MARCH 2021

EM Magazine
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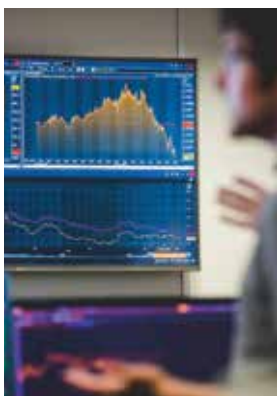
CLAMP-ON ENERGY/ HEAT METERING

12

INSIDE THIS ISSUE:



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FRONT COVER STORY:

Clamp-on Energy/
Heat Metering

See page 12

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INSIDE

EENSULATE PROJECT

"Development of innovative lightweight and highly insulating energy efficient components and associated enabling materials for cost-effective retrofitting and new construction of curtain wall facades."

Figure 1: EENSULATE module installation at the Polish demonstration site

The EENSULATE project is a research project funded by the European Commission under the Horizon 2020 programme. It gathers 13 partners from 8 different European countries (AGC Glass Europe, SAES Getters, Focchi, Universita Politecnica Delle Marche, Selena, Bergamo Tecnologie, Gmina Miejska Dzierzoniow, University College London, Ulster University, Evonik, UNStudio, and Fenix TNT). The consortium is led by RINA Consulting. The project started in August 2016 and will be concluded by May 2021 with total duration of 58 months.

EENSULATE project aims to develop an innovative lightweight (35 % weight reduction compared to the currently best performing modules), highly insulating energy efficient components. Simultaneously, it also develops associated enabling materials for cost-effective retrofitting and new construction of curtain wall façades. EENSULATE represents an ambitious project, which aims to introduce a novel unitized curtain wall system capable of meeting the market demand. It is expected to be an affordable (28 % reduction of total refurbishment costs), high performance prefabricated façade retrofitting solution with reduced weight and thickness. The objective of the project is to bring existing curtain wall buildings to "nearly zero energy" standards and reducing energy bills by at least 20 % while complying with the structural limits of the original building structure and national building codes.

EENSULATE PRODUCTS

The EENSULATE project develops a curtain wall module that consists of two main parts. The first one is highly insulating and environmentally friendly spray foam based on mono-component (OCF) and bi-component (TCF) elements. It allows for the cost-effective automated manufacturing and insulation of the opaque components. The curtain walls also enable significant reduction of thermal bridges during the installation process. The second product is a lightweight and thin double pane Vacuum Insulated Glass (VIG) with innovative sealant and getter technologies. The VIG is used for the insulation of the transparent component of curtain walls; it is manufactured through an innovative low-temperature process, enabling the use of fully toughened glass.

DEMONSTRATION

The EENSULATE products are being implemented at three different demonstration sites. Two buildings are located in Dzierżoniów, Poland (School Building and Museum) and one building is located in Pesaro, Italy (Public library). The performance of the installed EENSULATE solutions will be assessed and compared to the State of the art technologies already existing on the market (Triple Glazed Units).

This project has received funding from European Union's Horizon H2020 research and innovation programme under grant agreement No. 723868.

Project ID: **723868**
Website: **www.eensulate.eu**
Project coordinator: **Paola Robello**
Contact email: **paola.robello@rina.org**

NATURAL REFRIGERANTS: HOW TO ACHIEVE EFFICIENT SYSTEMS?

A new white paper examines the theory behind natural refrigerants and the technologies available to optimise energy savings

Natural refrigerants are considered a sustainable solution as they have a minimal effect on the environment, with technologies that have evolved over recent years to optimise their use. In several HVAC/R applications, natural refrigerants are now the preferred option in new equipment, especially in countries that have started phasing out HFCs. Nonetheless, this transition requires efficient systems that can also reduce indirect CO_2 emissions. The use of the highest-performance technology is essential for combining natural refrigerants and high efficiency. There are several variables to consider: the unique characteristics of natural refrigerants, such as high pressures with R-744 (CO_2) cycles and the flammability of hydrocarbons.

"The aim of the 'Natural Refrigerants' white paper is to systematically bring together the results of years of study and research into natural refrigerants", commented Miriam Solana, HVAC/R Technical Knowledge Specialist. "Our intention with this document is to contribute to making available as much theoretical information as possible, and providing an overview of the technologies for optimising energy savings and creating systems with the lowest total CO_2 emissions. At CAREL we believe in the importance of supporting broad use of these refrigerants, which represent a concrete and feasible response to environmental sustainability. We need to continue to study and carry out research: the goal of innovation is to achieve systems that are compatible with the unique characteristics of natural refrigerants and in compliance with regulations, without sacrificing efficiency".

The 'Natural Refrigerants' white paper is divided into five parts. The first provides a summary of the characteristics of natural refrigerants. The second examines the evolution of cycles with natural refrigerants and the possibilities that are currently available. The last three sections describe examples of modulating technologies and high-efficiency solutions. The goal is to have an overview of the technologies available to design high-efficiency systems using natural refrigerants.

The 'Natural Refrigerants' white paper is available free-of-charge at this link: **https://www.carel.com/-natural-refrigerants-white-paper**

GOVERNMENT AND INDUSTRY BACK NUCLEAR FOR GREEN HYDROGEN FUTURE

Government-Industry body endorses all reactor technologies to create emissions-free hydrogen

Nuclear power could produce one-third of the UK's clean hydrogen needs by 2050, according to the Hydrogen Roadmap agreed by the Nuclear Industry Council (NIC). The NIC, co-chaired by the Minister for Business, Energy and Clean Growth and the Chairman of the Nuclear Industry Association, sets strategic priorities for government-industry collaboration to promote nuclear power in the UK.

The NIC roadmap outlines how large-scale and small modular reactors (SMRs) can produce both the power and the heat necessary to produce emissions-free hydrogen, or "green hydrogen". Nuclear stations also provide a constant, reliable supply of power that allows electrolysers to operate more efficiently, cutting production costs. Existing large-scale reactors could produce green hydrogen today at scale through electrolysis, as could the next generation of gigawatt-scale reactors. SMRs, the first unit of which could be deployed within the next ten years, would unlock further possibilities for green hydrogen production near industrial clusters.

Advanced Modular Reactors (AMRs) under development offer one of the most promising innovations for green hydrogen production, since they will create temperatures high enough to split water without diverting electricity. The ability to generate both power and hydrogen would cut costs further, add flexibility, and allow co-location of reactors with industry to aid further decarbonisation. The UK Government has targeted an AMR demonstrator by the early 2030s.

The roadmap estimates that 12-13 GW of nuclear reactors of all types could use electrolysis, steam electrolysis using waste heat and thermochemical water splitting to produce 75 TWh of green hydrogen by 2050.

The Climate Change Committee estimates that the UK could need up to 225 TWh of hydrogen per year to hit its net zero target. Rapid deployment of clean alternatives will be required, as the vast majority of the UK's hydrogen is currently produced using fossil fuels.

The most common method, steam methane reformation, is low cost, but emits 10 kilograms of carbon dioxide for every one kilogram of hydrogen.

Since the main obstacle to green hydrogen is cost, the report identifies immediate steps to encourage nuclear-hydrogen development:

- Funding for electrolyser research and grants to zero-carbon generators of all kinds, including nuclear, to install electrolysers
- Ambitious carbon pricing to make green hydrogen more competitive
- Five-year R&D AMR funding settlements to support the government's target of a demonstrator by the early 2030s
- Inclusion of nuclear-produced hydrogen in the Net Zero Hydrogen Production Fund and the Renewable Fuels Transport Obligation
- Agreement of a new financing model to cut the cost of capital, for new nuclear projects, and thus the cost of electricity for hydrogen production

Commenting on the report launch, Tom Greatrex, Chief Executive of the Nuclear Industry Association, said:

"Nuclear power should be right at the heart of green hydrogen production, alongside renewable technology. Nuclear reactors offer the innovative solutions we need to decarbonise sectors beyond electricity as part of a robust net zero mix, starting today and going into the future. We are pleased the government has recognised that potential, and look forward to working with them and other partners to create a strong framework for green hydrogen production."

For further information, please contact: **Lincoln.hill@niauk.org 44 (0)7554 701533**

SSE TEAMS UP WITH GOLDSMITHS, UNIVERSITY OF LONDON TO SLASH CARBON EMISSIONS

Energy solutions provider, SSE Enterprise has signed a joint development agreement with Goldsmiths, University of London to design and deliver a low carbon campus infrastructure in pursuit of the university's ambitious net zero targets.

The project will see SSE Enterprise's distributed energy division look to consolidate all of Goldsmiths' significant energy consuming buildings onto a centralised campus-wide heat and power network. It is estimated that the first phase of the project will save the institution an average of 1,375 tonnes of CO_2 per year - the equivalent annual energy use of 144 homes.

The project has a core focus to reduce the carbon emissions associated with heat, as the university pledges to become completely carbon neutral by 2025. The system will heat the buildings using a low-carbon heat pump, removing the majority of gas consumption on site and saving up to 7,850 MWh of gas usage per year.

By integrating all power onto a single private network, the university will be able to use a much higher proportion of any on-site renewables, without the risk of exporting that electricity onto the grid. The new power system will expand on the university's existing solar resources, installing a further 400kW of solar PV into the new private network, which will then be used to supply the heat pump, further reducing carbon emissions on site.

Everton Williams, Deputy Director Estates at Goldsmiths, said: "We are excited to begin this journey with SSE Enterprise as they support us in our goals to deliver our PLAN25 strategy and achieve a completely carbon neutral campus by 2025. We have already made significant strides in this area with our investment in solar PV panels, but this new partnership will see us fully embracing a 'whole systems' approach by adopting and integrating other low-carbon technologies."

SSE Enterprise have already designed a concept for the system and are currently supporting Gold-smiths with applications for grant funding to enable the construction of the network and potentially the long-term operation of the system over a 25-year period. The 1MWth heat pump set to be installed will supply 6,500 MWh of low carbon heat to the site every year.

SSE has been confirmed as a major partner for this year's COP26 climate change conference in Glasgow in November. SSE Group aims to deliver a £7.5bn low carbon investment programme, developing some of the assets and infrastructure required for the UK to reach its target of net zero emissions by 2050.

https://www.sseenterprise.co.uk/

SURGE IN DEMAND FOR ETL'S NET ZERO CARBON DELIVERY FRAMEWORK RESULTS IN RACE TO ACCESS FUNDING

ETL's new Net Zero Carbon delivery procurement framework is now live and off to an impressive start with a surge in demand and supply. The Framework supports public sector bodies in their bid to reduce carbon emissions in line with legislative and sector led reduction targets.

Alexandra Hammond, Sustainability Director at ETL comments: "It's now a case of first in, best dressed. Uptake has been fast within the public sector and suppliers have been keen to back the framework.

"Its popularity sends a clear message that public sector organisations are taking their obligation to reach Net Zero seriously ahead of 2050. The Framework is free to access for the public sector, risk minimising and easy to access for all organisations, so those looking for a speedy and compliant route to market for low or zero carbon technology should really take advantage of this opportunity."

The following lots are available to access through the Framework:

1. All-encompassing technologies: A one-stop approach enabling clients to procure holistic low/zero carbon technology solutions. All technologies are available through this lot.
2. Heating and renewables: Access to a range of heating and/or renewable technologies, including: Solar PV and Solar thermal technology, Electric Vehicle charging points, air and ground source heat pump technology, power storage and voltage optimisation, low carbon heat networks and wind and biomass technology.
3. Metering: metering and submetering of electricity, gas, heat, water, air, steam, and onsite power generation. Intelligent building metering can also be included.
4. Building management systems: the design, supply, install, service and maintenance of BMS.

Available nationwide, the Framework provides a model for public sector bodies to follow when looking to implement low/zero carbon technologies. Organisations looking to form a robust partnership with a delivery partner to get projects over the line will find it invaluable as it provides a one stop solution with a list of pre-approved suppliers, ready to go terms and conditions plus project and specification support.

Focusing on technology, installation and delivery, it has been particularly popular with metering, lighting and integrated technology projects. In addition, it is open to private sector organisations looking to source pre-approved suppliers.

The Framework also assists public sector organisations to meet the criteria that is necessary to meet the terms for grant funding from the Department for Business, Energy, and Industrial Strategy (BEIS). This grant fund, now closed for applications, has funded hundreds of public sector organisations to deliver energy efficiency and heat decarbonisation projects, and the Net Zero Carbon Delivery Framework provides a mechanism for a quick and robust route to market.

Alexandra Hammond adds; "There are several alternative and flexible sources of funding available, such as loans offered by Salix. ETL can support with applications and support our clients throughout the process of funding, procurement and delivery."

ETL is an industry-leader in providing sustainability advice and procurement support. In 2018/19, ETL supported over 25 Trusts with NHS Energy Efficiency Fund (NEEF) applications and has recently supported 12 public sector organisations to successfully access grant funding through BEIS. For any other queries, please contact ETL's Sustainability Team at **sustainability@etl.co.uk**

LSBU estates team wins CIBSE Building Performance award

London South Bank University's (LSBU) Estates and Academic Environment Management team has won a prestigious CIBSE Building Performance award for efficient facilities management.

The team won their award for improving overall energy efficiency and sustainability across the University's estate. They employed energy efficient technologies to reduce overall electric, gas and water consumption.

Chris Barnes, Maintenance & Energy Manager for Estates & Academic Environment at LSBU, said: "LSBU's Estates team is very proud to have won this CIBSE award for efficient facilities management across the University's campus. It's recognition of the commitment we've given to upgrading our campus facilities and improving the performance of buildings, while reducing our impact on the environment.

"LSBU's commitment to renewable energy sources has resulted in a carbon emissions reduction of 85% since 2010."

The awards were presented at a virtual ceremony on Thursday 25 February. Find out more at: **www.CIBSE.org/BPA**

The CIBSE Building Performance Awards 2021, now in their 14th year, recognise the people, products and projects that demonstrate engineering excellence in the built environment. Fifty-five international projects were shortlisted for 14 awards, demonstrating global achievements in exceptional building performance within engineering.

A HEARTENING YEAR FOR THOSE TACKLING THE CLIMATE CRISIS

Vaughan Lindsay, CEO of ClimateCare asks: How does one even begin to talk about the year that was 2020?

It was a year full of uncertainly and one which presented challenges for so many people. Not only has the pandemic affected our health and personal lives, but it has also fundamentally challenged our political, social, and economic norms too. And indeed, it continues to do so too as we remain in lockdown and continue to see rates of infection increasing.

I think most notably though, the impact that the pandemic has had on how many of us think about tackling the big issues like climate change has been huge. It's because of this – and despite its challenges – that 2020 was actually quite an encouraging year for those of us involved in fighting the climate crisis.

INCREASING AMBITION FROM CORPORATES AND GOVERNMENTS ALIKE

For instance, 2020 saw record levels in corporate ambition on climate change, as companies looked to 'build back better' and place purpose at the heart of their business. Not only this, but we also witnessed corporates redoubling their efforts to tackle the climate crisis as well and saw many big brands sign up to the UN Race to Zero (in fact the figures doubled in 2020 which was fantastic).

Global politics also started to align too. You may have seen that the US made commitments to re-join the Paris Agreement, China made a commitment to Net Zero and the UK government also been pushing mandatory reporting of the business impacts of climate change by 2025. Even more recently, and towards the back end of 2020, the UK also increased its ambition to cut emissions by 68% by 2030 based on 1990 levels.

ACTION HIDING BEHIND PLANS

And certainly, for us here at ClimateCare, it's been ever so encouraging to see an ever-increasing number of corporates committing to achieve Net Zero status. Saying that, whilst it is great to see firms working hard to measure their footprint and set reduction

targets, many firms have admitted that they are waiting to get this right before they take action to reduce and compensate for their emissions. This attitude has been a concern for us over the past 12 months. Because, whilst these plans and long-term targets are truly commendable, they do little for the environmental damage that is being done right now; today and tomorrow. In fact, there is a risk of action hiding behind plans.

Many in the industry will be aware that we need to more than halve emissions by 2030. This is equivalent to reducing the current emissions of China, India, the EU and the US combined. This is, quite frankly, a mammoth task. Our advice therefore to clients over this past year has been to consider driving actions simultaneously and at pace, and then modifying and adjusting moving forward. In simple terms, there really hasn't been time, and indeed isn't time any longer, to take things one step at a time. We need to take action right away.

VALIDATION AND CONSENSUS

Saying that though, there is a great deal of hope as we move through 2021. Not least because we are seeing more and more experienced professionals and organisations (such as WWF, SBTi, Oxford University, UN and the Taskforce) all agreeing with the rationale that we cannot reach Net Zero without including external emission reductions and offsetting emissions. This acknowledgement by experts across the board of the vital role of offsetting, is of course, just the beginning and we are likely to see this filter down more into policy too.

THE TASKFORCE

Perhaps another key event of 2020, was the Taskforce on scaling the voluntary carbon markets launching its consultation paper in November 2020. This paper aimed to identify ways to scale the voluntary carbon markets by up to 160 times to help tackle climate change. It was great to see the experts agreeing with our long-held rationale and acknowledging that taking responsibility for today's emissions through carbon offsetting is essential if we are to meet our Net Zero targets and prevent catastrophic climate change.

As a project developer ourselves here at ClimateCare, we will be keen to see how the Taskforce can help to unlock new demand and finance for project development in 2021, helping us deliver more emission reductions from high quality projects. As always, the devil will be in the detail and more will play out on this as we move through the year. Certainly though, as this and other interest in the voluntary carbon market develops, our primary concern and focus remains on continuing to scale our activity to finance, manage and develop robust and effective carbon reduction projects that both cut carbon and improve lives. This, of course, has been a major focus throughout 2020, despite the pandemic, and will continue to be this year as we move through 2021 too.

TURNING PLANS INTO ACTION

As we look ahead in this year, we should also see more of these ambitious plans and statements put into practice, as companies continue to turn their plans (and pledges) into action. Ultimately the environment for ambitious action has never been better, be it via the UK Government's 10-point green plan or the recommendation to help scale the voluntary carbon markets and this certainly provides an exciting outlook for next year.

This year will also bring about the postponed COP26, which provides a real opportunity to clarify how to implement the Paris agreement and bolster international carbon markets. The US re-joining the Paris agreement adds further weight to this and hopefully we can help forge true international cooperation moving forward too. These will of course be great accelerators for the industry overall, however as previously mentioned, the key here is for corporates to act now rather than waiting on policy decisions because time is of the essence.

INCREASING ACTION

We believe that the issue of climate change is now central to nearly all forward-thinking corporates and this year will present one of the most encouraging environments for them to act on this. Never before has it been so vital to ensure that the role of the voluntary carbon market delivers real additional emission reductions on the ground and at scale.

With this in mind, let's make 2021 the year of increasing action to build on last year's increasing ambition. Because the climate will not respond to targets, it will only respond to carbon cuts. It is action that really counts this year. **www.climatecare.org**

GETTING TO CLIMATE ACTION

How can we cut through the noise around climate change? Manish Jain, Co-Founder of Complexity University

Climate change has been a topic of discussion in our society for decades, but now that information can now be disseminated with a tap of a screen, the discussion and contradicting opinions around the topic can quickly become overwhelming.

Fifty percent of all historic emissions have occurred since 1992 – when the world came together to form the UNFCCC at the Rio Earth Summit. Climate campaigners and scientists have for years voiced their concerns and issued warnings about approaching tipping points as deadlines for action fly by. Meanwhile, a vocal minority of politicians, scientists and industry leaders denounce the threat of climate change altogether.

With all the noise and contradictory opinions circulating around the issue of climate change, it is hard to understand how to approach the challenge. So where do we truly stand in the fight against climate change – and can anything really be done about it?

Fortunately, the answer is yes. Despite continuing debate climate scientists have long been clear about what needs to happen if we want to avoid climate change. With emissions rising steadily and showing no sign of peaking, the scientific community is now telling us that pathways to limit global warming are getting significantly harder but are still possible. If we hope to stay within the carbon budget, we need a net reduction of emissions of at least 1 billion tonnes (one gigatonne) per year for the next 30 to 50 years. More critically, if emissions don't peak and decline within the next decade, we will overshoot safe targets, heading for 3 degree terrain, risking the loss of many hundreds of millions of people. In reality we have months and not years.

Presently, the Paris Agreement represents our best strategy to curb emissions and limit global warming. However, the current level of political

commitments under the Agreement do not get us to safety. There are a range of obstacles which prevent us from making enough progress to avert catastrophic environmental and ecological damage.

Numerous climate change conventions, conferences and talks are held around the world each year. Unfortunately, the talk is not resulting in enough action to get us to these targets at the pace and scale that science dictates. It seems we know what needs to be done, but struggle when it comes to building and executing an effective approach.

Given that our current efforts are falling short, the need for new strategic responses is now clear. The complexity of a challenge like the climate crisis naturally leads to extended debate and a scattered approach to developing solutions. While it is of course important to engage in thought-provoking discussion to entertain different ways of tackling such complex issues, it is too easy to get sucked into paralysis by analysis.

What we know for sure is that the way we have been doing it so far has not worked. Emissions continue to rise, meaning we have a failure rate of 100% at tackling the climate crisis with our current approach. A classic error continues to be made when attempting to address the climate crisis, as governments, organisations and companies are framing the issue as a simple technical problem of reducing emissions, as opposed to a complex adaptive challenge.

When we come across a challenge or crisis, often our first response is to call a meeting and make a plan. We talk about what we will do, we hire other people to talk with us about what we should do, and we spend time and money we can't afford planning what we will do. Then we try to do it, and often it fails or certainly does not turn out as our hefty report suggests it will. The worst part comes when we are so invested in this plan that we refuse to acknowledge its shortcomings or failure, and continue to plough resources into an ineffective solution to the problem.

This kind of strategic planning approach arose as a way of tackling technical challenges, like building roads. It's a little like throwing a ball, we can predict, the arc it will take and how it will behave.

Contrast this with throwing a live pigeon. We cannot know with any certainty what path the pigeon will take or how it will behave. The path the pigeon follows is emergent. Tackling complex challenges requires a different set of skills to tackling complex challenges.

Our world is becoming increasingly complex. The amount of data we are producing is multiplying at a far greater rate than we can process and understand it. We cannot know everything about a situation or challenge, and as soon as we think we do – it has all changed again. To help us navigate an increasingly complex world, we need leaders who understand the nature of complex challenges, and recognise that we need to try a different approach than the ones we are familiar with taking.

With this in mind, new organisations such as Complexity University are working to cut through the noise that has built up around challenges like climate change. We are bypassing endless debate about what needs to be done, and taking a hands on, practice-based approach to doing it.

Teams and individuals are increasingly recognising the need to develop an understanding of the nature of complexity and complex challenges, and to practice new approaches that are fit for the purpose of addressing them.

As a strategic response to the climate crisis, we cannot simply focus on individual behaviour change, but more so on collective action. We see the real innovation as being the team, and as a result, it is essential that more teams within companies and organisations are practiced in tackling complex problems, learning to 'fail fast', develop dynamic strategies, and successfully execute them.

Complexity University's approach to helping teams rapidly develop a capacity for tackling complex problems is to bring together teams and put them straight to work on prototyping and delivering emissions reduction interventions in their local area. In a matter of weeks, companies that embark on a Complexity University course are making tangible impact, getting live feedback on their approach and learning how to do better by problem solving on the job, whilst simultaneously receiving valuable guidance and insight from experts with decades of experience in the field of tackling complex challenges like the climate crisis.

By getting employees and team leaders out from behind the desk and into the field, these teams quickly become adept at 'failing fast' to reach a more effective solution with minimal resource. They learn to prototype and iterate - testing out multiple responses at pace and processing live feedback from the field. When it comes to taking effective strategic action in the face of a challenge like the climate crisis, developing the capacities within our teams to navigate complexity is key to success of any initiative – before we even out pen to paper. **https://complexity.university/**

DON'T WASTE YOUR ENERGY. MEASURE IT!

Optimization of thermal energy from heat delivery between central heating plants to real estate end users or heat transfer flows in industrial processes: controlling and balancing the flow of energy is of utmost importance for cost conscious users.

But you can't identify or manage energy efficiency if you don't effectively measure energy usage in the first place.

To record thermal energy flows, which are based on the transport of liquids or gases in pipelines, the ideal measurement solution is: FLUXUS®. The clamp-on ultrasonic systems record thermal energy flows from outside the pipe, without the pipe having to be tapped or modified in any way. Portable FLUXUS® meters have long been part of the measurement tool kit of energy managers and energy consultants, but our fixed meters also offer quickly installed solutions at optimum cost – without any process outages for commissioning.

The introduction of an energy management system according to ISO 50001, and accompanying schemes such as ESOS, the Carbon Reporting scheme, Carbon Net Zero 2030, 2050, etc., increases the demand for permanently available and comparable data. Non-invasive measurement with FLUXUS® provides easy and permanent recording of consumption. Its ultra-wide measuring turndown is a particular advantage, revealing energy consumption at even the lowest rates, unlike many conventional inline and mechanical meters. As a result, even the lowest consumption is reliably and accurately recorded. Since there is no need to modify or penetrate the pipe, system operators save not only expensive installation work, but above all interruptions to operation or supply.

UK buildings covering commercial and public services, along with the manufacturing sector, are responsible for 93,000 GWh of the total final UK energy consumption; this is 30 per cent of UK consumption. And space heating of buildings is the most dominant energy usage at 49% of the non-domestic building stock energy consumption. When looking at non-electrical energy, space heating rises to 78%, and hot water 8% of non-electrical energy consumption. (Source: Dept for Business, Energy & Industrial Strategy; Business Energy Statistical Summary, July 2018).

Thermal energy use is one of the highest building operating costs and there is a need to manage facilities more effectively to control and reduce energy consumption. Metering allows managers to know how their buildings are performing and what is running efficiently. If we look at a typical air-conditioned prestige head-office or administrative centre 4,000m² to 20,000m², as much as 50% of the energy consumption could be accountable from HVAC & Computer room cooling alone.

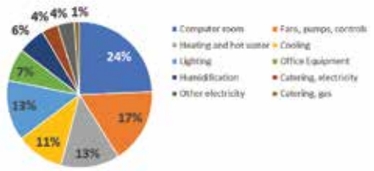


Fig. 1. Typical energy split of 4,000m² to 20,000m² prestige head-office or administrative centre

So, even small gains in efficient use of energy can have significant positive effects on both annual energy bills and carbon reduction. The opportunity for significant energy reduction exists at all major manufacturing, entertainment, municipal or administrative centres, such as:

- Local Government Offices
- Major corporate offices and Data Centres
- Hospitals & University Campuses
- Major manufacturing sites
- Airport Terminal Buildings
- Entertainment stadia and Expo halls
- Warehouses and significant supermarkets / wholesalers
- Refrigeration plants – clamp-on ammonia gas metering

Metering alone will not save energy, but allows comparative data before and after energy improvement initiatives, such as:

- Boiler, HVAC or CHP efficient delta T achievement

Fig. 2. Typical data centre installation showing clamp-on flow transducers and PT100 temperature sensors prior to reinsulating over the pipes.

Fig. 3. Clamp-on metering at a major UK airport

- Avoidance of excessive water flows
- Reduction in compressed air operating pressures and leaks
- Reduction in steam losses, e.g. via blocked open steam traps, etc

FLEXIM's FLUXUS Energy Meters provide the following key benefits:

- Ultrasonic measurement of:
  - Thermal energy
  - Compressed air
  - Steam flow metering up to 400°C
- Clamp-on instant feedback measurement for fine tuning energy efficiency
- Zero outages for installation
- Easy and quick installation –no leaks, no pressure drop, no contamination
- Calibrated, certified and traceable high-accuracy measurement with zero drift
- Extremely high turndown range, captures even the lowest energy flows
- Fixed installations or portable survey instruments
- Practically maintenance-free – no parts in contact with flowing medium

Fig. 4. Clamp-on steam measurement at major chemical manufacturing plant

FLEXIM's FLUXUS Energy Meters are the ideal solution for temporary or permanent submetering, energy audits, plant optimisation tasks and the verification of existing meters in the industrial sector.

For further information on how FLEXIM can deliver metering without supply interruption contact: sales@flexim.co.uk | 01606 781 420 | www.flexim.co.uk

NEW MICRONICS PORTAFLOW RANGE

A New Micronics, PORTAFLOW range with the latest ultrasonic flow measurement technology and Hydronic Liquid Flow Energy Measurement and a comprehensive data logging facility for the PF333 version.

Building on its considerable experience and success with the former PF330 and 220 range Micronics has developed a New range of portable, clamp-on, ultrasonic flow instruments, incorporating the latest technology whilst still retaining the key feature of simple operation, to provide quick, out of the box results!

The PORTAFLOW PF333 offers the user quick and accurate flow and energy measurement and with its easy to follow menu and simple set up, results can be achieved within minutes of opening the case! The range continues to bring simplicity to the non-invasive measurement of liquid flow and now with the addition of hydronic liquid flow energy measurement for hot and chilled water applications. The PF333 is a portable, simple to use ultrasonic clamp-on flow and thermal, heat/energy meter, that uses the latest cross correlation ultrasound flow measurement system to measure flow rate and clamp-on PT100 temperature sensors to measure flow and return temperatures. The PF333 measures energy rate and totalised energy and the Hydronic thermal energy, heat or cooling load is calculated from a combination of the flow rate and the flow and return temperature difference or delta T to comply with EN1434 section 6.

The integral Data Logging has a capacity of 100,000,000 data points with 12 named sites and can be downloaded via USB to CSV files and export to Excel for further analysis.

Compact, rugged and reliable, the PORTAFLOW range has been designed to provide sustained performance in industrial environments with the New cross correlation flow measurement

system providing improved accuracy for flow and measurement audits of old and often challenging pipe-work in existing installations.

For further information on this product or the Micronics range call Micronics on **+44(0)1628 810456**, or visit **www.micronicsflowmeters.com**.

QED ENVIRONMENTAL SYSTEMS LAUNCH PIONEERING GEOTECH SEM5000™ PORTABLE SURFACE EMISSIONS MONITOR

Leading manufacturer of environmental monitoring and remediation equipment, QED Environmental Systems, is officially announcing the launch of its much anticipated SEM5000™ into its Geotech product range.

The SEM5000™ is a portable methane detector specially designed for landfill surface emissions monitoring, reporting and detecting potential leaks at wellheads and surface penetrations.

The unique aspect of the product is its patented laser technology, which enables the device to detect even the smallest methane emissions – ranging from 0.5ppm to 100% concentration – in less than two seconds. Its state-of-the-art technology ensures the user acquires the highest quality readings that are a true representation of the air composition.

Once calibrated, the SEM5000™ can extract a sample, drawn up through an extendable probe across a laser path. The laser technology allows the device to scan the sample spectrum and identify methane (CH4) only, negating any cross gas effects from other close hydrocarbons.

Data readings including date, time, GPS coordinates and concentration value, which can then be saved internally and transferred onto a computer using the SEMSoft™ software – QED's proprietary software offering multiple reporting functions. The SEM5000™ is equipped with a GPS antenna and Bluetooth that makes this transfer easy and efficient. The device can also hold up to 480 hours' worth of scan data allowing the user to look back at readings and make a more informed decision on next steps.

The hot swap battery included in the SEM5000™ can save time and enables the user to extend their surveying hours in the field. The product is also ATEX Zone 1 certified and supports surface emissions regulations.

Paul Gooch, Global Sales and Marketing Director from QED said: "We are very excited to officially launch the SEM5000™ into our Geotech product portfolio. We announced the plans for the new product last year and we're looking forward to beginning production.

It offers users a safe, reliable and technologically advanced method of monitoring surface emissions. We're confident this product significantly advances our product and service offering and that our global customers will benefit from it."

For more information on QED's range of products, please visit the new QED website or call **+44 (0)333 800 0088** or contact **sales@qedenv.co.uk**

THE WIRING REGS: DO YOUR INSTALLATIONS REALLY COMPLY?

If you're responsible for an electrical installation in the UK, it will almost certainly need to meet the requirements of the IET Wiring Regulations (BS 7671). Very likely it will have been certified as doing so, but can you be sure? Julian Grant of Chauvin Arnoux raises some thought-provoking issues.

From the very first edition, which was published as long ago as 1882, the IET Wiring Regulations have been formulated as an aid to ensuring that electrical installations are safe and pose minimal risk to users. An important factor is and has always been ensuring that conductors and equipment are properly sized for the currents they are required to handle. And final confirmation that this requirement is being met, especially after an installation has been modified or extended, is to measure the current and confirm that this is within the permissible ratings of the cables and equipment.

Making measurements under operating conditions is without doubt an excellent way of assessing the performance and safety of an electrical installation – but there's a trap for the unwary. This statement is only true if the measurements are accurate and reliable. But why wouldn't they be? Most current measurements are likely to be made with a fairly modern clampmeter and, provided that this was procured from a reputable manufacturer and has been calibrated at appropriate intervals, surely it can be relied on to give accurate results?

The answer is yes – and no! That clampmeter may well give accurate results when used in the conditions for which it was designed, but those conditions may not reflect what's going on in many of today's electrical installations. Let's cut to the chase. There are two factors that may affect the accuracy of current measurements made with a typical clampmeter, including some that are still on the market today. These issues are harmonics and DC currents.

A few years ago, neither of these was a particular problem, especially in domestic installations, but that situation has changed. Factories, offices, shops and even our homes are now full of non-linear loads like LED lighting systems, televisions, computers, audio equipment, vacuum cleaners, air conditioning systems, washing machines and many others. All of these loads have the potential to produce harmonics so it's no longer safe to assume that harmonics are an issue that's confined to large industrial installations. Some of these types of load and also some renewable energy systems, such as solar PV installations, can also inject DC currents into the supply and, once again, this can happen in domestic as well as commercial and industrial environments.

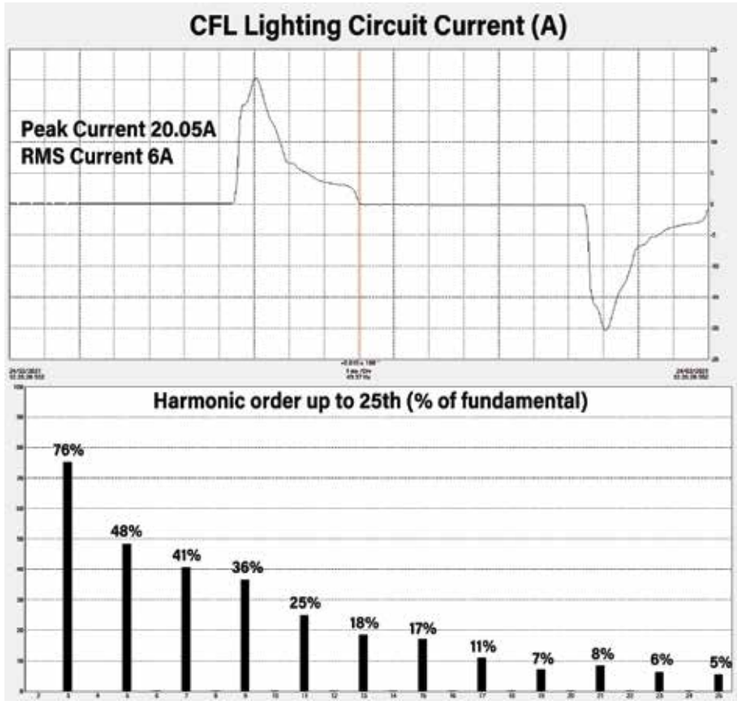


Figure 1

All of this is bad news if you're trying to make accurate current measurements using a typical clampmeter. Many of these are designed in such a way that they read correctly only when the current being measured has a pure sinusoidal waveform or something very close to it. With instruments of this type, the waveform distortions introduced by harmonics will seriously degrade measurement accuracy.

And there's another issue: frequency response. A lot of clampmeters have a frequency response that extends no further than around 500 Hz, so they will measure currents at higher frequencies inaccurately if, indeed, they measure them at all. That may not sound too bad – after all 500 Hz is the tenth harmonic on a 50 Hz supply system – but experience shows that today's non-linear loads frequently generate harmonics well beyond this – 11th, 13th, 15th and even higher harmonics are by no means unusual.

This deficiency is significant because the heating effect of harmonic currents can often be higher than that of the fundamental current, and in some equipment is proportional to the square of the harmonic order. In the example shown of a CFL lighting circuit (Figure 1) there are significant quantities of odd harmonics, relative to the fundamental current. In this case a "standard" clampmeter from a leading brand under reported the RMS current by 50% – displaying a reading of 2.9A versus the actual 6A RMS present in the circuit.

The final problem with traditional clampmeters is not connected with high frequencies, but with DC. This is because many of them simply don't respond to DC, so that if there's a DC component in the current be measured, it will be ignored.

In summary, if you're using a typical clampmeter to check an electrical installation, the current measurements it produces may well be inaccurate, for the reasons we've discussed. And if your current measurements are inaccurate, how can you be sure that your installation satisfies the requirements of the IET Wiring Regulations? Fortunately, there is a simple solution to this conundrum, and that's to acquire one of the new generations of clampmeters which has been designed from the ground up to take into account the conditions likely to be found in today's electrical installations.

Excellent examples are the F407 and F607 clampmeters from Chauvin Arnoux. These measure currents up to and including the 25th harmonic (1250 Hz), and they also feature true RMS measurement, which means that the accuracy of the results they deliver does not depend on the current or voltage being measured having a sinusoidal waveform. They also include any DC component in current measurement results.

The F407 and F607 will, therefore, provide complete certainty that current measurements made with them reflect the true operating conditions of the installation. But that's not all they can do. These versatile instruments also measure true inrush current for motors and inductive loads, as well as power factor and active, reactive and apparent power. Investing in an instrument of this type is money well spent because with it you not only have a valuable tool for installation testing and diagnostics,

but you can also use the results it produces for reassurance that your electrical installations really do meet the requirements of both the IET Wiring Regulations and Electricity at Work Regulations. **www.chauvin-arnoux.co.uk**

PUMP-UP THE CARBON SAVINGS FROM HEAT

Heat pumps provide a proven and effective solution to the complex challenge of decarbonising heat, says Luke Bannar-Martin of Centrica Business Solutions. In this article he explains how organisations can take a giant step towards delivering on their net zero ambitions.

Heat pumps can provide heating from 35°C to 120°C and do not emit any direct emissions, significantly reducing or replacing an organisation's need to burn fossil fuels on-site. Relative to a natural gas fuelled boiler, they can reduce overall greenhouse gas emissions by as much as 80%.

There is potential to couple heat pumps with other on-site generation technologies to improve cost and carbon performance, e.g. in combination with solar PV, heat pumps become carbon neutral, whereas adding CHP into the mix can enhance heat generation and accelerate cost returns.

FINANCIAL SUPPORT FOR HEAT PUMPS

Technology costs are reducing, making heat pumps more cost-effective. Importantly, several UK Government funded green stimulus grants are available to support organisations in switching to sustainable heat generation, such as the Public Sector Decarbonisation Scheme, and the Industrial Energy Transformation Fund (IETF).

As approved suppliers to both government funding schemes, Centrica Business Solutions is helping public bodies and industrial businesses to deliver heat pump projects. We can also provide project finance to spread out the cost of installing a heat pump.

As a proven, scalable technology, that's rapid to deploy, it comes as no surprise that the UK government is targeting a massive 20-fold rise in electric heat pump installations - from just 30,000 today to 600,000 by 2028.

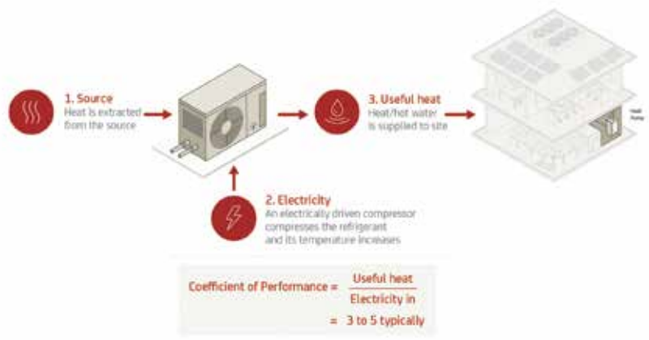
In its recent Energy White Paper, the Government signalled its commitment to gradually removing and replacing gas boilers with cleaner alternatives. It is hoped that by the mid-2030s at the latest, all newly installed heating systems will be low carbon, such as heat pumps.

Another driver is the proposed update to SAP (SAP10.1), which will reduce the carbon factor of electricity by 75%. This change will likely take effect when the Part L planning document is updated this year. As the new build market segment moves away from natural gas and towards electrically driven heating solutions, heat pumps offer the most efficient way to electrify heat.

Despite being a proven and mature technology, heat pumps currently only satisfy around 5% of global heat demand from buildings, but the market is growing rapidly. The International Energy Agency forecasts that, in the absence of a large build out of hydrogen infrastructure, over 50% of heating in Europe could be supplied by heat pumps in 2050.

HOW DO HEAT PUMPS WORK?

Heat pumps extract natural warmth from the ground, air, water, or other source (even in winter) and use it to provide heat for space heating, hot water and certain industrial processes. This operates similar to an air-conditioning unit running in reverse. This process will typically deliver between 3 and 5 units of heat for every 1 unit of electricity it uses. When configured to provide chilled water to supplement cooling, they can operate at a ratio of 5-9 units of heat /cooling per 1 unit of electricity. See Figure 1.



HOW TO CHOOSE THE RIGHT HEAT PUMP?

There are a range of heat pump options, so which one is right for your organisation? How do you choose between an air, ground, water or waste-source pump? What factors should you consider in the selection and feasibility process?

1. AIR-SOURCE HEAT PUMPS

Capable of supplying hot water to any site under most conditions, this option is the least intrusive and most capital cost-effective option. Normally fitted to the side or on the roof of a building, the heat pump draws air from outside and transfers the heat by means of compression. By utilising a waste heat interface, the heat pump can recover waste heat from chillers or waste water, thereby improving the performance and financials.

ADVANTAGES

- Lowest Capex and maintenance cost option; currently eligible for government grants
- Simple, scalable and straightforward installation
- Possible to increase efficiency by utilising waste heat
- Potential to integrate heat storage to load shift and enable the possibility to generate revenue from Demand Side Response services

CONSIDERATION

- Efficiency is highly dependent on ambient conditions
- Reduced thermal energy management
- Low efficiency of the system can impact business case
- Lowest lifetime carbon savings of all heat pump source options

2. GROUND-SOURCE HEAT PUMPS

Heat from the sun as well as from the core of the Earth keeps the ground at a reasonably consistent temperature all year. Ground-source Heat Pumps can use thermal boreholes as a heat source for a year-round reliable and predictable source of stable temperature heat. The heat recovery loop can be used to store heat in the ground during the hotter months for drawing off during the cooling months.

ADVANTAGES

- Greatly increased seasonal efficiency and performance over air-source
- Larger reduction in associated carbon emissions
- Ground loop system enables seasonal thermal balancing
- Improved cash flow and eligible for green stimulus grants

CONSIDERATION

- Increased Capex, relative to an air source system
- Process to drill boreholes can be disruptive
- Retrofit projects can be challenging due to space required
- More complex to retrofit on an existing site than air-source

3. WATER-SOURCE

A similar system to a ground-source, they extract heat from a body of water and convert it into useful heat using submerged pipes containing a working fluid to absorb heat. If available to your organisation, an open body of water (e.g. reservoir, lake, sea), a flowing body of water (e.g. river, wastewater) or underground water (e.g. aquifer) source, can provide more an even more advanced heating solution.

ADVANTAGES

- Seasonal performance similar to, or better than, ground-source
- Larger reduction in associated carbon emissions
- Capex and land requirement lower than ground source
- Can use water source provide 'free cooling'

CONSIDERATION

- There is no 'one-size-fits-all' with water source systems
- Unlike ground source systems, thermal energy management may not be possible
- If needed, obtaining abstraction licence can be a lengthy and complex process

SPECIALIST HEAT PUMP SUPPORT

As heat pump specialists, Centrica Business Solutions provides a complete design, installation, operation and maintenance service – with flexible financing to ensure that projects can be kept off balance sheet, if necessary.

Further information:
www.centricabusinesssolutions.com

THREE MAJOR TRENDS CHARACTERIZING GLOBAL HEAT PUMP MARKET OUTLOOK BETWEEN 2020-2026

The global heat pump market is anticipated to observe heavy growth owing to rising environmental concerns across the globe. In addition, the implementation of heating technologies that are energy-efficient is further likely to shape the market growth over the coming years.

Apart from environmental concerns, growing installation of reliable and cost-effective heating technologies throughout the commercial and residential sectors is slated to be the major factor augmenting the overall market demand.

Additionally, increasing consumer awareness around energy optimization coupled with growing urbanization across the globe will further proliferate the industry share through 2026. Favorable initiatives introduced by the government along with decreasing component prices is likely to create new business chances for market players, thereby augmenting the overall industry share.

According to a research report by Global Market Insights, Inc., global heat pump market is projected to exceed 16 million units by 2026.

Below are the top trends that are expected to help the industry reach the aforementioned level of growth.

FAVORABLE REGULATORY INITIATIVES:

The heat pump market is slated to observe considerable growth owing to supportive regulatory incentives and schemes globally. In addition, expanding efforts to reduce carbon footprints as well as growing energy prices should majorly outline the market growth through 2026.

Citing an instance, as per the NYSERDA (New York State Energy Research and Development Authority), the new incentive initiated for the whole house system having $1,000 per ton cooling capacity, single-family home is expected to get about $3,000 to $4,000 as financial assistance.

WSHP TO GAIN MAJOR TRACTION:

The water source heat pump (WSHP) product segment is projected to observe heavy growth owing to its advantages over ground source or air source heat pumps. In addition, strict regulatory norms to tackle greenhouse gases are likely to outline the water source heat pumps growth through 2026. These pumps use very less energy as compared to other sources.

The WSHP need a water source, including rivers and lakes, that are heated by the sun with some support from a small amount of electricity. WSHP boast of a high level of efficiency having a CoP of approximately five, which means each unit of electricity gives five units of heat.

Furthermore, WSHP units don't need any deep excavations which are required in ground source heat pumps. Longer life and quieter operations are better offered by WSHP units, which should augment their growth in the future.

MOUNTING DEPLOYMENT ACROSS EUROPE:

The growing need for heating appliances in the residential sector is anticipated to augment the Europe heat pump market share. Extreme climatic conditions in the region have led to the growth in the sales of heating pumps. The market is projected to observe growth of more than 5% through 2026. Additionally, heat pumps help in reduction of carbon footprints, which might add up to their market demand in the future.

Increasing deployment in the residential sector and stringent government norms to curb carbon emission are some of the major factors indicating a definitive growth opportunity for heat pump market players. The competitive landscape of heat pump market is inclusive of players such as Danfoss, Glen Dimplex, Bosch Thermotechnology, Viessmann, Trane, and Valliant Group among others. **www.gminsights.com**

A HIDDEN BENEFIT OF HEATING CONTROL DURING COVID

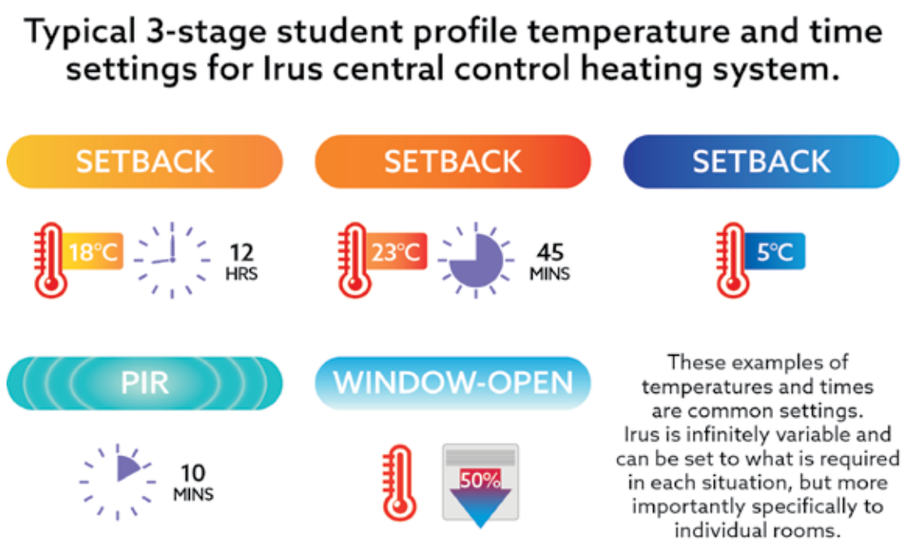
With more than 30,000 students the University of the West of England (UWE) Bristol is the largest University in the region.

'Strategy 2030 - Transforming Futures' announces their ambition to be carbon neutral with net-zero emissions of greenhouse gases by 2030 along with achieving ISO14001 to set clear targets to reduce water and energy use.

Kirsti Norris, Energy Manager, heads the team that implements projects to achieve these goals. Melissa Clarke is Energy Projects Officer and ensures the efficient delivery of projects.

The Student Village built in 2006, on Frenchay Campus, is home to 2000 students. The original heating system was becoming tired and inefficient to manage. Each room needed to be visited to programme the control with a handset, and the heater panels needed replacing. As Kirsti explains, "As panels failed, there was a risk of them getting replaced on an ad hoc basis with integrated control heaters, but we had always wanted a better way of controlling the heating and, having to enter students' rooms, even before Covid, was not great. We had a hotch-potch of settings in rooms all over the place and no way to re-set them all at once."

Kirsti attended the AUE conference in 2019 and stepped onto the Prefect Controls stand. Although aware of their Irus system, she was pleasantly surprised by the scope of features. Melissa explains, "When we saw the Prefect offering, we thought Fab! This is what we need, more control, shorter running times, reduced energy consumption…"



Irus is a centrally controlled system, accessed via an internet portal. It enables Energy Managers to set temperatures/ times for the 3-stage student profile. Setback mode is the default setting (typically 18°C), but if the student requires more heat, they simply tap the 'up' button triggering Boost mode (commonly 23°C). Boost runs for a pre-set time (45 minutes) before reverting to Setback. If the student leaves the room during Boost, the PIR detects their absence and reverts to Setback, likewise if windows are opened heat input is reduced by 50%. If rooms are vacant for longer periods (typically 12 hours), Frost mode is activated, maintaining at least 5°C. Irus also monitors humidity, light and decibel levels. Melissa continues, "the accommodation team are very keen on the decibel monitoring feature. When they receive antisocial noise complaints, they will be able to determine exactly when and where the noise occurred".

Being a centrally controlled internet system, universal adjustments can be made from anywhere – as Melissa explains, "We are really keen on a reset button for the end of the year so that when students return to site in September all rooms will be back to the standard profile and we won't have various different settings throughout blocks." She continues, "The main drivers for considering Irus were energy, carbon, and of course cost reduction."

Kirsti contacted Prefect to discuss the project. A survey was commissioned, savings calculated, and quotations submitted.

Kirsti had to convince colleagues that disruption during the installation would be minimal. "The biggest fear we had for this whole project was from the accommodation team. Considering we were planning the install around conference bookings they were really anxious about disruptions to residents. No matter how good the product is, it was the installation upset that could have blown the whole thing. To have the reassurances we received from Bangor and Bristol universities, who have worked with Prefect before, really helped to get the accommodation team on board. That good reputation went beyond the product."

> "If we have students isolating and they have a problem with their heating, we can deal with it without even entering the building, which is an added bonus in these Covid-times"

Will Mills is the project manager at Prefect, "It all happened very quickly, and everything was slotting nicely into place. We were just about to embark on our biggest Irus project – then Covid struck!"

Melissa continues, "The project stalled in February (2020) and of course budgets were frozen. Very frustrating because we saw all these buildings, empty! Usually in the summer we have conferences and we felt this was a real missed opportunity to get on with the job – the quicker we make the projects happen, the quicker we make the financial savings. We are conservatively estimating saving 20-30% – that's over £75K per year!"

Will continues, "After lockdown and a return to the office Melissa contacted us, 'We have the money, and we want to try and do it this summer!' she said. So, we rebooted the project and had 6 weeks to install as many rooms as possible. We managed 75%, the rest will be completed during 2021."

So, what was the Covid-effect? Melissa explains, "Covid hasn't really affected the installation process too much, we have been working in empty blocks, but had to make a lot of considerations for safe-working. Everything that is being done just requires an extra line of thought."

One hidden benefit of the system that Kirsti has identified, was never even considered in her business case, "If we have students isolating and they have a problem with their heating we can deal with it without even entering the building, which is an added bonus in these Covid-times."

www.prefectcontrols.com

THERE IS NO PLAN(ET) 'B'... OR 'C' ...

CO-OPERATION AND UNITY OF ACTION NEEDED TO ACHIEVE DECARBONISATION GOAL

De-carbonisation of our entire societal structure can be achieved through close co-operation and unity of effort by all interested parties of the global energy industry in order to achieve the goal in the shortest possible timeframe.

Fossil based fuels have been conclusively proven too damaging to the global environment to continue any possible justification of their use, so there is a pressing need to quickly adopt alternative energy sources that assist in providing clean and continuous power to all urban and rural areas.

"In the UK we have welcomed the Government's initiatives to change the energy consumption landscape. However, I believe that the industry, in total, can look to combine all its efforts and knowledge to promote far better awareness of energy efficiency as this is a vital part of the transition to the range of alternatives fuels and appliances for domestic heating and hot water – plus the needs of industry and commerce," says Rinnai UK managing director, Tony Gittings.

"A collective realization is required by the public and industry alike, to the idea that not only is an energy transition imminent, but it is also urgently required. This country's housing stock is over 24 million units and the UK had a total energy consumption increase by 1.1 per cent in 2018 to reach 143 million tonnes of oil equivalent (mtoe), the highest level since 2013.

"We believe that Hydrogen is the main contender for mass market consumption. But there are several primary fuels which can also do the job, especially the natural powers of solar, wind and wave. Hydrogen is set to be a key player in the energy sector and has widespread governmental, scientific and industry support.

"Hydrogen can be transported through infrastructure already in place, saving billions in revenue and years of time in design and manual labour. Replacing toxic fossil fuels with cleaner, friendlier, Hydrogen ensures harmful emissions will be nullified. Hydrogen is going to play a crucial role in domestic and commercial life at some time in the near future.

"We are aware of reports which state that existing gas appliances can be converted from natural gas to Hydrogen in the same amount of time as a standard annual service of a domestic boiler. "

'Hydrogen in the domestic setting is seeing up to £500 million government funding on trials for homes using hydrogen, starting with a Hydrogen Neighbourhood in 2023, moving to a Hydrogen Village by 2025, with an aim for a Hydrogen Town – equivalent to tens of thousands of homes – before the end of the decade. Of this funding, £240 million will be for hydrogen production facilities.

Drawing attention to these matters: a Rinnai web information hub has been created to provide valuable information on the impact of a Hydrogen conversion as well as its benefits and potential future uses.

The Rinnai Hydrogen Information Hub will be aimed at building services consultants, engineers, specifiers and end-users. It will be online and include webinars plus all requested digital or onsite meetings.

'Rinnai welcomes the UK government's recent 'Ten Point Plan', the drive to decarbonisation using Hydrogen. Heating emissions are a huge issue and Hydrogen is one answer to the Energy Trilemma, as we have stated several times,' says Rinnai's Chris Goggin who is also a board member of the ICOM Energy Association.

Rinnai is a true global player in the manufacture of domestic and commercial appliances and operates in almost 50 countries. Rinnai is the world's leading manufacturer of continuous flow hot water systems - it makes and sells 2

million units each year. The range of units can be manifolded to supply, limitless hot water to any site of any size. This means fast, efficient, temperature-controlled water on demand at the point of delivery – kitchens, showers, accommodation blocks, bathrooms, washrooms - and less space spent on plant rooms with no or little maintenance as all units are proven to be robust with a long, long working life. **www.rinnaiuk.com**

WHAT IS HOLDING YOU BACK FROM GOING SOLAR, DESPITE THE IMMEDIATE SAVINGS YOU CAN ACHIEVE?

The dilemma is real. You want to contribute to a cleaner, greener way of working, after all we are waist-deep in the middle of a climate crisis and sustainability is up there on the list of long-term goals for your organisation. Renewable energy is something you have potentially toyed with before, perhaps solar energy because you have the roof space required and it's fairly easy to install. But then you've dismissed it. For now anyway. The upfront investment required isn't viable at the moment, you've priorities elsewhere and you've looked into the payback of a PV system – it's slightly longer than you would like. It is on the back burner. This is completely understandable. But what if there was a way to benefit from the advantages of solar PV immediately, including big cost savings, without the upfront cost? Not to mention cutting your carbon footprint significantly from the get go.

Leading solar solutions provider and inverter manufacturer Fronius have recognised that cost is a major barrier for organisations wanting to take up solar and is prohibiting businesses all over the UK benefiting from the enormous savings that can be achieved with the technology.

The company's overriding vision is "24 hours of sun" which is a future powered 100% by renewables and opening up the opportunity for businesses to produce their own green electricity brings us all one step closer to this vision. Specialising in the efficient and intelligent conversion and control of energy for over 70 years, Fronius has partnered with some of the UK's biggest brands to deliver financial savings, carbon reductions and energy independence. With their new short and unique leasing model it is possible to not only offset any potential, and let's face it inevitable, energy price increases for years into the future, but can provide you with big savings immediately – and definitely no upfront costs. We are not talking about a Power Purchase Agreement here, where you agree to purchase the power generated by the system at a set price per kWh. Instead, their model simply allows you to lease the equipment required to generate your own green electricity over a 7 - 15 year period, with the option of ownership thereafter.

Now here's the best bit - Throughout the duration of the lease, your monthly fixed payments should be LOWER than the cost of that same electricity if purchased from the energy supplier at today's rate kWh for kWh. Furthermore, as you own the electricity being generated, any excess generation can potentially provide your business with a revenue via an export tariff with a supplier. Alternatively excess generation can be redirected to heat water, or be stored in batteries onsite.

There's even more good news. In addition to the benefits outlined above, there is a production guarantee for the duration of the contract. This means that if the system produces less than guaranteed contractually, a reimbursement will be issued for the underperformance – a completely risk-free arrangement for you.

GETTING SET UP

Fronius works closely with a network of certified Fronius System Partners - installers around the UK who have all undergone extensive training to work with Fronius products. After completing a thorough analysis of the roof or land space available and current electricity usage, the optimal size and set-up of a PV system can be established. One of these partners will then install the system to the highest specification. High quality engineering drives everything that Fronius does, so you can rest assured you'll be getting the highest quality products from the very best manufacturers. You won't need to worry about maintenance or insurance of the system throughout the duration of the lease. It really is a win-win.

Please note your energy bill is not replaced entirely. Electricity that is required above that generated, or used in non-daylight hours will still be taken from the national grid and billed via the energy supplier.

So the message from Fronius here is a simple one: Don't miss out on the benefits of photovoltaics for your organisation because investment priorities lie elsewhere right now. Get in touch with Lee, Project Manager at Fronius Renewable Energy Solutions UK: **pv-solarlease-uk@fronius.com** call them on **01908 512300**.

WHY THE FRONIUS LEASE?

- **Immediate savings**
- **Production guarantee**
- **No upfront costs**
- **Maintenance included**
- **Protection against rising electricity costs**
- **Go green**

ABOUT FRONIUS

Headquartered in Austria and established almost 75 years ago, the technology company has over 1,200 granted patents and over 3,800 employees worldwide. In the UK, Fronius has a large Technology Centre in Milton Keynes that houses their warehouse, tech support team, classrooms, product showroom and offices. Dedicated to building products that will last a lifetime in the harshest conditions, all Fronius products go through extensive tests. Its high standards have named them quality leader in solar electronics since 2002. **www.fronius.co.uk**

THE RENEWABLE TIPPING POINT IS HERE: NOW WE NEED TO FOCUS ON FLEXIBILITY

Richard Molloy, Business Development Manager – Energy Storage, Eaton

We tend talk a lot about tipping points in the energy industry. There's a tipping point, for example, after which fossil fuel extraction will go into consistent long-term decline, or a possible tipping point for energy subsidies after which they cost more than the economic activity they stimulate, or (perhaps most importantly) a tipping point after which renewables can be seen as our dominant power source.

It can be hard to tell when a tipping point has been reached. For all these examples, there are arguments about when they will happen, what they will look like, or even whether they have already happened. One way of identifying a tipping point, though, might be to notice when the conversation stops debating the idea itself, and starts to deal with all the different things that the idea will affect.

This is, I think, where we are with renewables. Renewable energy is not new: even putting aside millennia of windmill usage, the first electricity-generating wind turbine was constructed in the late 1800s, while efforts to commercialise photovoltaic technology have been underway for more than half a century. For most of this history, the questions have been around viability and feasibility; we have asked whether the technology will work, and whether we can afford to build and operate it. Now, we are thinking in terms of managing and maximising the transition.

THE TIPPING POINT FROM WHETHER TO HOW

It has been clear for some time that, in many contexts, renewables have become cheaper per kilowatt-hour than alternative sources, and they already fulfil around a fifth of Europe's energy demand. An even bigger reason for optimism about the speed of renewable adoption, though, is that we are increasingly talking about what needs to happen when – not if – renewables are supplying sixty, seventy, eighty percent of our power.

While many alternative sources are highly predictable in their output, solar and wind are inherently variable. For solar, we naturally have a daily rise and fall along with the sun, but also a seasonal cycle of sunlight duration and intensity as well as a much more rapid variation when cloud cover and other weather conditions limit production. Wind, of course, fluctuates more dramatically still. Forecasting the variations in output from solar and wind generation has improved dramatically over recent years and continues to increase in accuracy with the application of AI, but even when we know when and by how much outputs will vary, we still need to enable a system response in a fast enough time-frame to manage these changes. When these sources supply some 20% of our needs, fossil fuel plants can be throttled to compensate – but this won't be possible for a renewable-majority grid.

Perhaps less well known is the challenge that this poses in the other direction. From a grid stability perspective, oversupply is just as much a problem as undersupply, and without a solution in place it's possible that, by 2040, as much as 16% of Germany's renewable production will be curtailed. That will mean 2,300 hours a year when potential supply is being wasted even while, at other times of the year, additional sources are needed to manage shortfalls.

BRIDGING THE HILLS AND VALLEYS

All of this means that, as renewables continue their rapid ascent into our energy systems, we need to place our focus on flexibility. Our grid is designed for simultaneous production and consumption, with every watt of supply matched as closely as possible by a watt of demand at all times. In a renewable world, that leads us to needing both back-up generation capacity and costly grid upgrades.

Flexibility will mean decoupling supply and demand through large-scale storage infrastructure. A range of tactics will enable this. For short-term, intra-day fluctuations, integrated battery storage is an ideal way of siphoning off over-production of power and feeding it back in hours later when it is needed.

As the requirement for this kind of flexibility grows, electric vehicle batteries will also play a role. The average EV battery can store enough power for several days of demand from the average European home, and smart charging can delay that demand until renewable supply is abundant – and, for the driver, potentially less expensive. In the future, we will also see vehicle-to-everything solutions sell this stored energy back to the grid when it is needed.

For longer-term storage, possibilities include pumped hydro, compressed air batteries, and green hydrogen. These approaches all offer long-term energy storage with no degradation in capacity over time, making them ideal to smooth out generation gaps which may last weeks or even months.

DECOUPLING LEADS TO SECTOR COUPLING

In short, what we think about when we think about renewables now is the prospect of a smart, flexible, multi-directional grid which performs in ways that current infrastructure cannot. It's not just about replacing our current electricity generation capacity, though: this decoupling of supply and demand will, ironically, also help set the stage for the important work of sector coupling.

While renewable adoption will make much of our daily lives decarbonised by default – from the lights in our homes to, with an EV, our commute to work – much still relies on direct fossil fuel supply. To extend our emissions-reduction efforts to areas like heating, shipping, and the manufacture of goods like steel and chemicals, we need to eliminate their need for fossil fuels.

We can do this by finding ways to link these industries to the grid, in a process known as sector coupling. Shipping, for example, currently relies on highly polluting bunker fuel, and battery technology cannot deliver the power density needed for a cargo ship's high weight, long range requirements. Green hydrogen, however – either used directly in fuel cells or reformed into ammonia – offers a realistic route to carbon-neutral shipping.

Identifying the tipping point for renewables might feel like an academic exercise, but looking at sector coupling we can start to grasp the importance of flexibility, as a consequence of that tipping point, in our energy systems. It will be the key to unlocking the full potential of renewables for society, and in the process it will make the variability of renewables into an enormous opportunity for our collective future. **www.eaton.com/**

HYDROGEN EXPERTS ALL UNDER ONE ROOF

Fronius has been researching and developing hydrogen solutions for around 20 years and, in this time, has become the innovation leader in the production of green hydrogen. The company has big plans to further build on this enormous wealth of experience. The ground-breaking ceremony for the Fronius Hydrogen Competence Center took place at the company's Steinhaus site in Upper Austria back in 2020. In the future, Fronius will be able to pool its resources here and drive forward the development of renewable mobility and energy solutions using green hydrogen.

"24 hours of sun is possible because we are able to make renewable energy available around the clock," asserts Martin Hackl, Global Director Sales & Marketing, Solar Energy, Fronius International "The technology to turn our vision into reality is already there, the generation of hydrogen through electrolysis being one example. Used in combination with a fuel cell, hydrogen has the potential to completely revolutionise the entire supply of energy." Hydrogen is versatile and is very easy to store. It can be used as a fuel in vehicles or to supply energy to generate heat and electricity. Nevertheless, hydrogen can only be said to be renewable if it is generated using solar or wind power to produce 'green hydrogen'.

RESEARCH AND DEVELOPMENT LOCATION

"The Hydrogen Competence Center in Steinhaus is the ideal way to combine our resources and drive forward hydrogen research, development, production and sales in H2 systems," says Walter Stockinger, Global Director Research & Development, Solar Energy, Fronius International. "Training and customer presentations will also be conducted under one roof in the future." The high-tech company is further expanding its know-how through numerous collaborations, innovative pilot projects and its participation in expert panels focused on hydrogen power. This modern development location will therefore serve as an innovation hub and provide the ideal trial and test environment for the latest H2 applications.

Hydrogen will above all play a central role in the decarbonisation of transport – its benefits are most clearly seen where large ranges, heavy loads and short refuelling times are among the considerations. The zero-emission, low-noise and powerful hydrogen drive has great potential when replacing conventional combustion engines in diverse vehicle types, such as buses, HGVs, special vehicles and forklift trucks. Fronius has already developed a solution that is scalable depending on the customer's requirements: the Fronius Solhub. The facility at Steinhaus will have its very own Solhub, including reconversion and storage systems, and hydrogen vehicles are now being added to the existing vehicle fleet.

POWERING VEHICLES WITH GREEN HYDROGEN FROM SOLAR ENERGY

The Fronius Solhub, which was recently singled out for 'The Smarter E Award 2020' in the 'Smart Renewable Energy' category,[1] is a complete turnkey solution for decentralised hydrogen production, storage and supply. It uses electrolysis to convert environmentally friendly energy generated on-site into green hydrogen, which can be stored over the long term. Not only that, a further positive side-effect of the electrolysis and reconversion process is that the waste heat can be used to heat buildings or generate hot water, maximising the overall efficiency of the system.

An increasing number of vehicle manufacturers are already offering models or prototypes with fuel cells. Examples include buses, HGVs, internal logistics vehicles and even piste machines. The next stage is to install the necessary refuelling infrastructure. The Solhub allows companies, municipalities and other organisations to produce their own fuel in the form of green hydrogen at the precise location where it is needed. It is often the case that large roof areas are available for the installation of photovoltaic systems and, once they are in place, the generation of clean, green hydrogen can start!

Further information can be found at: **https://www.fronius.com/en/solar-energy/installers-partners/products-solutions/commercial-energy-solutions/green-hydrogen-with-solar-energy-solhub**

1 Other awards: VCÖ Mobility Award Upper Austria (2020), Energy Star Award of the State of Upper Austria in the "Innovation" category (2019), National Environmental and Energy Technology Award (2018)

HYDROGEN – WHAT IS THE HYPE ABOUT?

INTRODUCING HYDROGEN – A BEGINNER'S GUIDE

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Max Boemke

Marianne Anton

Oui, mes amis, je crois que l'eau sera un jour employée comme combustible, que l'hydrogène et l'oxygène, qui la constituent, utilisés isolément ou simultanément, fourniront une source de chaleur et de lumière inépuisables et d'une intensité que la houille ne saurait avoir.

Yes, my friends, I believe that water will one day be employed as fuel, that hydrogen and oxygen, which constitute it, used singly or together, will furnish an inexhaustible source of heat and light of an intensity of which coal is not capable.

Jules Verne, L'Île mystérieuse (The Mysterious Island) (1875)

INTRODUCTION

There has been a lot of hype in recent years about hydrogen and the deployment of hydrogen fuel cells. Interest is only increasing as countries around the globe look to cut their carbon emissions, to re-use existing infrastructure where possible, and to move away from internal combustion engine vehicles. The International Energy Association produced a report in June 2019 which found that "clean hydrogen is currently enjoying unprecedented political and business momentum, with the number of policies and projects around the world expanding rapidly". It is a call to arms, concluding that "now is the time to scale up technologies and bring down costs to allow hydrogen to become widely used".

However, hydrogen is not a new technology. It has been around for a long time: it helped power the first internal combustion engines 200 years ago and since then has become a key component of the modern refining industry. Current primary uses for hydrogen are as a feedstock for industrial and chemical processes, for example, refining petroleum products, methanol or ammonia.

As set out by the International Renewable Energy Agency (IRENA) in a September 2019 report, these current uses will change, there are transferable skills gained in these industries:

"While today's hydrogen use has limited direct relevance for the energy transition, it has resulted in ample experience with hydrogen handling. Hydrogen pipeline systems spanning hundreds of kilometres are in place in various countries and regions and have operated without incident for decades. Similarly, there is a long track record of transporting hydrogen in dedicated trucks."

Hydrogen Basics, a guide produced by Hydrogen Europe, is an ideal introductory resource for those new to the landscape and terminology of hydrogen. It cites steam reforming from natural gas as the "most commonly used method for hydrogen production" at 70%. This is followed by oil, coal and electricity (as a secondary energy resource). While the contribution of renewable energy as a production source has been small to date, this is set to increase.

COLOUR	PROCESS	IMPACT
GREEN HYDROGEN	Electrolysis, using renewable energy (wind, solar etc.) to split water into its component parts (H2 + O2).	No carbon emissions, ability to "store" surplus electricity from renewable sources.
YELLOW HYDROGEN	As above, using nuclear power instead of renewable energy.	Low carbon emissions, ability to "store" surplus electricity.
BROWN HYDROGEN	Gasification, using coal/ biomass/waste to heat water and break it down. Also known as "town gas".	Along with the component parts of water, other harmful elements are produced: carbon dioxide (CO2), carbon monoxide (CO), methane (CH4), and ethylene (C2H4).
GREY HYDROGEN	Steam Methane Reforming (SMR), using methane to heat water and break it down.	As above, produces other harmful elements: CH4 and CO2.
BLUE HYDROGEN	SMR and carbon capture, use and storage (CCUS).	Grey hydrogen but with carbon capture so it is seen as a lower carbon option.
TURQUOISE HYDROGEN	Using Molten Metal Pyrolysis, natural gas is passed through a molten metal that releases hydrogen and solid carbon.	Solid carbon can be used for industrial applications, so it is seen as a lower carbon option.

Fig 1

TECHNOLOGY	DESCRIPTION
ALKALINE ELECTROLYSIS (AE)	Low-temperature electrolysis that uses a solution composed of water and a liquid electrolyte. This method has been in commercial use since the middle of the 20th century. With a liquid electrolyte, more peripheral equipment such as pumps for the electrolyte, solution washing and preparation are required. So, although it is the cheapest to purchase, it has relatively high maintenance costs.
PROTON EXCHANGE MEMBRANE (PEM) ELECTROLYSIS	Low-temperature electrolysis that uses a conductive solid membrane and requires no liquid electrolyte. Compared to alkaline electrolysis, PEM electrolysis can react more quickly to fluctuations in generation. It is often used for distributed systems because the equipment is low-maintenance and delivers high-quality gas. However, precious metals such as platinum are often required so it is expensive up front.
ANION EXCHANGE MEMBRANE (AEM) ELECTROLYSIS, ALSO KNOWN AS ALKALINE PEM	Newer variant of low-temperature electrolysis which does not use precious metals, currently only manufactured by Enapter.
SOLID OXIDE ELECTROLYSIS (SOE)	Some studies posit that H2 production by high temperature steam electrolysis using SOEs is competitive to H2 production from fossil fuels at electricity prices below €0.02–0.03/kWh, while recognising that "substantial R&D is still required to obtain inexpensive, high performing and long-term stable electrolysis cells".

Fig 2

TYPES OF HYDROGEN

Not all hydrogen is created equal – there is an entire rainbow of hydrogen, not all of it "clean". While the focus of our series is green hydrogen, it's helpful to be familiar with other ways that hydrogen can be made. (Fig 1).

TYPES OF ELECTROLYSING TECHNOLOGY

Electrolysis of water is the process of using electricity to split water into hydrogen and oxygen. This reaction takes place in electrolysers, devices which can range in size up to large-scale production facilities that can be linked to wind and solar farms.

As pure water is not a particularly good conductor, electrolysers use substances that are able to conduct electricity when dissolved in water which are known as electrolytes. There are different types of electrolysers depending on the (i) electrolyte materials they use and (ii) temperature at which they are operated.

Low-temperature electrolysis technologies are the most developed. High-temperature electrolysis is also possible but is still in development stage and not yet commercially available. The hope is that, in due course, it will increase conversion efficiency (efficiency being measured as the amount of electricity required to produce a certain amount of hydrogen) and produce synthetic gas for use in synthetic liquid fuels. (Fig 2).

This list is by no means exhaustive, but we hope it will serve as a helpful introduction to the language of hydrogen technology. It is also worth noting that many of the electrolysis processes above do not need to operate solely in large industrial installations. Electrolysers can be large scale, or they can use the modular approach favoured by Enapter.

Finally, a word about fuel cells. A fuel cell generates electricity from an electrochemical reaction just like a battery but the 'fuel' often being referred to is hydrogen, e.g. the hydrogen produced from electrolysis. The fuel cell converts the chemical energy of hydrogen into electricity by reacting hydrogen with oxygen to form water and as by-product, releasing electrons through an external circuit as an electric current. Fuel cells can produce electricity indefinitely as long as the hydrogen and oxygen are supplied.

DRIVERS OF GROWTH

There are many factors that are driving interest in and growth of green hydrogen. Many countries have signed up to the Paris Agreement and are therefore seeking to reduce carbon emissions. Their goal is to limit the impact of climate change and, more specifically, limit global temperature increase to 1.5 degrees Celsius. Some countries have gone even further, with the United Kingdom being the first major economy to enshrine a net zero emissions target into law in June 2019. As the United Nations reported in September 2020, the "number of commitments to reach net zero emissions from local governments and businesses has roughly doubled in less than a year".

As part of this commitment, many governments around the world are looking to ban vehicles with internal combustion engines in the run up to 2050. In its Global EV Outlook 2020, published in June 2020, the IEA noted that "17 countries have announced 100% zero-emission vehicle targets or the phase-out of internal combustion engine vehicles through 2050." The report cited France as the first country to put this into law in December 2019, with a target date of 2040. The UK recently (November 2020) increased its ambition, bringing forward the target date to 2030. As set out by the BBC, "the UK is now in second place after Norway, which has a fossil fuel vehicle abolition date of 2025".

Reducing carbon emissions in electricity production is, in some ways, the easiest part of the puzzle. Work has clearly started toward reducing emissions in road transportation, as set out above. However, reductions are also needed in long haul transportation, heating and industry. Hydrogen can play a large role here – see below for possible applications.

APPLICATIONS

There are many existing applications for hydrogen technologies, and many more industries with vast potential. It is an exciting time for stakeholders in these industries, whether they are transforming and revitalising existing businesses, building new business models or deploying new hydrogen technologies.

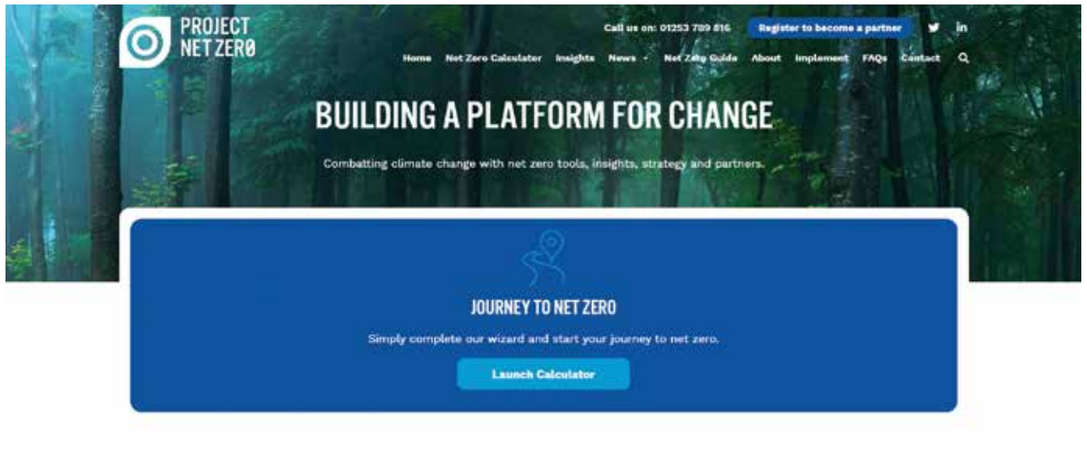
Current and potential applications for hydrogen include:

- As a replacement fuel for oil and gas, making use of existing gas pipelines;
- A potential export to boost economies;
- Revitalising industrial ports;
- Fuel for ships, heavy goods vehicles and freight;
- Marine transport, both shipping and cruise lines;
- Aviation;
- Submarine transport; and
- Storage of "excess" renewable energy, e.g. from offshore wind.

The opportunities in these industries are exciting, and we look forward to exploring them with you in future articles in this series.

www.wfw.com

GETTING TO NET ZERO: NEW WEBSITE HELPS ORGANISATIONS PLOT A ROADMAP TO NET ZERO EMISSIONS



"Project Net Zero" provides tools and insights for carbon-conscious businesses, with practical steps on how to reach their net zero targets.

BiU, the UK's leading energy consultancy has launched an online platform for organisations seeking to develop and deliver on net zero strategies. Crucially, the site is a resource for action, not just intention, with advice on real-world solutions to meet net zero goals.

PERSONALISED ROADMAP

Project Net Zero – **www.projectnetzero.co.uk** – was conceived in response to the urgent imperative for companies to end their contribution to climate change.

Primarily aimed at large corporates and large public sector organisations, Project Net Zero guides companies at all stages of their net zero journey, from initial target setting through to implementation.

An important feature of the site is its intelligent net zero calculator – which offers a personalised roadmap to net zero based on a company's individual characteristics, such as core activities, budget, sector and level of ambition.

The site also offers a wealth of advice on practical solutions required to decarbonise, including energy efficient tech, renewable energy and offsetting. A technology provider directory makes it easier for firms to connect with partners implementing carbon reduction measures.

To keep companies informed, an industry-leading Insights section features regular news, advice and analysis on net zero developments.

THE RACE TO NET ZERO

The site launches just days after the US re-joined the Paris Agreement under Biden's presidency, a move which means two-thirds of the world's emissions are now covered by net zero commitments.

The UK enshrined its 2050 net zero target into law in 2019, and is developing policies to support the transition. Organisations with net zero targets futureproof themselves for tightening legislative frameworks, as well as creating opportunities for growth and innovation.

Over 1,500 businesses globally have set net zero targets of some kind*, and public sector bodies are also driving the transition. The majority of UK local authorities now have net zero targets in place, and the NHS recently became the world's first national health system to commit to net zero.

Importantly, large organisations are also pushing their supply chain to also set a net zero plan. These are often smaller businesses with limited resources, and Project Net Zero provides them with the tools they need to start their decarbonisation journey.

"Net zero presents a huge opportunity for businesses, but we recognised the need for a comprehensive information platform that would show companies how to get there – previously there has been no "go to" source for independent advice," says Anthony Mayall, Chief Commercial Officer at BiU. "An organisation's aspirations, budget and resources can determine the route it takes – Project Net Zero provides a tailored roadmap to help you set, progress and achieve your net zero goals."

Learn more by visiting **www.projectnetzero.co.uk.**

FOUR THINGS TO CONSIDER WHEN IT COMES TO YOUR ENERGY CONTRACTS

The last 12 months have been turbulent. Many organisations have faced unprecedented uncertainty, with a return to business as usual still out of sight.

The past year of rolling lockdowns - local, regional, and national - has bled into a new year, where we face both economic uncertainty and continued restrictions. Saving money and staying afloat will be the top priorities, and all businesses will have outgoings at a time when income isn't guaranteed. Your energy contract is unlikely to be front of mind, but over the course of the pandemic we've seen businesses renewing their contracts, rather than shopping around or falling into rollover rates.

Businesses are looking for certainty and stability at a time when it's been hard to find. Depending on the exact terms of your energy contract, there may still be room for uncertainty.

Now is the right time to familiarise yourself with your energy contract and to look for those charges or elements that could have an impact on your business.

1. INCREASES IN THIRD PARTY COSTS

The total cost of energy comprises lots of various charges. Only around half of the final cost of your bill comes from electricity. The rest comes from third party costs (TPCs).

These costs – also called non-energy or non-commodity costs – include the costs of energy distribution and transmission, grid balancing, and environmental charges like the Climate Change Levy. These charges are paid for by energy suppliers, who then charge end users.

Businesses on pass-through contracts will have these costs charged directly, while businesses on fixed contracts should look closely to see which of the costs are fixed, as some may not be.

We expect third party costs to rise this year due to COVID-19. The pandemic created difficult circumstances for the energy network, making it more expensive to manage the grid. The additional costs incurred as a result will be passed through to suppliers. Charges will increase to cover this cost. Some organisations that used less electricity during the pandemic may find their bills have fallen by less than expected, while others who worked throughout the pandemic may find their bills are higher than usual.

To find out more about how third party costs might impact your business over the coming year, download our latest TPC guide from our website at **www.havenpower.com/news/charges-on-your-energy-bill**

2. RENEWABLES OBLIGATION MUTUALISATION

The Renewables Obligation (RO) was a support mechanism for large-scale renewable energy projects, administered by Ofgem (now replaced by the Contracts for Difference mechanism).

The RO requires energy suppliers to source a percentage of their electricity from renewable sources. The Renewables Obligation is funded by suppliers, with the costs recouped from consumers.

RO mutualisation happens when the amount paid to Ofgem falls short. As the RO is paid in arrears, this shortfall is spread across all suppliers. The sum any supplier pays is determined as a percentage or proportion of their share of Renewables Obligation Certificates (ROCs).

As a result of difficult trading conditions and the ongoing impact of COVID-19, we expect that mutualisation may occur again in the next compliance period.

3. TARGETED CHARGING REVIEW (TCR)

Ofgem's Targeted Charging Review (TCR) is intended to reduce distortion across the energy network, ensuring that charges are cost-reflective and paid by the right end-users.

The TCR was introduced because larger energy consumers - who often contribute the most to system stress - are also more sophisticated and better able to predict when prices may be highest. This enables them to lower their consumption during these periods; this is called triad avoidance or red zone avoidance.

The TCR is a wide-ranging programme, with little certainty around the distribution of charges following the review. This creates contractual uncertainty; 2022 is only months away and as a result, many decision makers will have to prepare for potentially increased non-energy costs over the next 12-14 months.

4. REFORECASTING AND VOLUME TOLERANCE

Volume tolerance clauses are a common element of energy contracts for medium and large business customers. They're a partial cost recovery mechanism, designed to protect suppliers from significant consumption deviation from a customer's original forecast. This helps National Grid and District Network Operators (DNOs) to manage the network appropriately.

Typically, tolerance clauses offer variance of around 20% above or below the customer's pre-calculated annual energy consumption. However, the dramatic impact of COVID-19 on the energy network means that many suppliers are now likely to be more cautious.

While we can try to accurately predict future demand, we don't know how businesses will be impacted over a sustained period. At Haven Power, we consider circumstances on a case-by-case basis and always adopt a consultative approach with our customers to help them navigate through any challenges. We think it's vital to ensure that contracts don't contain any unpleasant surprises.

HOW TO MAKE YOUR BUSINESS MORE WATER EFFICIENT

Reducing the water usage and consumption of your business will only become more important as time goes on and the pressures of climate change, population growth, extreme weather events and ageing infrastructure are felt increasingly – and it's essential that you start taking steps now to become more water efficient and reduce your company's water footprint.

Water resources are finite and less than three per cent of the water on earth is actually fresh, so it's vital that we all work together to become more eco-friendly when it comes to usage - and the good news is that there's a lot that can be achieved in this regard.

The best way to make improvements to how you manage water resources is to gain a level of understanding of your current consumption, so you can see how and where you use water across your site, which then allows you to focus on key areas more effectively.

Taking regular meter readings is a good first step. Start by taking them at the start and end of every day so you can build up a picture of how much you're using.

Alternatively, you could set up automated meter reading, which tracks your water flow every hour for ten years, so you can identify areas of weakness quickly, as well as spotting leaks as and when they occur.

You could also find water bill validation useful, with ongoing monitoring of your bills helping you to spot if your water consumption varies a lot. This could be down to something like a leak onsite or faulty equipment somewhere.

From here, you can arrange to have a water audit carried out across your premises to help you work out which water-saving strategies would be most appropriate.

In terms of actual solutions, there is a lot you can consider, whether you want to start by investing in water-saving devices such as automatic or spray taps, or dual flush toilets.

Fittings and fixtures can make a real difference to how much water you're using and it also encourages your team members and colleagues to think more about how they use water, as well.

Looking into alternative water sources could also prove particularly effective, so consider the likes of greywater or rainwater recycling if you do want to reduce your reliance on mains water supplies.

Greywater is that which has been lightly contaminated through the use of showers, sinks, washing machines and so on, and it can be used for the likes of flushing toilets, irrigation and more, so could certainly be worth looking into.

Rainwater harvesting involves collecting the rain that falls on the roof of your buildings, filtering it and reusing it for laundry and process water, toilet flushing, vehicle washing and more. If you'd like to find out any more about any of the above, get in touch with SWS today. Email: graham.mann@switchwatersupplier.com
Tel: +44 (0)3300 552532
www.switchwatersupplier.com
www.linkedin.com/groups/13746944/

THE CHEMISTRY OF CONFLICT: INCENDIARY DISPUTES– PART 1

In the first half of this paper, Forensic Engineering Expert Professor Robert Jackson and Construction Lawyer Peter McHugh discuss the risks to sustainability borne from the explosive consequences of energy-from-waste (EfW) facilities. The paper will highlight contentious disputes relating to design, construction, operation, environmental impact and personal injury, together with strategies for their avoidance.

Professor Robert Jackson

Peter McHugh

A timeline through the ages, via the Middle East, Italy, India and the UK, allows the scene to be set to discuss ongoing challenges to the creation of a sustainable future. In the 10th Century BC, bio-gas, a mixture of gases emitted from natural waste decomposition through the anaerobic breakdown of organic matter, was first used to heat bath water in the Middle East. In the 17th century Robert Boyle, one of the founders of modern chemistry and best known for Boyle's law, recognised that disturbing settled sediments within natural waters released a flammable gas. In the late 18th Century the Italian physicist Alessandro Volta identified this gas to be methane and in the early 19th Century, Sir Humphry Davy, the inventor of the Davy lamp for use in flammable atmospheres, proved the presence of methane in gases emitted from cattle manure. However, it was not until 1859 that the first commercial anaerobic digester was constructed, albeit at a leper colony in Bombay. Since then much has changed and, in today's global drive toward sustainability, UK waste streams are becoming an increasingly important source of energy. Modern society produces wastes in many forms but this paper will focus on two topical processes: the anaerobic treatment of wastewater and the incineration of solid wastes.

During the anaerobic digestion of wastewater, a mixture of gaseous compounds (biogas) is released into the atmosphere which commonly includes odourless methane and carbon dioxide, together with ammonia, and highly odorous volatile sulphur compounds contained within human sewage which include hydrogen sulphide. Hence the mixture is made from the individual elements of carbon, hydrogen, oxygen, sulphur and nitrogen. The resulting development of odour nuisance depends on individual odour characteristics, odour dispersion and dilution, together with peoples' perception, and its environmental impact can be determined by assessing its frequency, intensity, duration, offensiveness and location. Emitted odorous compounds, other than hydrogen sulphide (H_2S - rotten eggs), include ethyl mercaptan (C_2H_6S – garlic, onions, and cabbage) and methyl mercaptan (CH_4S – faeces and cheese), all of which are prejudicial to the health of people living or working in the affected areas. Human excreta, comprising faeces and urine, also contain pathogens and viral and bacterial toxins.

pH is the scale used to specify the acidity or alkalinity of an aqueous solution and is on a logarithmic scale of 0.0-14.0, with zero the most acidic and 14 the most alkaline. The halfway point of 7.0 is neutral with acidity increasing as pH decreases from 7.0 to 0.0, and alkalinity increasing as pH increases from 7.0-14.0. As the scale is logarithmic, each pH value below 7 is ten times more acidic than the next level, so a pH of 5 is ten times more acidic than a pH of 6 and one hundred times more acidic than a pH of 7.

Chemical and biological reactions in sewage greatly depend on the pH with sewage treatment processes normally operating best within the neutral/alkaline pH range of between 7.0 and 8.0, whilst ammonia oxidising bacteria for nitrification prefer 7.2 to 8.2. Raising the pH is usually carried out by adding sodium hydroxide (caustic soda) or sodium carbonate to the incoming sewage flow. These compounds yield moderately alkaline solutions in water and are used as pH regulators to maintain stable alkaline conditions.

Domestic sewage often comprises food waste residues which may include by-products of glucose contained within, for example, cakes, pies, honey, bananas, ketchup and fruit juices. When sewage undergoes organic decomposition it produces a biogas that typically contains 50-75% methane; 25-45% carbon dioxide; 3% hydrogen sulphide; <2% nitrogen; and <1% hydrogen; plus trace amounts of other gases. An example of this chemical breakdown through anaerobic digestion can be illustrated by the equation representing the decomposition of glucose: (Glucose) $C_6H_{12}O_6$ → (Carbon Dioxide) $3CO_2$ + (Methane) $3CH_4$.

Hydrogen sulphide is the most common form of volatile sulphur in faeces which have an average pH of 6.6 i.e. raw human sewage is slightly acidic. However, percentage gas emissions vary and high pH values inhibit the activity of sulphate-reducing bacteria. So, increasing the pH from 6.5 to 8.0 increases biogas production by 10%, increases methane production by 65%, but decreases hydrogen sulphide production by 45%. Therefore, increased alkalinity increases methane emissions and decreases hydrogen sulphide emissions.

Consequently, it is undeniable that wastewater treatment plants remain a potential source of toxic/explosive gas emissions from anaerobic digestion following the microbial decomposition of organic matter in sewage. Methane, together with carbon dioxide, ozone and nitrous oxide, is a major greenhouse gas responsible for global warming but is also the main constituent of natural gas. Hydrogen sulphide is a highly flammable irritant/asphyxiant that is heavier than air and so may travel along the ground, often collecting in low-lying, enclosed and poorly-ventilated areas including manholes and sewers. If mixed with air the gas may become explosive, and if it is able to travel to a source of ignition it burns to produce toxic vapours which may include sulphur dioxide. Furthermore, gases emitted from anaerobic digestion have a direct and undeniable impact on nuisance and human health; repeated exposure, even at low concentrations, often results in irritation to the eyes, nose, throat and respiratory system with prolonged exposure leading to headaches, conjunctivitis, insomnia, irritability, digestive problems, fatigue, central nervous system weakness, or weight loss.

Whilst methane lends itself to being a sustainable and renewable source of energy, its capture and storage prior to use is technically challenging for the designers, constructors and operators of energy-from-waste (EfW) facilities. This is shockingly demonstrated by the recent explosion on 3rd December 2020 when a silo containing sewage sludge bio-solids exploded at a Wessex Water wastewater treatment works in Avonmouth, Bristol killing three men and a 16-year old apprentice, and injuring another person. At the time, stored sludge was undergoing further treatment by mixing it with lime within oxygen-free tanks to produce agricultural fertiliser and renewable energy. Investigations by the Health & Safety Executive (HS&E) are ongoing but current thinking is that the explosions resulted from the anaerobic digestion of organic waste coupled with alkaline pre-treatment which increased methane production. The bio-methane gas produced by the works was supplied to local bus operators including Bristol Community Transport responsible for a Metro-Bus route.

Such an explosion will push air outwards at very high speeds creating a partial vacuum in its wake that will subsequently be filled with air from the surrounding atmosphere. This reaction will create an abrupt change in pressure which can give rise to a powerful shockwave and blast of air which, under certain circumstances, may have fatal consequences. This supports the need for wastewater treatment works and municipal waste incinerators to be constructed and operated at a safe distance from private housing, to eliminate potential risks to human health and safety emanating from anaerobic gas emissions.

The findings of a study recently published in the journal The Proceedings of the National Academies of Science show that whilst hydrogen sulphide gas is poisonous, corrosive, and smells of rotten eggs, it may help protect ageing brain cells against Alzheimer's disease. The research showed that the human body naturally creates small amounts of hydrogen sulphide to help regulate functions across the body, from cell metabolism to dilating blood vessels. It is very important to remember, however, that the beneficial effects of hydrogen sulphide are most probably generated by exposure to that gas in pure form and on its own, without the other compounds present in emissions from wastewater treatment works.

In parallel with risks borne from an engineering and scientific perspective, there is an imperative to address the financial and legal implications of the development of EfW plants within the wider economy. A circular economy is an economic system aimed at the continual use of resources by employing systems of recycling, re-use, re-manufacturing and refurbishment to create a closed system that minimises resource input and the creation of waste, whether municipal, household, biodegradable or agricultural. However, part of minimising the creation of waste involves the transition to renewable energy from waste projects.

EfW is a sector that can be fraught with problems not dissimilar to those faced by the pioneers of the 19th Century Gold rush when failed schemes resulted in the loss of money, confidence, reputation, or injury. Whilst operating an EfW plant will yield great benefits for the environment and financial rewards for the pioneer owners, excessive build costs and associated risks are areas that need to be eradicated. In a modern society where climate change is of paramount importance, the role that EfW plants play cannot be underestimated with respect to reducing our carbon footprint and supporting the Covid-19 recovery.

The EfW sector is fast-growing and driven by changes in legalisation and regulation that have taken place over the last 20 years, to reduce landfill and pollution whilst increasing the generation of low carbon energy. In June 2019, the UK parliament passed legislation requiring the government to reduce the UK's net emissions of greenhouse gases by 100% relative to 1990 levels by 2050. Doing so would make the UK a 'Net Zero' emitter by achieving a balance between the amount of greenhouse gas emissions produced and the amount removed from the atmosphere. There are two different routes to achieving 'Net Zero', which work in tandem: reducing existing emissions and actively removing greenhouse gases. Consequently, EfW will play an important future role in the future economy and will offer a potentially lucrative opportunity for UK-based contractors and professionals.

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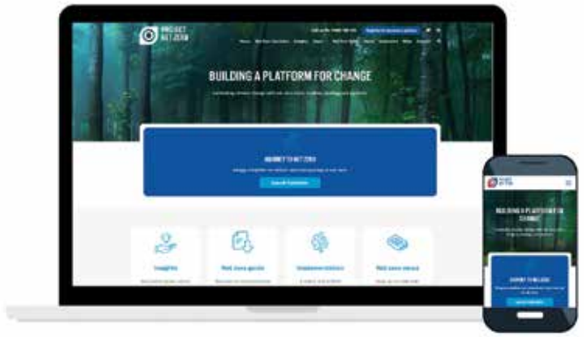
INTRODUCING PROJECT NET ZERO, A PLATFORM FOR CHANGE

Project Net Zero (projectnetzero.co.uk) provides tools and insights for carbon-conscious public sector organisations, with practical steps on how to reach their net zero targets.



BiU, the UK's leading energy consultancy, launched the online platform for public sector bodies who are seeking to develop and deliver on their net zero strategies. Crucially, the site is a resource for action, not just intention, with advice on real-world solutions to meet net zero goals.

NET ZERO PUBLIC SECTOR: PUTTING PLEDGES INTO ACTION

A wide range of public bodies have now declared ambitious net zero targets, many by 2030, well ahead of the UK's legally binding 2050 goal. The NHS has formally adopted two targets: net zero by 2040 for emissions under NHS direct control, and a target of net zero by 2045 for emissions including the wider supply chain.

However, the challenge lies in putting pledges into action. While the majority of local authorities have declared climate emergencies and now have net zero targets in place, a recent poll by non-profit Icebreaker suggests that more than a third are not confident they will meet them. Another recent study by the ECA reveals that over half of public sector bodies and quangos have not yet made plans to reach net zero by 2050.

ENTER, PROJECT NET ZERO

Project Net Zero guides organisations at all stages of their net zero journey, from initial target setting through to implementation.

An important feature of the site is its intelligent net zero calculator – which offers a personalised roadmap to net zero based on an organisation's individual characteristics, such as core activities, budget, sector and level of ambition.

The site also offers a wealth of advice on practical solutions required to decarbonise, including energy efficient tech, renewable energy and offsetting. A technology provider directory makes it easier for organisations to connect with partners implementing carbon reduction measures.

To keep companies informed, an industry-leading Insights section features regular news, advice and analysis on net zero developments.

THE RACE TO NET ZERO

The site launched just days after the US re-joined the Paris Agreement under Biden's presidency, a move which means two-thirds of the world's emissions are now covered by net zero commitments.

The UK enshrined its 2050 net zero target into law in 2019, and is developing policies to support the transition. Organisations with net zero targets futureproof themselves for tightening legislative frameworks, as well as creating opportunities for growth and innovation.

Importantly, large organisations are also pushing their supply chain to also set a net zero plan. These are often smaller businesses with limited resources, and Project Net Zero provides them with the tools they need to start their decarbonisation journey.

"Net zero presents a huge opportunity for organisations of all kinds, but we recognised the need for a comprehensive information platform that would show them how to get there – previously there has been no "go to" source for independent advice," says Anthony Mayall, Chief Commercial Officer at BiU. "An organisation's aspirations, budget and resources can determine the route it takes – Project Net Zero provides a tailored roadmap to help you set, progress and achieve your net zero goals."

GET AHEAD OF POLICY CHANGES

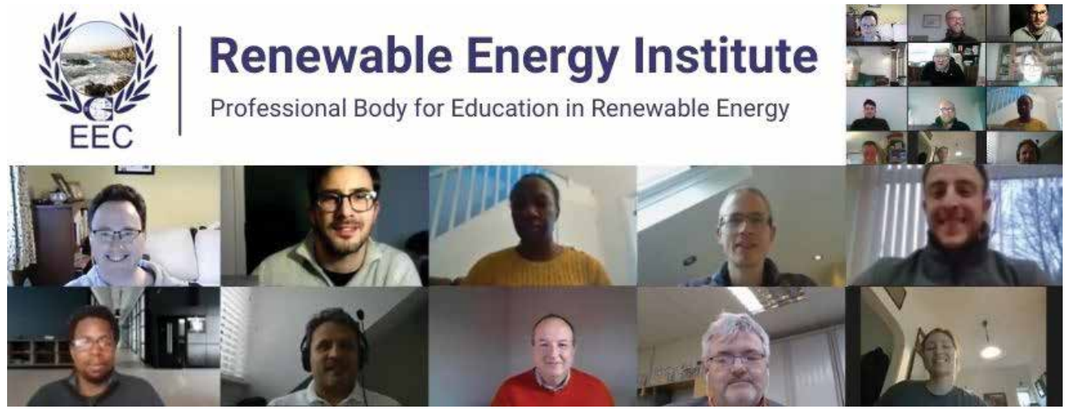
2021 needs to be a defining year for action on climate change – especially for the UK, as it gears up to host the crucial COP26 climate conference in November. A number of major green policies are due from the government which will impact on public sector organisations:

The Transport Decarbonisation Plan: due to be published soon, this plan will affect all transport elements of public sector organisations.

The Heat and Buildings Strategy: due to be published soon, this strategy will set out immediate actions the government will take for reducing emissions from buildings, from low carbon heating to emissions reductions.

The Future Homes Standard and Future Buildings Standard: these will set higher performance targets for buildings from 2021 onwards, to get them "zero carbon ready" by 2025.

Learn more by visiting **www.projectnetzero.co.uk**



THE RENEWABLE ENERGY INSTITUTE HAVE A RANGE OF UPCOMING LIVE VIRTUAL CLASSROOM COURSES THAT YOU CAN JOIN FROM YOUR OWN LOCATION:

Electric Vehicles, 30th–31st March
Hydrogen Energy, 13th–14th April
Renewable Energy Management and Finance, 20th–21st May

Live Virtual Classroom courses feature 2 full days (9am – 5pm UK time) of interaction and networking with the expert lecturers and other delegates. All courses are CPD-accredited.

Take part in up to 2 Live Virtual Classroom courses with the Hydrogen Energy Expert Certificate or attend all 3 as part of the full Master in Renewable Energy Award. Sign up today and receive 25% funding on all Expert Pathways and the full Master Award. Simply head to: **https://www.EUenergycentre.org/training/** or email **training@EUenergycentre.org**

ABERDEEN LEADING THE FIELD WITH NEW ENERGY TRANSITION DEGREE

The University of Aberdeen has launched the UK's first postgraduate degree programme in Energy Transition Systems and Technologies.

The new course, which is available to study full-time on campus from September (depending on the Covid-19 situation), or part-time online, reinforces and builds upon the city's reputation as a major international energy centre.

It will educate to MSc level a new generation of systems engineers providing industry-relevant skills and training, with future career possibilities in all areas of the energy sector.

Based in the School of Engineering, with expert contributions from the Schools of geosciences, business and law, the new Masters programme will draw on much of the ground-breaking research being conducted within the University's Centre for Energy Transition (CET).

The launch of this programme represents one of several exciting energy developments in the region, including the National Decommissioning Centre (NDC) and the OGTC, both national centres of excellence for the oil and gas sector. The North East already boasts many large scale infrastructure projects such as the Kincardine Floating Offshore Wind Farm, the Acorn Carbon Capture and Storage project and the planned renewable energy superhighway linking Scottish offshore sectors and to the English mainland.

With an emphasis on the transition from fossil fuels to sustainable energy types through the integration of LCTs into current and future energy systems, the programme will encourage students to take a 'systems-thinking' approach to energy transition.

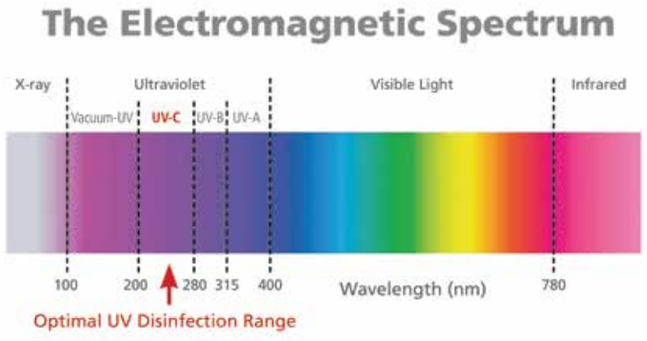
It will also combine technical knowledge of individual LCTs - including energy efficiency technologies and renewable energies such a wind, solar and ocean energy – with non-technical aspects, such as economic and political developments.

The University of Aberdeen's School of Engineering is renowned for its world-class energy programmes in oil and gas, renewable energy and subsea engineering. Energy Transition is one of the five Interdisciplinary Challenges prioritised in the University's Aberdeen 2040 strategy.

For more information about the MSc in Energy Transitions Systems and Technologies, which will be available both on campus and online, go to: **https://www.abdn.ac.uk/pgt/etst/**

HYGIENE AND UV-C LIGHTING

Wim Vinckx, Senior R&D Engineer, Sylvania Lighting



In light of the latest pandemic it has never been so important to sanitise and disinfect. Crowded areas with poor air circulation (such as public transportation, offices, shops and schools), frequently touched surfaces and recreational water facilities make it easy for pathogens to spread and increase our risk. Alongside the changes we can make personally in our routines, businesses are also striving to make the places we visit as safe as possible, and one of the most effective ways to do this is with UV-C technology.

For over 110 years UV-C technology has been used in the sanitisation of air, water and surfaces, and Sylvania is one of the pioneers in the design and manufacture of UV-C lamps. Whilst some micro-organisms are essential for life, such as in the human digestive system, others can lead to potentially life-threatening diseases, such as COVID-19. Traditional techniques for the control of pathogens, such as heating, filtration, and the use of chemical agents have some effect, but irradiation by UV-C lamps is considered by far the most effective.

UV-C irradiation has many benefits for use in a variety of applications, the key ones being:

- Extremely fast purification time
- East to install, use and maintain
- Cost-efficient
- Ecological

So how does ultraviolet sanitisation work? UV-C radiation has short wavelengths which are more energetic than visible light, and have sufficient power to destroy the DNA and RNA in biological organisms. The optimum wavelength for this effect is 265nm (nanometre), which falls within the UV-C range. Destroying the genetic code of a micro-organism prevents its cells from reproducing and effectively deactivates them.

The electrical discharge through mercury vapour in UV-C lamps, such as those manufactured by Sylvania Lighting, produces intense radiation at a peak of 253.7nm. Not only is this value very close to the optimum of 265nm for deactivating micro-organisms, these lamps are also supremely efficient – with up to half of the power input being converted to UV-C radiation. No other method achieves such high values. UV-C LEDs tend to radiate at 275-285nm and although this is also close to the peak germicidal wavelength of 265nm, their conversion of electrical energy into UV-C is at best around 5%. Therefore ten times more electrical energy is required for the same effect. This will undoubtedly improve in future and indeed LEDs already have advantages today where small or highly focussed UV-C sources are required, but for many applications they still have a long way to go.

So how do we know that UV-C lamps work on COVID-19? A prominent study was recently undertaken by the National Emerging Infectious Diseases Laboratories at Boston University[1]. In this study UV-C radiation was tested against SARS-CoV-2 and the results clearly demonstrated that a dose of 5mJ/cm^2 of UV-C during an exposure of 6 seconds resulted in a 99% reduction of that virus. This was confirmed by other studies, including Bianco et.al. in Italy[2].

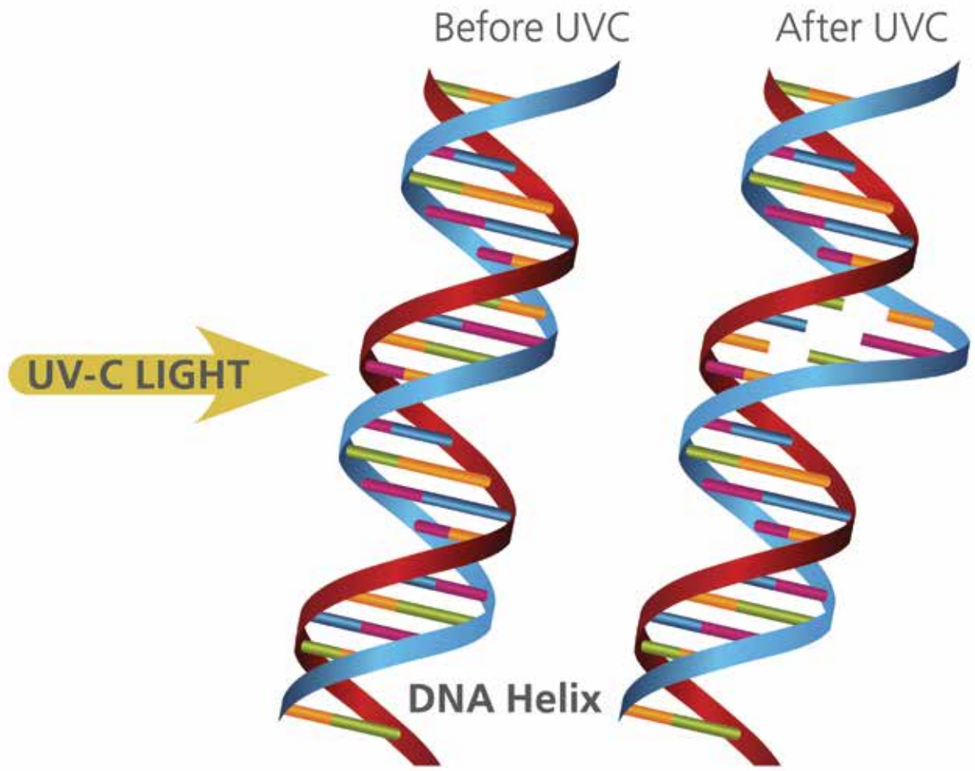
We know from academic studies that coronaviruses can survive on surfaces for up to 28 days, however infected people are far more infectious than surfaces. The primary spread of SARS-CoV-2 appears to be via aerosols, i.e. through the air we breathe. Therefore it's important to understand what the most effective mechanisms for disinfecting air and surfaces with UV-C are when deciding which method to use for a business.

'Fresh air' has always been considered beneficial. Indoors, however, air can be relatively stagnant or have poor circulation, particularly in cold weather when windows are often kept closed. Under such conditions air can be a means of carrying infectious organisms into the body. In some industries, bacteria and mould spores in air can also cause considerable damage to products, resulting in additional costs and a threat to the health of consumers. Therefore disinfection of air is vitally important.

The good news is that air is easy to purify because it is quite transparent to UV-C, allowing it to penetrate and kill floating pathogens. Direct irradiation methods can be used based on ceiling mounted lamps which are energised when the room is unoccupied. Upward radiation mounted safely above eye level, or concealed downward radiation to disinfect floors may under some circumstances be used when people are present. Alternatively, UV-C germicidal lamps may be mounted within air ducts of a ventilation system which has the advantage that higher UV-C doses can be given because the lamps are out of view – but the disadvantage that since the air is generally moving fast, it flies past the lamps quickly and is irradiated

1 Rapid and complete inactivation of SARS-CoV-2 by ultraviolet-C radiation, Research Square, September 2020

2 Global Lighting Association Paper September 2020 'Germicidal Irradiation, Sources, Products and Applications



for less time. Portable standalone units which draw air in, disinfect it and then expel clean air into the room are becoming increasingly popular. The optimum technique depends on many factors, but since the latter two do not allow escape of any radiation they are considered entirely safe, and can be applied beneficially in nearly all cases.

Pathogens can survive on surfaces for anything from a number of hours to a number of days, depending largely on the material the surface is made from and its roughness. Cleaning physically removes dirt, organic matter and most micro-organisms from surfaces, but does not always destroy them. Therefore in some locations, such as hospitals, doctors' surgeries and offices, it may be important to use a secondary method of surface disinfection such as UV-C direct irradiation. This could be via UV-C robots, open UV-C luminaires, cabinets or a hand-held device. It is important to note that similar to when light from a window creates shadows when there are objects in front of it, the same happens when treating areas with UV-C rays. Areas such as seats which are under the desk, areas underneath office equipment etc. will not be reached by UV-C radiation and there will be no benefit. Therefore UV-C surface disinfection should only be seen as supplementary to chemical cleaning and air purification, but by no means a replacement for that.

One other area where UV-C is currently used is in the disinfection of water. Clean water is needed not just for drinking but for sanitation and recreational purposes. UV-C technology is often the most effective, cost-efficient and ecologically friendly mechanism for water disinfection.

Recently there have been a few negative articles about the safety of UV-C light and therefore it is important to stress that UV-C disinfection is safe, but only with the correct safety protocols in place. Yes, in the case of high UV-C irradiance levels, direct exposure is harmful to humans or animals. However standards and industry guidelines outline the information and safeguards manufacturers must provide to ensure people's safety and address foreseeable misuse. Most UV-C disinfection devices produced by reputable companies have many of the following: Instruction manual and training, timer-control and equipment safeguards (such as a motion sensor). It is therefore important to source UV-C products from companies with a proven expertise in Germicidal technologies, such as Sylvania Lighting, which will have undertaken rigorous testing and included effective safeguard features in their products[3].

As we move through 2021 and the global vaccination programme, we are a step closer to the end of the pandemic. However one aspect is clear, there will be a sustained increase in the use of UV-C disinfection in the world around us. For more information: **UV-C@sylvania-lighting.com**

3 Global Lighting Association Paper May 2020 'UV-C Safety Guidelines'

AVOID EXCESS ELECTRICITY BILLS DURING COVID-19 CLOSURES

Steve Gardner, Managing Director, EcolightingUK

The onset of COVID-19 has impacted businesses in ways never experienced before. From grappling with remote working to rolling out company-wide testing measures, businesses have had to adopt immediate agility in order to overcome the various challenges presented by the pandemic.

In the midst of these unprecedented obstacles, the UK economy is currently experiencing a 9.7% drop compared to pre-pandemic levels. Businesses have undoubtedly been hard hit by the virus, but a recent article found that some companies could be set to pay over £1million in unused electricity while closed due to lockdown measures.

With new restrictions that mirror the strict lockdown in March 2020 recently implemented by the UK Government, the issue of unused electricity leading to substantial bills could become an added concern for businesses that are already struggling.

Businesses aren't always aware of the types of energy-saving solutions available to them, and are missing out on systems and grants that could help to significantly reduce the financial cost and environmental impact that is contributed to by a rise in unused electricity. From government schemes to just choosing the right solution for a building, help is available to get businesses on the road to the UK's net zero target as well as ensuring no extra money is being spent on electricity bills.

With lockdown measures becoming a staple for most businesses over the last 12 months, many companies have spent a lot of time not trading, with a high percentage of these having to close abruptly during the first lockdown resulting in them not being given the opportunity to review their current energy contracts. There are many outdated usage agreements with energy suppliers still being used by thousands of companies which are charging businesses for their estimated use of electricity based on meter readings, previous usage or both, says Co-op SEO Steve Murrells.

Businesses have to use a certain percentage of their estimated annual consumption or face penalties, for both under-use or overuse, because of a small print clause known as 'volume tolerances' generally found in energy supply contracts. Very often businesses remain locked in such contracts in fear of paying a penalty, but also could be paying for unused energy without even realising it. With this in mind, businesses are being urged to not only review their current contracts but also to make the switch to more energy efficient systems.

In addition to substantial economic benefits, making the switch to LED lighting provides a sustainable contribution towards the fulfilment of long-term environmental objectives for all businesses. Significantly lower energy consumption means a reduced carbon footprint and less impact on the environment, and creates a lighter and brighter working environment with improved visibility for employees.

Aside from the financial and environmental factors, the most obvious and instant benefit of LED lighting is the quality. They also allow companies to save in excess of 70% in lighting energy costs, significantly reduce the cost of carbon tax as well as lowering maintenance costs, and depending on the grants available to them, companies can expect to see massive energy savings, with it now easy to achieve 50% to 80% energy savings on most projects leading to a fast return on investment, often in just 18 months.

Grants vary depending on the authority but can be as high as 60%, and whilst often capped this can be as much as £50,000, which can outweigh any penalties that could occur from exiting an energy contract early.

Introducing smart systems is also a good way to monitor and control how much electricity is being used and allows users to access the systems from their mobile devices, so they aren't required to be on site in order to manage consumption. Smart systems follow schedules and make decisions, and when operated alongside the right energy plan can still help businesses save thousands even when they aren't able to open their doors.

In what has been an extremely unprecedented and difficult year for everyone, there have been many challenges that have surfaced that weren't even on the radar for many businesses 12 months ago. By taking the time to research local and national finance grants for your business sector and investing in upgrading the onsite electrical equipment to include sensors, smart lighting and energy efficient systems, companies are given the peace of mind that they are doing what they can to save money on their bills when so much else is still uncertain. **https://ecolightinguk.com/**

COGENERATION: A FUTURE-PROOF SOLUTION FOR PUBLIC BUILDINGS

Will public buildings still be counting on cogeneration as an important energy efficiency solution to lower their emissions and energy bills in the future? Will combined heat and power generation play a significant role for the building sector in reaching carbon neutrality?

Cogeneration, also known as combined heat and power (CHP), has been an excellent solution for industry and public buildings to reduce their energy bills and emissions. A CHP unit can reach much higher efficiencies than a separate power generator and heating boiler by combining power and heat generation in one unit. In other terms, you need less fuel for the same amount of energy output.

Hospitals, businesses and district heating systems have been relying on cogeneration for decades to cut their use of fossil fuels. However, as the world is looking for alternatives to fossil fuels to counter climate change, is there any future left for cogeneration?

The answer is simple: Yes! The cogeneration sector has put tremendous investments in preparing its systems for the fuels of the future. CHP systems can run now on greens gases and biofuels such as hydrogen and biomass. Furthermore, CHP systems can maintain the same high levels of efficiency when running on carbon neutral fuels. Today, more than 30% of the fuels used in cogeneration are renewable.

As Europe is striving to reach carbon neutrality by 2050, different green technologies and solutions are tested and implemented. Wind and solar power are being ramped up, buildings upgraded, heat pumps installed, and electrical vehicles introduced.

COGEN Europe asked consultancy Artelys to calculate if there is a place left for cogeneration in a 2050 decarbonised society. Will the high efficiencies of CHP still pay off vis-à-vis other decarbonisation technologies, both for the end-user as well as for the energy system?

The Artelys study based its calculations on two decarbonisation pathways outlined by the European Commission in 2018. The study finds that in both scenarios, cogeneration will bring cost reductions

to the end-user and will help to integrate different decarbonisation solutions at system's level.

For example, a hospital can save up to 50.000 euros per year on its energy bills if it installs a CHP unit running on green gas. The CHP unit will run to produce power for the hospital with heat as a valuable side product. Combined with a heat storage unit and a peak boiler, this will be a very efficient heating system for a larger building needing a constant supply of reliable energy.

Moreover, these cost savings do not include the savings from avoided taxes and levies, as well as from avoided network tariffs as no or little electricity will have to be bought from the grid. In the future, cogeneration units might be remunerated for their services to the distribution grid. Thanks to their flexibility, on-site cogeneration can generate electricity for the grid when outputs from wind a solar are insufficient to cover current power demands.

It is expected that buildings with a similar energy profile as a hospital, such as large office spaces, schools, and universities, will enjoy the same benefits. The study also finds that residential areas and industry will continue to benefit from cogeneration in a carbon neutral society.

A single house can save 800 euro every year by installing a domestic cogeneration unit powered by hydrogen and fuel cells. A district heating network can save up to 3 million euro annually when running on renewable cogeneration. Depending on its size, industry can cut its annual energy bill by 1.7 to 10 million euro.

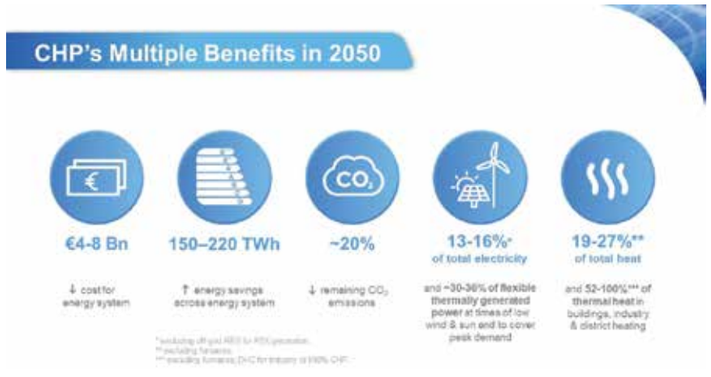
Artelys calculated that cost reductions for the European energy sector vary between 4 and 8 billion euro every year thanks to the energy savings from cogeneration. These energy savings can amount to 220 TWh. Furthermore, the share of cogeneration in the electricity mix will be between 13% and 16%, and in the heat mix between 19% and 27%.

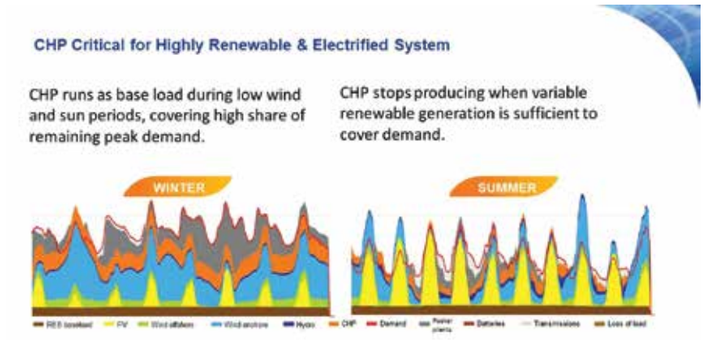
The largest system benefit of cogeneration is that a CHP unit can run at any time. The flexibility cogeneration provides will be invaluable in an electrified system dominated by variable power generation from wind and sun. Alongside batteries, hydro storage and demand-side management, cogeneration will guarantee that electricity supply and demand are in balance. As shown in the graph below, this will be especially relevant when in winter heat pumps will demand extra electricity.

The Artelys study concludes that cogeneration will accelerate the energy transition. By providing sufficient flexibility to the system, the uptake of additional variable power generation will be facilitated. Moreover, the efficient generation of heat and power will continue to translate into significant cost reductions for the users and the system as a whole.

Electrification, renewable energy and efficiency will direct our society towards a successful decarbonisation pathway. As demonstrated by the study, in many cases cogeneration will be the preferred option to decarbonise a building. Therefore, cogeneration will play a crucial role today and tomorrow.

https://www.cogeneurope.eu/





PREPARING OLD SYSTEMS FOR NEW BOILERS: THE ART OF SEPARATION

Energy-efficient boilers are now the industry standard. Many of these are only compatible with modern pressurised systems. In contrast to this, open vented heating systems were common back in the day. This can be a problem when refurbishing them and that's why finding a solution to 'bridge the gap' between old and new is necessary. An example of good practice is hydraulic separation between the primary circuit (with the boiler(s)) and secondary circuit (existing old pipework). In this article, Andrew Dabin, Product Manager for Hamworthy Heating takes a look at different methods to achieve this.

The use of a no flow boiler with twin return connections can combine low temperature (e. g. underfloor heating) and high temperature heating circuits.

ASSESSING PRIMARY CIRCUIT DESIGN

A first point of examination is the condition and size of current pipework. For best performance and efficiency such as enabling the required lower return temperatures for condensing operation, alterations need to be considered. When it comes to the water flow around the system, it is necessary to take into account whether the boiler has an integral pump and if a primary circuit pump is required. Does the current pipework's flow capacity match the primary/shunt pump minimum requirements?

Possible consequences of an inadequate flow rate are not only annoying for the client but can also be costly: A broken heat cell due to an insufficient water flow costs thousand to repair, a scaled up heat exchanger causes efficiency losses and longer heat-up times as well as a shorter life expectancy. As commercial boilers are a large capital investment, it makes sense considering what they are linked to.

KEEPING EQUIPMENT SAFE

How are you going to protect your boilers? It is worth considering the installation of 1) a dosing pot for introducing chemicals (to e.g. prevent corrosion) into the system, 2) an air and dirt separator to remove air bubbles and dirt particles and 3) strainers to catch debris. The next step is choosing how to connect to the secondary circuit.

SPOILT FOR CHOICE

There are several ways to achieve this: via low loss header arrangements, plate heat exchangers or the use of a no flow boiler.

LOW LOSS HEADERS

Low loss headers are also referred to as common headers and are available as different types: horizontal, vertical and some have dual action with combined air and dirt separators.

Using a low loss header in a heating system ensures adequate flow, resistance and temperature around the primary circuit, while flow rates and temperatures

A plate heat exchanger delivers 'full' hydraulic separation and protects equipment from debris and pressure.

in the secondary circuit may vary. Another benefit when using a vertical low loss header is the low flow velocity allowing sludge to sink to the bottom which can then easily be removed from the system via a trap. They are often supplied as part of a package directly from a manufacturer correctly sized to suit the chosen boiler's connections.

However, alteration costs on an old heating system to include a low loss header or buffer vessel can speak against this choice. Other factors could be space requirements and an insufficient number of ports (depending on how many heating circuits you want to connect to it).

PLATE HEAT EXCHANGERS

Plate heat exchangers provide hydraulic separation of heating circuits and protect new boilers from dirt and debris from an existing secondary circuit, as the water does not mix. Several types of heat exchangers are available. While brazed heat exchangers can't be taken apart, most can be cleaned. Gasketed types can be fully maintained and increased in duty (depending on the frame size) for future extension of the heating circuit. Domestic hot water plate exchangers are solely for the purpose of providing hot water – hence for a different temperature profile and different controls.

Benefits include the protection of boilers through separation which prolong their life. A reduced amount of water in the primary circuit means treatment becomes cheaper (less chemicals used). Additionally, they provide pressure protection.

Downsides are space issues when both heating circuits are pressurised, and two pressurisation units needed. While it is common practice to use several boilers to prevent a single point of failure, only using one plate heat exchanger would reintroduce this risk. The use of high micron filters to catch debris in the system and additional maintenance are also recommended.

NO FLOW BOILERS

A no flow boiler on the primary circuit is non-dependent on the secondary circuit flow for safe operation. Instead, an internal variable speed circulation circuit ensures water movement when circuit pumps are off or set to low. Furthermore, it uses differential temperature supervision to control the output power for safe operation. The high water content in a no flow boiler equals high thermal mass which allows it to fire without flow and without risk of overheating. Once the control stat stops the boiler, the thermal mass safely absorbs residual heat. These types of boilers often have dedicated return connections for low temperature and high temperature heating circuits to ensure maximum efficiency can be obtained.

The main benefit of installing a no flow boiler is that it removes the need to install it in a dedicated primary circuit as well as the installation of additional equipment such as low loss header, plate heat exchanger and pumps. Thanks to its high water capacity, it can operate with wide differential temperatures and the twin return connection allows maximum

A low loss header ensures adequate flow, resistance and temperature around the primary circuit, while flow rates and temperatures in the secondary circuit may vary.

operating efficiency. High and low temperature circuits connect to dedicated heat exchanger return connections.

What speaks against choosing a no flow boiler is the required flow isolation through non-firing boilers. This helps the system pumps to modulate which ensures flow through the firing boiler. Isolating any non-firing boiler in any system is good practice. Furthermore, the boiler should not be operating using its own thermostats or integral temperature controls but instead be integrated using a sequence controller or building management system. This improves overall boiler control for many boiler types. Space limitations (access) and weight must be taken into consideration with this option.

THE CHOICE IS YOURS

Which method of hydraulic separation is preferable will be mostly determined by available plant room space, time, and budget.

Depending on the choice, other considerations would be low loss header/ heat exchanger sizing, type of pump(s) used and if a reverse return is required.

On the one hand, hydraulic separation can be achieved by using low loss header or heat exchanger. This offers flexibility, as this equipment is optional. On the other hand, opting for a no flow boiler means the most integral part of the heating system determines the remaining design considerations.

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RESPONSIVE CONSUMPTION FORECASTING

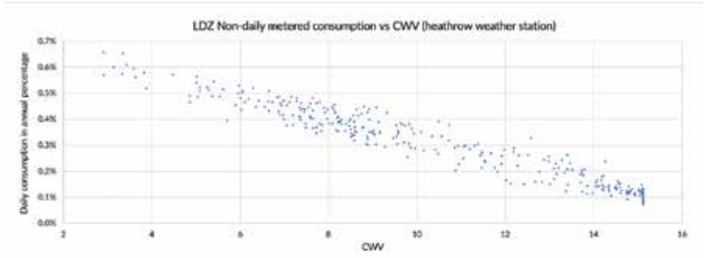
COVID19 has materially changed the level of focus applied to energy consumption forecasting. Invariably the pandemic is driving the requirement for many organisations to re-forecast, and we are finding that this is having to be undertaken on a much more frequent basis due to the heightened levels of uncertainty organisations are currently experiencing.

The consumption forecast forms the basis of an organisation's energy budget. Any change of consumption forecast will therefore directly impact an organisation's financial forecast/budget, which will itself require reforecasting to ensure the correct financial resources are allocated. Budget forecasting and reforecasting are best undertaken on a platform which offers meter level granularity in order to improve forecast accuracy and to automate workload.

Significant price risk management and hedging implications also result from volume forecast changes. From a strategy perspective – an organisation may need to change its stance on hedging, perhaps moving away from trading its entire forecast volume months/years in advance, leaving a proportion open to maintain some flexibility - but this change will have implications which require consideration and modelling etc. Secondly, from a trading perspective, the revised forecast may require costly corrective trades to be placed and it is highly desirable to avoid this where possible

The supplier's perspective must not be forgotten either. It is in the supplier's interest for consumption forecasts to be accurate. Inaccuracy will lead to additional cost. This extra cost invariably finds its way onto the customer's bill – in the simplest form via the volume tolerance clause.

For the reasons outlined previously (amongst many others) it is imperative that energy teams proactively monitor actual consumption against forecast consumption and keep a constant eye on contractual volume clauses. A basic framework of consumption forecasting can be established by normalising the energy usage with historical operating activities and weather conditions. Based on the types of business, the operating activities can be captured by different variables such as operating hours (office), footfall (retail) or production (manufacturing). Commonly, weather condition is proxied by Heating Degree Days (HDD), Cooling Degree Days (CDD) and/or Composite Weather Variable (CWV). Figure 1 shows a linear relationship between LDZ non-daily metered demand and CWV and indicates that CWV can explain approximate 95 percent variation of the demand.



After the normalised consumption is generated, it is vital to check if parameters used for forecasting need to be finetuned due to the change of current conditions, such as the substitution for high energy-consuming machines or upgrades of a HVAC system. In order to do this effectively, an organisation needs a platform which tracks actual consumption data against the consumption forecast. Ideally the platform will track actual consumption against forecast on a daily basis. Any discrepancy implies possible parameters adjustment. The platform should therefore provide automated key stakeholder alerts where consumption is atypical, or there is a risk of triggering a tolerance clause. Additionally, it is important to be able to quickly identify which sites and meters are over or under consuming to speed up cause identification.

CONCLUSION

COVID19 is causing organisations to re-forecast consumption on a more regular basis - creating consequences for existing energy budgets and hedging strategies. Energy teams should consider engaging stakeholders to develop a basic framework of consumption forecasting by normalising the energy usage and adapting any on-going changes to improve consumption forecast accuracy.

The proactive monitoring of actual consumption against the forecast is now imperative. In order to effectively monitor forecast accuracy, an organisation needs a digitalised platform which tracks actual consumption data at meter level against the consumption forecast, alerting key stakeholders automatically so that any variance can be investigated and resolved.

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