**Back in 2014 a Dutch firm called Switch Datacenters bought the AMS2 data centre in Woerden, just south of Amsterdam, from the Dutch bank ABN AMRO.**

**It’s a big old unit, with a footprint of more than five thousand square metres or almost sixty thousand square feet. Up until that point, ABN AMRO had been using industrial air conditioning units to cool down their servers. AC units are extremely energy hungry and, as we’ve explored in previous videos, they’re already, and will increasingly be, a major contributor to our growing greenhouse gas emissions crisis.**

**While they were doing all that expensive, carbon heavy, processor cooling, ABN AMRO were also running gas generator units to heat up all their offices and service buildings.**

**Now, I don’t know if you’ve spotted the slight flaw in this strategy, but if not, let me help you. You see, it’s all to do with a concept known as ‘complete insanity’.**

**ABN AMRO weren’t unique of course. The same madness has, until fairly recently, been pretty much standard in the vast majority of data centres, and for that matter the vast majority of industrial processing plants, all over the planet.**

**What WOULD my hero of lateral thinking, Edward de Bono, have said to those operators?**

**Well, he’d have probably said the same thing you’re shouting at the screen right now…**

**Why not find a way of capturing all that process heat and do something a bit more useful with it?**

**I agree. And so do the new owners of the AMS2 datacentre, who have now implemented a system to do just that. And it’s not just Switch Datacenters who have apparently experienced the epiphanically blinding light of the epically blindingly obvious. The EU has been running projects to find solutions to this major climate issue for several years, as has the US National Renewable Energy Laboratory and many other academic and commercial enterprises around the globe.**

**So, I guess the question is, how close are we to fixing the problem?**

**Hello and welcome to Just Have a Think.**

**Back in 2016 an energy industry consultant called Mark Monroe wrote an article in which he summed up, rather well, what it is that data centres do**

**Now it would of course be very easy for me to just steal the words in his summary paragraph and use them to kick off this video.**

**So, that’s what I’ll do**

**It says this**

**“Data centres worldwide are energy transformation devices. They draw in raw electric power on one side, spin a few electrons around, spit out a bit of useful work, and then shed more than 98 percent of the electricity as not-so-useful low-grade heat energy.”**

**And that’s because reusing that heat is not quite as straightforward as you might think. First of all, most data centres have historically used air to cool things down, and that tends to result in relatively low temperatures of around twenty-eight to thirty-five degrees Celsius.**

**And that heat is expensive to move around. Mark Monroe calculated the piping required to share heat with a facility a quarter of a mile away could add a quarter of a million dollars to the cost of a data centre construction project. And data centres have often been located a long way from anything that can actually do something useful with their second-hand energy.**

**But things are changing as we all move towards a greater level of environmental and energy efficiency consciousness.**

**In Denmark for example, Facebook has secured a tie-up between its facility in Odense and a local district heating company called Fjernvarme Fyn, to recycle their waste heat. The warm air is directed over a coil filled with water. The air heats up the water, and the warm water is then piped across the street to a heat pump which pushes the temperature up to more than seventy degrees Celsius before sending it into the district heating system.**

**Heat pumps have coefficients of power, or COPs as high as six. In other words, for every unit of electrical energy you put in, you get six units of energy out. That’s because the fuel you’re using is the free energy in fresh air.**

**Monroe reckons a profit can be made from investing in one of these systems. He calculated back in twenty sixteen that a one-point-two megawatt data centre selling all of its waste heat could make more than three hundred and fifty-thousand dollars a year, which could be as much as fourteen percent of the annual gross rental income from the data centre. And, much more importantly, it’d save six thousand metric tonnes of CO2 per year.**

**In twenty-twenty one there were seven point two million data centres in the world, so it’s not hard to see how the potential CO2 emissions reduction from these heat recovery systems could become very significant indeed.**

**The Facebook Odense scheme alone is expected to recover about a hundred thousand megawatt-hours of energy per year, which is enough to heat almost seven thousand local homes.**

**Switch Datacenters, who I mentioned at the start of the video, has opted for a slightly different heat recovery system called direct liquid cooling or DLC.**

**Rather than using air to cool servers, DLC uses**[**liquid-cooled**](https://www.datacenterdynamics.com/en/news/dcdkeeping-it-cool-liquid-cooling-coming/)**heat sinks to transfer heat away from components. The water reaches temperatures of sixty degrees Celsius, which is hot enough to be sent directly into nearby properties without the need for a heat pump. The heat gets used by the properties, which in this case includes a neighbouring hospital, and the water can then be recirculated back to the data centre without any additional cooling.**

**Switch reckons that ninety seven percent of the server heat will be captured and delivered to two thousand homes and offices, plus the hospital, and those customers will get a 20-30 percent discount on their power costs.**

**The Netherlands actually has legislation called the “Nearly Energy Neutral Building Rules”, known as BENG. The BENG rules requires all new buildings to be almost energy-neutral. That law suddenly makes residual heat from data centres look even more valuable to developers. It’s a good example of how governments can ‘gently’ nudge the commercial sector into doing the right thing sooner rather than later.**

**Not many data centres have large, conveniently located campuses or district heating schemes right next door though. And of course, heat energy is not always required by consumers at the point when it’s generated by a producer.**

**So, a great deal of development work has been taking place to find effective ways to effectively capture AND store waste heat that can then be drawn down as required at a later time.**

**And here’s where we can add the industrial sector to our potential carbon footprint reduction. Total global industrial energy use was just short of ten thousand terawatt hours in twenty eighteen.**

**According to this article from the European Commission, that equates to thirty seven percent of total global final energy use and twenty four percent of global emissions. Between twenty and fifty percent of that energy is lost as hot exhaust gases, cooling water, and heat losses from equipment and products.**

**A research team from Eindhoven University of Technology, has developed what they describe as a cheap, compact battery system for domestic use, that could be a game-changer for the energy transition.**

**They all say that though, don’t they? But, in fairness, this one’s based on the pretty well-established thermochemical principle of adding water to salt to produce heat, AND conversely using heat to evaporate water from salt, effectively storing heat energy inside the salt itself ready to be liberated whenever required. The system is specifically aimed at utilising waste heat from factories and data centres using the tried and tested configuration of a heat exchanger, a fan, an evaporator/ condenser, plus a boiler containing salt particles.**

**The team built a small proof-of-concept model capable of providing heating for an average family of four for two days, and they’ve now upgraded that to a fully working prototype, which I have to say is slightly alarmingly large, but I guess would fit in a basement or a large garage should you be fortunate enough to own such spaces. If you do though, then a set up this size would provide heat for your home for up to two months. Enough to get you through the depths of winter.**

**Here in the UK, a project led by Swansea University and the Active Building Centre Research Programme is being funded by the governments Department for Business, Energy and Industrial Strategy, or BEIS through its Longer Duration Energy Storage Demonstration programme, which itself is part of a one-billion pound initiative called the Net Zero Innovation Portfolio or NZIP.**

**The project is called Adsorb, which is of course, yet another catchy acronym. This one stands for ‘Advanced Distributed Storage for grid Benefit’.**

**They’re looking at Thermochemical Storage or TCS, systems similar to the salt storage developed in Eindhoven, and they’re also pursuing Phase Change Materials or PCMs.**

**A PCM system would use waste heat to transition a solid material into its liquid form, effectively storing latent heat for several days.**

**These sorts of systems have the potential to provide day-to-day storage of thermal energy at densities far greater than traditional technologies. Releasing heat for hot water or space heating simply by pumping lower temperature water through the system.**

**The majority of the global population already lives in urban areas and already accounts for about seventy percent of total primary energy usage. That’s projected to hit seventy five percent by 2030. We already know that renewable sources like wind and solar coupled with energy storage systems will most likely be the predominant form of energy provision for those towns and cities. But, if planners and architects can get the locations and logistics of new data centres and industrial facilities right, AND find innovative ways to convert existing facilities so that they can recirculate their waste heat into city centres and suburbs, then they could provide some useful additional income to commercial operators and also play a crucial role in reducing our overall energy consumption and greenhouse gas emissions.**

**Now, this sort of research has been going on for some years now, so no doubt there are plenty of you good folks who have some experience of these systems. If that’s you, or if you have views on how these systems could best be integrated into our urban environments, then why not jump down to the comments sections below and leave your thoughts there.**

**That’s it for this week though. Thanks, as always to our amazing Patreon supporters who keep this channel one hundred percent independent and completely ad free. And I must just give a shout out the folks who’ve joined recently with pledges of ten dollars or more a month. They are**

**Colin Brooks**

**Archer Sully**

**Jack Liu**

**Michael Langford**

**Steve Hall**

**David Burman**

**Michael Cohen**

**Paul Nuzzi**

**James McKie**

**and**

**Alice Tulloch**

**And of course, a huge thank you to everyone else who’s joined since last time too.**

**If you feel like you could support the channel for the price of a coffee each month and keep me making these videos every Sunday, then you can find out how to do that by following the link in the description to**

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**As always, thanks very much for watching, have a great week, and remember to Just Have a Think.
See you next week**