Access to the right information sources will bring net zero success



Introduction:

Engineers and scientists around the world are working hard to solve some of the planet's most urgent challenges. Global warming, in particular, is in the spotlight, and we are racing against time to meet net zero targets designed to arrest the rise in global temperatures. Many are searching for new solutions to reduce our carbon footprint, lower emissions, and rapidly bring about an energy transition.



One of the biggest challenges, however, is that these solutions must be cost competitive with traditional approaches to energy generation. None of us has the time to spend millions on a multi-year research path that dead ends. Solutions are needed to de-risk investment in technological innovation and bridge the knowledge gap that stands in the way of a rapid energy transition.



"Researchers need access to data and to have confidence that the information is real, concrete, and current"

> **—Ali Flynn** Vice President of Sustainability, Arq

Finding the right data

The good news is that there are answers out there. Researchers in a great many fields are discovering technologies and solutions that can be harnessed to further net-zero programs. However, some of the best information sources that contain material addressing sustainability challenges are hidden or hard to find — and a great many other information sources are unlikely to offer what they are looking for. The data they provide is either too general or potentially helpful information is buried within thousands of responses to search queries.

What is needed is broad access to curated data that specifically applies to individual disciplines. This data must be easily shared among academia, government, and organizational researchers as they seek to develop technologies and solve materials issues. No one has all the answers. Inability to find the right answers and accelerate collaboration could endanger net zero target achievement.

"Researchers need access to data and to have confidence that the information is real, concrete, and current," said Ali Flynn, Vice President of Sustainability at Arq. "This helps them to view literature that will either validate or repudiate their hypotheses."

The climate crisis is here

Extreme heatwaves across Europe, South Asia, and North America; the Rhine, Thames, and the Colorado River are drying up; severe droughts in East Africa and the Western USA; heavy rain and flooding in Bangladesh, China, and parts of Europe; unprecedented wildfires sweeping across Australia and the American West — there are few areas of the world that have escaped the impact of climate change unscathed. In response, more than 70 countries have set net-zero targets aimed at keeping global temperatures in check.

"2050 will be upon us before we know it; we don't have much time to make a difference," said Kyle W. Elam, M.S., Senior Process Engineer at 3M. "It is essential that we make major advancements towards net zero every single year."



Net zero risk demands immediate action

Much of the net-zero focus, understandably, has been on the climatic consequences of a warming planet. Yet severe risk lies ahead for those organizations that fail to embrace climate action. These risks extend into areas such as corporate reputation, competitive advantage, and the ability to form business partnerships.

"Net zero is becoming an expectation in the business community and most companies are embracing it," said Sami El Kadi, Former Supply Chain & Manufacturing Executive Leader at an energy technology company. "Net zero programs are now an essential aspect of growing the business, obtaining investment, gaining permit approval, and ultimately being able to sustain profitability. In certain countries and with certain companies, net zero is a contractual requirement."

And in the months and years to come, the pressure will only mount. Those ignoring carbon emissions or exposed for a greenwashed business-as-usual attitude may find themselves shut out of key markets.

"If you don't move forcibility towards the reduction of your carbon footprint, a negative perception in the public and stakeholder mindset will impact you economically and impair competitive advantage," said Elam of 3M.

Increasingly, the availability of financing and the ability to obtain licensing and permitting approval hinges on environmental credibility. Those in severe violation can incur hefty government fines. Others are taking a major hit on the bottom line.

"A lot of financial institutions won't lend you money unless you have your ESG goals in line," said Ali Flynn, Vice President of Sustainability at Arq.



Siloed information is stalling progress and inhibiting collaboration

Climate change demands that we greatly accelerate the transition to clean sources of energy. That's why a third of Europe's largest listed companies have pledged to achieve net-zero carbon emission targets by 2050. Many more are joining, as are a great many organizations from nations around the world. They need sustainable answers now.

The good news is that a large number of professionals in geoscience, renewable energy, power generation, oil & gas, academia, science, and engineering are working around the clock to find solutions to the world's biggest problems. They seek the right geological formations that can store carbon dioxide once it has been captured. They are searching for underground caverns where green hydrogen can be stored and reused after it has been produced via electrolysis using excess renewable energy.

They want to find alternative materials to minimize corrosion and make energy transition applications more viable. But finding what they need is taking far too long. Sometimes they can't find it at all.

"We struggled to find answers in an ocean of information. This was slowing down projects and we were unable to deploy capital in an efficient manner," said Parag Bandyopadhyay, Development Manager for carbon dioxide storage at energy company Oxy.

Time is wasted when valuable data is hidden from view

This challenge revolves around the information sources at their disposal. There may be a great many of them. But relatively few provide engineers with the validated sources they need in a timely manner.

"Information needs to be available and sharable if we are to arrest environmental decline," said El Kadi.

Progress towards net-zero goals is often curtailed due to lack of access to complementary material by researchers in similar or disrelated fields. Traditional search engines are cluttered with irrelevance. Online technical resources sometimes offer a breadth of coverage but suffer in terms of relevance and usability. In-house databases and industry handbooks are generally siloed and unavailable to the researchers that urgently need to access them.

This labyrinth of data sources causes researchers to waste time covering ground that has already been explored. If an earlier researcher spent years following a path that proved fruitless, those findings should be broadly available. Similarly, key breakthroughs should not be horded away if they may assist others to fight climate change.

"Many companies have become science labs trying to figure out their own recipes," said El Kadi.

Why customers value Elsevier resources

"Using Elsevier resources, I was able to search for biodegradable polymers, review a list of relevant material," said Flynn. "The system also provided me with a list of related words to narrow down my search to find even more applicable papers."

"I once spent a long time searching in various places and experimenting in the lab to find the best materials of construction to minimize corrosion caused by hot bleach," said Elam. "Two hours in the corrosion database would have saved 80 hours of unnecessary work."

"Elsevier offers a safe, collaborative environment where companies, schools, government entities, and the engineering and scientific communities can contribute to a knowledge pool and to use it to develop net zero solutions," said El Kadi.

Limited engineering resources inhibit net zero progress

In the midst of an ongoing climate emergency, timely access to leading-edge research and historical information is critical.

"Without access to historical papers as well as the latest findings, we are starting from scratch like little kids playing with LEGO pieces," said Flynn.

Here are the key factors needed to facilitate innovation and knowledge sharing and bring about a smooth, rapid, and costeffective energy transition:

Accessibility

Information must be easily accessible, sharable, and available to engineers where and when they need it. It should be contained within one resource that spans a great many technical areas yet remains tightly curated so that only validated and authoritative engineering and scientific content is gathered. Further, it should be available outside of the office so that researchers or engineers can find answers when they are out in the field or visiting other facilities.

Searchability

Information must be easily searchable. This goes well beyond the simple search functions of the web. Queries should be able to scan across a wide range of diverse multidisciplinary areas. This enables researchers to drill down into search results to unearth a rich set of resources that includes full-text content, equations, material properties data, and interactive charts and graphs — to use filters, autosuggestions, and advanced search capabilities across scores of disciplines and hundreds of subtopics to narrow down results by keyword, title, subject area, and material.

By precisely targeting their queries, engineers should be able to rapidly find and apply the right equations and validated data points to solve operational challenges. They should also be able to locate the most appropriate materials for any project by querying a comprehensive materials database.

Cross-Pollination

It is not very common for information sources to compile and cross-reference data from multiple disciplines. This inhibits the cross-pollination of ideas. Someone operating in food packaging or plastics, for example, may have unearthed a solution, material, or approach that would have broad applicability in the capturing of carbon or in reducing the price of solar panels. Yet that data might remain hidden from engineers who desperately need that information to solve immediate net zero challenges. "Evolving net zero technology and solutions are likely to span across many disciplines"

> ----Kyle W. Elam, M.S. Senior Process Engineer, 3M

"Evolving net zero technology and solutions are likely to span across many disciplines," said Elam of 3M. "I've been involved in situations that led me to need meteorological, seismic, environmental engineering, electrical, and chemistry as part of new product development."

Comprehensiveness

Generic online resources provide billions of potential data points. Most of them are irrelevant. Some industry resources limit themselves to a small niche. Others attempt to provide a volume of data points. They focus on quantity, offering vast numbers of titles. But quality suffers. What is needed is a resource that is tightly curated across thousands of authoritative resources yet provides tens of millions of potentially relevant data points.

From information to insight

These areas of accessibility, searchability, cross-pollination, and comprehensiveness are where most industry and scientific resources miss the mark. Within the fields of academia and engineering, information silos are so prevalent that organizations sometimes spend years researching an area and coming up with a solution — only to eventually discover that they have been reinventing the wheel. Others have already traveled that path. In some cases, millions have been invested in a promising approach that eventually proved to be fruitless.

Had they discovered the work of earlier pioneers into that area, they might have saved all that time and money as that approach had already been discarded as unfeasible or unviable by others.

The bane of engineers and researchers, then, is that their efforts are thwarted by untargeted, unverified, untrustworthy, and uncurated data. Despite this, they must find answers quickly to slow the rise in global temperatures. But how? They need a means of finding the data they need and transforming that information into actionable insights — a way to aggregate organizational data and enrich it with curated information from a trusted source to provide actionable insight.



Collaboration is the key

Combating climate change will take collaboration within and outside disciplines.

"With a huge goal like the 2030 net zero target, we can't do it alone," said Kyle Elam of 3M. "It takes a group of people working together collaboratively to meet that goal."

This must transcend organizational or competitive boundaries as a united effort to find sustainable solutions. Intellectual Property (IP) being horded and licensed purely for profit, for example, develops yet another silo. In the future, pressure to share will rise. Those interested primarily in profit are likely to suffer reputational and financial repercussions.

What is needed is a curated and verified source of scientific and engineering information on one platform that can be shared broadly. Some of the features of such a platform include:

- Delivers trusted, accessible, relevant, and sustainable engineering answers and insights for industry and academia
- Accelerates the discovery process and connects engineers across the globe to the latest research and breakthroughs
- Provides discovery of insights from authoritative and validated technical content sourced from hundreds of publishers and content providers
- Offers knowledge that spans dozens of engineering and scientific disciplines and hundreds of subtopics
- Interactive tables and graphs, data visualization capabilities, equation worksheets, and comprehensive databases of materials and other scientific content
- Text and numeric search designed for engineers to query across a wide range of diverse multidisciplinary areas using filters, autosuggestions, and advanced search capabilities to narrow down results by keyword, title, subject area and material
- The ability to incorporate technical and scientific data with internal and external datasets as well as software programs to manipulate data for further analysis to solve specific challenges
- Mobile tools for continuous access to enable engineers to catch up on projects in transit, reference best practices while at a project site, and access critical content while away from the office or offline

Elsevier products such as Knovel, ScienceDirect, and Scopus provide the above advantages and more.

"Technological advances and economic gains are based on the availability of knowledge," said Elam. "Elsevier shares what others are doing across private, governmental, and academic fronts."



Case study: reskilling of energy workers to achieve net zero

Geothermal energy is one of several areas essential to the success of the transition away from fossil fuels.

"The world is demanding more and more energy in the most efficient way, and that means that it has to be greener and more cost-effective," said El Kadi. "We have to be able to obtain clean energy such as geothermal resources in the fastest way possible."

The industry faces major challenges in reskilling its workforce. While it possesses great amounts of experience in subsurface exploration, discovery, drilling and production, the skills employed in traditional conventional energy projects do not necessarily translate directly into geothermal development. One challenge is how to take advantage of existing data from other wells and extrapolate it accurately using appropriate criteria. In conventional energy, and eventually in geothermal, there is no room for error. Engineers and analytics specialists must read the geological signs correctly to find viable energy sources.

To eliminate uncertainty and provide engineering teams with reliable data and the correct sources of innovation, Elsevier resources can be used to streamline the development process by reducing the number of iterations required while saving time by helping professionals make more informed decisions.

"Elsevier tools deliver access to industry-wide knowledge that helps us come up with better designs and better tools that reduce drilling costs," said El Kadi. "Engineering groups industry-wide are now more confident in the decisions being made despite the unfamiliar nature of the projects." "Technological advances and economic gains are based on the availability of knowledge," said Elam. "Elsevier shares what others are doing across private, governmental, and academic fronts."

Case study: carbon storage

International energy company Occidental (Oxy) started a subsidiary known as Oxy Low Carbon Ventures to advance leading-edge technologies and business solutions that economically grow its business while reducing emissions. This is part of its commitment to advance a lower-carbon world.

Parag Bandyopadhyay, Development Manager for carbon dioxide (CO₂) Storage at Oxy, has been assessing CO₂ storage technologies as well as the many possible ways they can be developed and integrated into operations to achieve Occidental's net-zero goals. While Oxy was committed to carbon storage investment, Bandyopadhyay realized that the company could waste capital without achieving the desired outcomes. If research was done haphazardly, products and technologies could be incorrectly designed, and new reservoir models and simulations might contain inaccuracies. Such errors could seriously delay the attainment of net-zero targets.

"We struggled to find answers in an ocean of information. This was slowing down projects and we were unable to deploy capital in an efficient manner," said Bandyopadhyay. "We wanted to avoid reinventing the wheel in our CO₂ storage efforts." Elsevier products are harnessed at Occidental in the reskilling of the existing workforce as well as in reducing the unpredictability factors that accompany any transition into unknown territory. He cited one example of gaining technical confidence on specific metrics related to the number of reservoir barrels and tons of CO₂ that could be stored.

"Elsevier's research tools have provided real help in filling the knowledge gaps to enable us to make informed decisions and improve outcomes," said Bandyopadhyay.

"The ability to go through an extensive knowledge catalog and find results in Elsevier products that are pertinent to what we are doing saved us months in CO2 storage research and development."



Conclusion:

We are playing a high stakes game. There is no time to lose. Access to the right knowledge is more critical than ever. If we are to meet the Net Zero targets set for this year, for 2030, and ultimately for 2050, we must revolutionize the field of information sharing, collaboration, and the curation of scientific/ engineering information. This will enable the implementation of new technologies to find sustainable alternatives to current materials and processes that offset environmental impacts. It will foster innovation and speed time to market for next-generation energy and environmental solutions. It will also help organizations realize sustainability and net-zero goals while remaining in compliance with environmental, health and safety regulations.

Elsevier is a vital information resource that can help engineers, scientists, and researchers to solve some of the most pressing challenges in the modern world.

"We need platforms that provide insight and expertise from instead of isolated silos of knowledge. If we don't share and collab, we won't meet targets," said El Kadi

The Elsevier portfolio can:

- Accelerate R&D to achieve goals aligned to the achievement of net zero compliance
- Validate designs for prototyping, scale-up, and manufacture of sustainability solutions
- Query and search more than 12K+ resources and 65 million data points, using filters, autosuggestions, and advanced search capabilities across 40 disciplines and 230 subtopics
- Narrow down results by keyword, title, subject area and material to rapidly validate data points to solve operational challenges
- Feed live data into >100,000 interactive tables and graphs to determine the ideal parameters for project success
- Efficiently pinpoint material and substance property data for specific scenarios and conditions
- Provide access to property tables of >21,000 compounds and substances
- Manipulate more than 1,000 equations and compute exact values automatically
- Utilize a unit converter for >1,000 unique units and 90 properties
- Deliver results to office or mobile devices to enable engineers to catch up on projects in transit, reference best practices while at a project site, and access critical content while away from the office or offline
- Seamlessly bring data together via plug-ins and add-ons for popular engineering software and application tools to streamline engineering workflows

The benefits include accelerated time to market, optimization of processes based on field proven technical and materials knowhow, reduced business and compliance risk by learning from the mistakes and successes of others, and the realization of sustainability and net-zero goals while remaining in compliance with environmental, health and safety regulations.

Together we can create possibilities for a sustainable world

Transitioning to a net-zero world won't be easy. Some say it may be one of the greatest challenges humankind has faced. It entails the reskilling of a large segment of the current workforce, the bridging of the knowledge gap, and finding ways to greatly enhance collaboration in order to de-risk net-zero related decisions and accelerate the energy transition. But there is no alternative. GHG emissions must be curtailed to arrest the rise in global temperatures. By working closely together to achieve this goal, we can transform our entire way of life.

Call to Action: Connect with Elsevier representatives to engage a conversation on how Elsevier products can help to unlock energy transition through data insights and data management.

Case study: overcoming hydrogen storage challenges on the road to net-zero

Major technical barriers must be overcome if the potential of hydrogen power is to be realized. Since hydrogen is about 11 times lighter than air, it occupies a far larger volume than other gases. Researchers are working hard to figure out how to store it at high pressure to reduce its volume.

"There are technical challenges for hydrogen storage to overcome such as deciding upon the best tools and products that will reduce risk and enable the best outcome possible," said Thomas Shaw, Chief Technology Officer of a joint venture specializing in hydrogen storage.

Compression of gases and underground drilling demand the highest levels of safety. Accordingly, an abundance of safety regulations already exist, with new ones being originated regularly.

"Elsevier tools helped our team to gain access to quality information and develop segment expertise quickly on how can store and transport hydrogen efficiently," said Shaw. "We went from being totally ignorant to being able to offer our local customers a specific geotechnical proposal within a matter of days. A small investment in an Elsevier subscription allowed us to win a contract worth millions."

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