# KIRSTY GOGAN

**KIRSTY GOGAN IS AN INTERNATIONALLY SOUGHT-AFTER ADVISOR TO GOVERNMENTS, INDUSTRY, ACADEMIC NETWORKS AND NGOS. SHE IS REGULARLY INVITED AS AN EXPERT SPEAKER ON SCIENCE COMMUNICATION, CLIMATE CHANGE, COMPETITIVENESS AND INNOVATION TO HIGH PROFILE EVENTS.**

## TELL US ABOUT TERRAPRAXIS AND THE REPOWERING COAL INITIATIVE?

TerraPraxis is a non-profit organisation, founded to design and implement strategies that leverage science, technology and energy innovation. Our focus is on accelerating action for climate and prosperity, leading the development and accelerated deployment of highly scalable solutions for the hardest-to-decarbonise sectors by enabling high-impact rapid transitions for the toughest parts of the decarbonisation challenge.

More than 2,000GW of coal-fired capacity are used in the world today, adding roughly 15bn tons of $CO_2$ emissions each year – making up almost half of all carbon emissions. Since more than half of the global coal fleet is comprised of young assets (less than 14 years old on average), retirement of this infrastructure is an unattractive and unrealistic prospect for many owners and investors. Existing coal-fired power plants have enormous value in established markets for their power, grid connections and experienced personnel.

**"WE'RE BUILDING THE MARKET FOR AMRS AT THE SAME TIME AS THE PRODUCT ITSELF IS BEING DEVELOPED"**

## WHO ARE YOU WORKING WITH AT TERRAPRAXIS?

Eric Ingersoll is another Co-founder – he is a strategic advisor and entrepreneur with deep experience in the commercialisation of new energy technologies with extensive project and policy experience in renewables, energy storage, oil & gas, and nuclear, with a special emphasis on advanced nuclear technologies.

Martin Wood is co-founder of Bryden Wood, tech-powered global company of creative technologists, designers, architects, engineers and analysts who are working with Terra Praxis on Repowering Coal.

TerraPraxis has assembled a world-class design team to create a scalable, rapidly deployable architecture for a cost-effective coal plant repowering system for a wide range of existing coal plants.

The design team is made up of experts across a range of sectors (eg Microsoft, KPMG, MIT, University of Buffalo and Bryden Wood) which are developing new tools that leverage best-in-class, highly automated design and delivery models, drawing on tools used in sectors like data centers and pharmaceuticals.

## HOW VIABLE IS IT TO REPOWER COAL PLANTS?

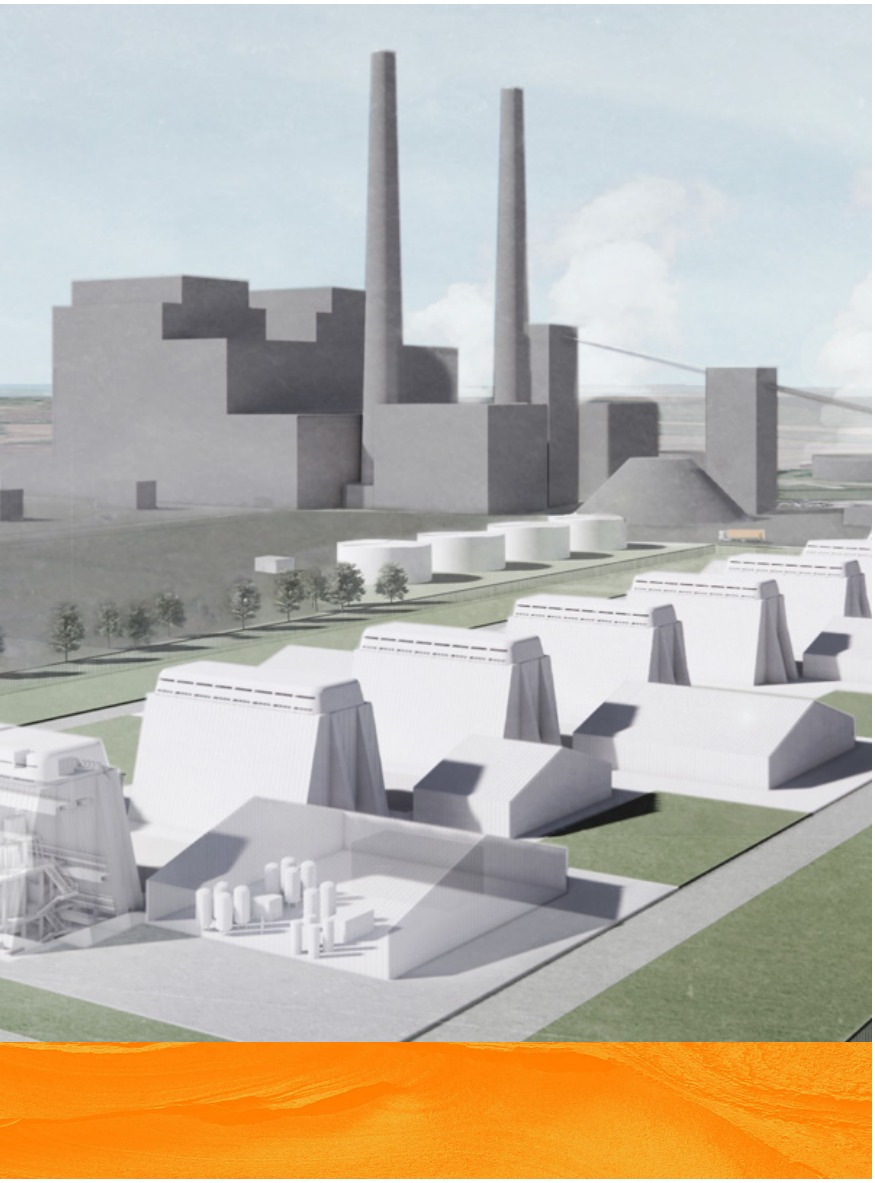
Replacing coal boilers with small modular reactors (SMRs, a.k.a clean heat sources) allows the use of existing infrastructure for clean electricity generation and a fast, low-risk path to decarbonising global power generation. Unlike other proposed solutions, repowering coal plants offers robust political viability because it preserves jobs, local economies and existing, high-value infrastructure investments.

## WHAT ARE THE PROS AND CONS OF AMRS?

We're building the market for Advanced Modular Reactors (AMRs) at the same time as the product itself is being developed. The digital tools

we're creating will enable us to have a huge number of projects, across multiple sites, ready to go as soon as the reactors are approved.

Speed and agility have never been so important. There's a seat at the design table for everyone from plant owners to regulators, to suppliers, AMR vendors, customers, investors and assemblers – everyone involved in the project. Now, for the first time, it's possible to connect these people together using a digital platform, and give them access to all the information on their project.



Advanced fission reactors are heat sources that produce electricity at very high efficiencies and can reliably deliver large amounts of high temperature (>500°C) steam to industrial end users. Given these attributes and with projected capacity factors of over 90%, advanced heat source technologies are uniquely suited to support the production of low-cost hydrogen at a global market scale.

Power density is an important additional benefit. While solar PV has a power density of 50 MW per km2, offshore wind can deliver only 2 MW/km2 . This calculation includes the space between the turbines, to be more realistic.

In contrast, advanced heat sources have a power density of 2,080 MW/km2: about 500-times greater than solar PV and 1,200-times greater than offshore wind. This is illustrated in the image below, which compares the total area required to replace the UK's current oil consumption with hydrogen generated from either wind, solar, or advanced heat sources.

## CAN THEY BE PRODUCED AT SCALE BY 2027?

A range of advanced heat sources are being demonstrated and commercialised now, such as the TerraPower-GEH Natrium plant, co-funded by Bill Gates and the US DOE, with the goal of being operational by 2027. However, given the need to convert 5,000-7,000 coal plant units globally between 2030-2050 (about 250-350 per year), a streamlined strategy that can meet this rate of deployment will be required.

> **"THE DIGITAL TOOLS WE'RE CREATING WILL ENABLE US TO HAVE A HUGE NUMBER OF PROJECTS, ACROSS MULTIPLE SITES, READY TO GO AS SOON AS THE REACTORS ARE APPROVED"**

For global coal plant conversion to be successful, the deployment model has to de-risk the construction process (the riskiest part of a new build project) and provide coal plant owners with a high level of certainty with respect to schedule and budget. This is necessary to facilitate a rapid and confident assessment, initiation, and completion of these repowering projects.

Coal plant owners will be in a position to evaluate the benefits of repowering within budget and with schedule certainty and begin pre-development analysis. Providing innovative design and delivery strategies, including financial models and online tools, will reduce the scope and complexity of licensing and site development—making new, clean energy plants easier for customers to buy, build, maintain, and operate across a broad range of markets.

## WHAT ADVICE WOULD YOU GIVE ENERGY UTILITIES IN TERMS OF THEIR DIGITAL PLATFORM PRIORITIES?

The digital platform that underpins this project demonstrates how such platforms enable highly complex projects to be delivered at scale and at speed. Bryden Wood have already developed similar data-led solutions for the UK Ministry of Justice, UK Department of Health and Social Care, and major commercial clients, resulting in reductions in construction time, carbon and cost.

For Repowering Coal, new digital infrastructure will enable design knowledge to be embedded in the building systems and design tools so that all parties can share progress and results in real time across all projects.

New algorithmic design tools are being created to:

- Assess coal plant viability for AMR replacement
- Create initial concepts using a design configurator in just days
- Produce detailed design outputs for manufacturing

The structural components for the standardized design (also by Bryden Wood) can then be mass produced by existing and new manufacturers and assembled on-site by non-nuclear specialists.

Together, the tools create a completely new, open, digital platform to which everyone has access and can contribute.