

VENTILATION AIR METHANE · WALES

Open Doors at 0.2%

The UK's largest methane hotspot is a coal mine in Wales. After a few weeks of running in, a steel box beside its ventilation shaft has destroyed that methane continuously at 0.2% since mid-June. Manufacturers have long stated that this concentration is possible. Aberpergwm is the proof: at full scale, measured, independently audited and open to anyone who wants to see it.

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Aberpergwm Colliery, Glynneath, Wales: Peak Carbon's regenerative thermal oxidiser beside the ventilation shaft. Video: Peak Carbon.

Dan Barry holds a piece of coal up to the camera. It is shiny, almost metallic, and it catches the light. "It's not like traditional coal in the way we imagine traditional coal," says the chief executive of Peak Carbon.

The coal is anthracite, from Aberpergwm Colliery near Glynneath. But the story here is not the coal. It is a steel box beside the mine's ventilation shaft, and the decision to let the world inspect it.

The box

Coal mines are ventilated to keep miners safe, and the fans that clear the methane from underground push it out into the sky. The concentration is tiny, often well under 1%, but the volumes of air are vast. Around 70% of coal mine methane leaves this way, as ventilation air methane, or VAM. And methane warms the planet 82 times more than carbon dioxide over 20 years.

Peak Carbon's unit is a regenerative thermal oxidiser, or RTO. Mine air passes through a bed of ceramic material heated to around 1,000°C, where the

methane turns into carbon dioxide and water. The reaction releases heat, and the bed keeps it. Above a certain concentration the box sustains itself with no added fuel. That threshold is 0.2%.

"It doesn't really count if you're not running auto-thermally," Barry says. Fuel only starts the unit. "Once it's hot, you turn off the gas burner and it's just the energy from the destruction of the methane that is keeping the heat within the system continuously."

There is nothing exotic about the machine. RTOs are workhorses of industrial air cleaning, with tens of thousands in service worldwide, and destruction efficiencies of around 98% or more come with the design. Many standard units, the same type used on mine air, routinely treat air so weak in pollutants that a little natural gas is added to keep them hot. In effect, they already run at the energy level of 0.2% methane. Specially designed units can sustain themselves on as little as 0.1%. What coal mining has lacked is not the technology, but a full-scale unit at 0.2% that anyone could go and inspect.

The Aberpergwm unit is also wired into the mine's own safety and control systems. "Not only do you have to be able to operate at 0.2%," Barry says, "but you have to be able to operate safely. That's the most important thing."

Why 0.2% became the question

Since the first commercial VAM plant began operating in Australia in 2007, projects have gone for the easiest cases: mine air carrying 0.4% methane or more. Often the concentration can be raised by mixing in drainage gas, the richer methane drawn from coal seams, which is mostly vented too. An RTO costs the same whatever the concentration, so more methane means more emissions destroyed for the same money.

Only in the past few years has part of the mining industry begun to argue that RTOs cannot work at 0.2%, pointing to the absence of any plant doing so. Established RTO VAM suppliers say they can guarantee auto-thermal operation at 0.2%, and some have run units at 0.17% for hours and days at a time. Richard Mattus, The Methane Brief's technical co-founder, who led the contract for that first plant in 2007, sees the new focus on 0.2% as a way of delaying a costly investment while the financial case remains weak.

Running since May, at 0.2% since mid-June

The Aberpergwm unit treats 90,000 cubic metres of air an hour, or 25 a second, about a sixth of the mine's planned airflow. The mine's air naturally carries 0.4 to 0.5% methane, rising to around 0.8% in winter, so Peak Carbon dilutes it with fresh air to prove the hardest case.

The first weeks were a running-in period, with two problems to fix. The first was the link to the mine: the plant is wired into the mine's safety system, so whenever the connection between the two control rooms dropped, the system shut the plant down as a precaution.

Barry calls these "nuisance trips". The second was dilution: the damper that lets in fresh air could not bring in enough to dilute the mine's methane all the way down to 0.2%. The unit first reached 0.2% at full flow on 27 May. With a redesigned damper letting in more fresh air, it has held there steadily since

mid-June.

What Aberpergwm demonstrates is not a new kind of machine. It is a standard design doing, at full scale and for months on end, what suppliers have long said it could.

AT A GLANCE • THE ABERPERGWM UNIT

The box, in three numbers

0.2%

methane in the mine air, with no added fuel, steadily since mid-June

90,000

cubic metres of mine air treated an hour, about a sixth of planned airflow

>98%

destruction efficiency, verified by Bureau Veritas

Peak Carbon regenerative thermal oxidiser (RTO), Aberpergwm Colliery, Glynneath, Wales. Credits rated AAA by BeZero; Verra registration in progress.

An open door

Peak Carbon could have run its test quietly. Instead, it turned the site into a showcase. "We're inviting anyone who wants to come to visit," Barry says. Mine owners and regulators from China, Australia, the EU and the United States have taken up the offer.

The auditors have come too. Bureau Veritas verified that the monitoring instruments were in place and that the unit was running within its design parameters: 0.2% methane, 90,000 cubic metres an hour and more than 98% destruction efficiency, with no added fuel. Dr Roy Moreby, a mining engineer and ventilation specialist known in UK and Australian coal mine safety, carried out a similar audit. The UN's International Methane Emissions Observatory took its own measurements at the site for a study of the monitoring system, and will publish its report.

Safety has been checked separately. Coal Services New South Wales Mines Rescue Consulting audited the process safety design and found it compliant with applicable Australian and New South Wales standards, codes, regulations and guidance. Finch Consulting then audited that the plant as built matched that design. The project is being registered with Verra, and its credits have a AAA rating from BeZero for the integrity of the emissions reductions.

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All the manufacturers say 0.2% is possible, but people want to see it.

DAN BARRY, CEO, PEAK CARBON

A mine with a quarrel attached

Aberpergwm is the UK's last working underground coal mine, operated by Energybuild Ltd. In January 2022 the Coal Authority approved a licence extension allowing about 40 million more tonnes to be mined until 2039, against the Welsh Government's policy of ending coal extraction. Coal Action Network challenged it and lost in the High Court in 2023 and the Court of Appeal in 2024, which found that Welsh Ministers did not have the power to stop it. The campaigners estimate the extension could release up to 1.17 million tonnes of methane. A 2024 analysis of official data by The Guardian and Watershed Investigations ranked the site as the UK's largest methane hotspot.

Whatever anyone thinks of the licence, the mine is operating and its methane is leaving the shafts now. Destroying that methane does not license the mine or lengthen its life. It changes what the mine adds to the atmosphere. Methane does not stay above the Vale of Neath: what leaves a shaft in Wales warms the whole planet.

What the coal is for

Steel is not going away, and neither is its need for coal. About 69% of the world's crude steel is still made in blast furnaces that run on coking coal. Steel made with hydrogen, the alternative most often promised, is struggling: in Europe, green hydrogen costs around €5 to €8 a kilogram, against the €2.50 to €3 steelmakers say they need, and major projects have been postponed or cancelled. Even electric arc furnaces, the cleaner route already in use, need carbon.

That is where anthracite comes in. It is not coking coal, which is baked into coke for blast furnaces. It is the purest coal, 92 to 98% carbon in the US Geological Survey's classification, and electric arc furnaces add it for two jobs: to give the steel its chemistry, and to create the foamy slag that shields the furnace and saves power. "Steel needs carbon within the structure," Barry says.

Aberpergwm's customers are changing. In 2022 most of its coal went to household heating and to blast furnaces, and the nearest of those, at Port Talbot, closed in 2024. Today the mine supplies water filtration and battery recycling, and ships anthracite to electric arc furnaces in the United States.

The prize is next door. A short drive from the mine, Tata Steel is replacing Port Talbot's blast furnaces with a £1.25 billion electric arc furnace, backed by up to £500 million of government support, to make up to 3.2 million tonnes of steel a year from the end of 2027. Aberpergwm hopes to supply it. Without a local source, Barry says, that carbon may arrive by ship from Russia, Colombia or Vietnam. In Vietnam, the IEA estimates, coal mine methane intensity is almost four times the global average.

When coal is mined for steel, its methane becomes part of the steel's footprint. A furnace can run on clean electricity and still carry the emissions of a mine that vents its methane into the air. Hydrogen steelmaking may one day change that, but it is years and many euros away. Destroying the methane at the mine cuts that footprint today, with technology that already works.

Three questions

Barry sees three questions standing between one unit in Wales and methane abatement at coal mines worldwide. Does the technology work at 0.2%? Can it be installed safely? And who pays for it?

Aberpergwm, he says, has answered the first. The second is being answered country by country. Inspectors from the Health and Safety Executive's Mines Inspectorate visited before commissioning and raised no concerns; they will return to inspect the unit in operation. In the UK, as in Australia, Barry notes, inspectors do not approve a plant: they either object or they don't. Australia's regulators have visited and are still forming their view.

He acknowledges the debate over further pilots. Some see more demonstration projects as "a convenient excuse to stall progress", while others point to real risks for miners underground. "You can't disregard that risk at all," he says. His answer is a formal, science-based safety assessment, which he says often shows risks far lower than many already accepted underground. Now that regulators and mine owners can visit a working full-scale unit, he expects more of them to follow.

The next tests are under way. Peak Carbon will replay two weeks of real methane readings from an Australian mine through its dilution system, to show how the box responds as concentrations rise and fall. Then it will stop diluting and run on Aberpergwm's natural air, at up to 0.8%, where the problem reverses: too much heat rather than too little, which could be recovered for power or district heating.

From whether to how

The third question is not one a single unit can answer. Who pays for methane abatement at coal mines is a question for the whole sector: for the regulators who write the rules, the markets that decide what a destroyed tonne of methane is worth, and the investors who must judge whether abatement is a risk or an opportunity.

What Aberpergwm has done is move the first two questions out of the realm of argument. For years, the case for destroying ventilation air methane at low concentrations rested on papers, pilots and promises. Now a full-scale unit is running at a working mine, and inspectors, regulators and mine owners have been invited to come and see it for themselves.

In an industry used to closed doors, that openness is rare. It shifts the conversation from whether this can be done to how quickly it can be repeated.

The Methane Brief will follow the next tests at Aberpergwm, as the unit moves from diluted air to the mine's own.

SOURCES

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