Decarbonisation

– Does it change our HVAC&R design and installation practise?

If our focus is already on realising (Nearly) Zero Energy Buildings (NZEB), changing this focus to Zero Emission Buildings (ZEB) may not seem a fundamental change. But this is very depending on the energy carriers we still continue to use to cover the limited amount of energy we still need to run our HVAC&R systems.

This limited amount of energy should come from renewable sources, which may be available at central or local energy grid level or produced at the building site. If this is the case, we have an operational ZEB building as the embedded carbon emission is not yet part of this equation.

For new or deeply renovated buildings this may be achievable till a certain extent. Until today most of these assessments are made on yearly basis. But we know that the availability of sustainable energy is not the same all year around. This is already clearly demonstrated with the negative kWh pricing on sunny and windy days. The traditional way we operate our buildings causes peak demands during certain hours which is also influenced by the season and climate. To overcome this, our systems have to take care of energy storage in whatever way: thermal (heat and cold) or electric.

For NZEB and ZEB buildings this may be possible to realise and could even be cost-effective given the expected fluctuating energy prices. Energy prices fluctuating on hourly and even sub-hourly basis. Energy suppliers will be required to inform their consumers on hourly or sub-hourly basis on the price and carbon (CO_{2eq}) emission of the delivered energy. This carbon footprint stamp (and connected pricing) has to be used by our HVAC&R systems to act and operate. This means that in the near future building systems have to be able to communicate with the energy grid (electric or even thermal) to decide which systems can temporarily switched down or which storage should be accessed. Our building systems should become smart and a first step in that direction is the inclusion of the Smart Readiness Indicator (SRI) in the expected new EPBD. Already well-known concepts like peak-shaving become again part of our system design.

To be able to check if the HVAC&R systems where energy storage is a part of these systems can operate to certify it as a ZEB building, an hourly (or in some cases sub-hourly) calculation procedure is needed. Important input data like the climate, user pattern and expected (contracted) carbon footprint of the delivered energy carriers should also be available on hourly or sub-hourly basis. This may sound as wishful thinking but it is the only way to achieve a decarbonised building stock (on operational basis) by 2050. If we cannot achieve this on short term for our new and deeply renovated buildings, we will not be able to achieve our 2050 zero target.

If the energy storage issue should be solved at building level is an open question. In many cases it seems a logical task for the energy (thermal and/or electric) grid provider. If the grid interaction is managed by the local or central grid provider this can only be successful at a grand scale if the HVAC&R systems in buildings are able to interact. This grid and building system interaction has to result in a zero-carbon footprint of the HVAC&R operation without compromising the Indoor Environmental Quality (IEQ) and other user needs like the Domestic Hot Water and energy for non-EPB uses, which will grow in percentage in NZEB and ZEB buildings.

What to do with the existing building stock? If we are able to reach the 3% renovation target and assume that all renovation will step by step lead to deep renovation before 2050, the decarbonisation target can be achieved. The current situation in many European countries is that we lack the working force and professional capacity. As mentioned in the expected new EPBD, also tackling energy poverty and worst-performing buildings towards healthy housing/buildings will be an enormous challenge. Even if the financial barriers are overcome, capacity building will be the biggest challenge for the HVAC&R professional sector.

Apart from all these technical capacity and financial barriers, the issue of sharing building user data with 3rd parties as grid providers has to be regulated to safeguard the privacy of building users in line with the EU General Data Protection Regulation (GDPR).

With these observations I was very limited, I ignored the Life-cycle Global Warming Potential (GWP) due to the production, maintenance and decommissioning of the HVAC&R systems and the building as such. Addressing this requires more skills and capacity building, REHVA Education and Training Committee (ETC) is considering to address these issues in the near future as well. ■

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