. 1937: https://www.congress.gov/bill/114th-congress/house-bill/1937/text
S. 883: https://www.congress.gov/bill/114th-congress/senate-bill/883/text

in the Energy Policy Modernization Act (EPMA) of 2015, an omnibus energy bill compiled and passed in September 2015 by the Senate Committee on Energy and Natural Resources (ENR).

On the House side, Representative Mark Amodei (R-Nev.) has introduced the National Strategic and Critical Minerals Production Act of 2015 (H.R. 1937). Amodei's bill passed the House in October 2015 and was referred to the Senate Energy and Natural Resources Committee. H.R. 1937 has several shortcomings including its definition of critical minerals, which leaves out the essential concept of supply risk; its lack of sustainability policies like critical minerals recycling, development of alternative materials, and minimization of critical mineral usage; and its sweeping changes to the regulation and permitting process for domestic critical minerals mining.

The active role MRS has played in helping to inform and evaluate different policy options is vital to ensuring the development of environmentally responsible and scientifically sound policy around ECEs and critical materials. While it is impossible to predict if any of the critical mineral legislation from this session of Congress will make it to the president's desk, it is important that the materials community continues to closely watch and engage in the discussions around this issue.

Jennifer A. Nekuda Malik

Energy mix models make a case for increasing EU renewable targets
www.energeo-project.eu

Using sensors on board platforms such as satellites and advanced modeling systems, European Union-(EU)-funded researchers have quantified the impact of future energy use on the environment. Their headline conclusion? That we can go further than the EU goal of increasing renewable energy's contribution to global supply to 80% by 2050.

The production, transport, and consumption of energy all put considerable pressure on the environment. If the EU were to make changes to its energy mix, for example by relying more on biomass, solar, or wind energy, what would the impact be? Would it impact air pollution or human health? What about ecosystems, fresh water systems, or the biosphere? The EnerGEO project—an international organization funded by the EU's 7th Framework Program—designed and built a system to evaluate this.

The team started by linking environmental observation systems already under the umbrella of the Global Earth Observation System of Systems (GEOSSs) with new energy models developed during the project.

One of the major challenges for EnerGEO was to connect a variety of observation systems, each focused on a very specific environmental question, with a large array of energy resources that have widely different impacts on the environment.

Finding a way for experts from very different specializations to work together went some way toward solving this, explains EnerGEO coordinator Martijn Schaap of the Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek (TNO) in The Netherlands: "People came from different backgrounds, which meant they were not talking the same language. We had to connect certain parts and understand how we could use each other's expertise."

By linking observation data and energy models, it is possible, for example, to have an idea of how much biomass is available, and then to estimate how much could be harvested. This, in turn, indicates how much energy could be produced from biomass.

EnerGEO also worked with data on air pollution trends and the presence of pollutants such as carbon monoxide and nitrogen dioxide.

Once the data had been connected to the team's models, the whole system was applied to four scenarios:

- *Baseline*—current EU policies on limiting CO_2 remain as they are;
- *Open Europe*—solar energy is imported to Europe from North Africa, the share of energy provided by biomass is high, and nuclear energy is phased out;
- *Island Europe*—no electricity is imported from outside of Europe, renewable energy use is equal to or higher than that in the Open Europe scenario, and nuclear energy use continues;
- *Maximum Renewable Energy*—renewable energy penetration is close to 100%.

Testing these scenarios showed that the potential of wind, solar, and biomass energy would make it possible to increase the share of energy from renewable sources by more than is currently targeted. "The targets can be more ambitious than the EU 80% target," confirms Schaap.

Another key finding was confirmation that earth observation data can indeed be used to create spatial maps illustrating renewable energy potential. These would be useful for engineering consultants looking for the optimal location for new infrastructure, such as solar panels.

Many of the EnerGEO project partners are now working with the new modeling systems while continuing to develop them. Although no follow-up project is currently planned, Schaap would be keen to expand the EnerGEO system geographically and to other energy sources, such as geothermal and tidal energy, and to expand beyond electricity production. He also has further scenarios in mind for testing, including the impact of higher electric vehicle usage on electricity demand and consequent shifts in environmental impacts. □

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