

Decarbonisation technologies are the solution to the engineering question



Ireland has committed to reducing its greenhouse gas emissions from the energy sector by at least 80% by the year 2050. In an effort to achieve this, the Government has set decarbonisation of the grid as a priority, and so is promoting electricity as a primary power source for the heat and transport sectors, writes *Gerard Keating, Chartered Engineer and Director at Homan O'Brien (inset).*

In general, the most effective way to meet the requirements of NZEB is with air-to-water heat pumps augmented by PV panels. This will differ, however, depending on the specific requirements of any given project.

Electric Ireland is a green electricity provider and with decarbonisation at the root of all of these new standards and targets, ESB has set further ambitious targets for 2020 and further to 2050. Ireland has set out reduction objectives from 38Mt of greenhouse gases in 2016 to less than 6Mt in 2050.

Heat pumps and electric vehicles will deliver immediate and longer-term solutions to Ireland's carbon reduction

challenge. By 2050, it is envisaged that 60% of households will have a heat pump and that electric vehicles will account for 60% of new car sales by 2030.

On foot of the increasing demand for large multiples of electric vehicle (EV) charging points and large heat pump schemes, Homan O'Brien recently met with key ESB staff to discuss the coincident implications of large-scale heat pump technology and electric vehicles on their network. The aim was to discuss how we can work together from a design perspective, and to review "After Diversity Max Demand" (ADMD) numbers. For particular projects engineering consultants should

consult local ESB Networks Design.

These still relatively new technologies present challenges to the ESB networks, and to the MV/LV infrastructure designer. The issues are many and varied, and include harmonics as a result of VSDs on heat pumps, and metering and aggregation for EVs.

Heat pumps

Heat pumps operating within a group control scheme can have an immediate reaction to very low external temperatures. Sudden and collective operation of heat pumps would cause disturbance on the grid and potential for voltage dips. This is an area where solutions that use artificial intelligence

and smart algorithms that can control and optimise when flexible assets use energy come in to their own. They are already in use internationally and, while not widespread here yet, are the type of smart grid control that may be a solution for group schemes going forward.

Another area of concern to Homan O'Brien is the mechanical operation of the heat pump technology. In large-scale developments the utilised Coefficient of Performance (COP) figures which are used in our computational models deliver an optimum solution based on a leaving water temperature set-point for ASHPs of 45°C. Should this temperature increase the COP would be less efficient and the power demand would be increased.

Other complications experienced on networks to date are from heat pump variable speed drives. These are causing harmonic distortion affecting the grid and showing high neutral currents. At lower input power levels, some of the inverter-driven heat pumps produce high harmonic current levels. Power monitoring and conditioning equipment will be required on large developments and local filters would also be recommended.

Electric vehicles and EV aggregators

Homan O'Brien has received an ever-increasing number of requests for EV aggregators. Where only a few were requested last year, an average of one per apartment is being requested by developers and local authorities. "EV Ready" is the new catchphrase of letting agents.

The provision of EV charging points should be carefully designed. This should be offered via a dedicated metering CT at approximated MIC/MD with an initial moderate kVA, rising to increased levels should there be higher than expected take-up. This CT would be assigned under an AFD Policy to an Aggregator (landlord or management company). The preferred solution is EV

aggregation and dynamic load management systems, preferably open protocol, for smart-charging of EVs.

The powering of electric vehicles from individual apartment consumer units would be in breach of ETCI National Rules for Electrical Installations, Fourth Edition, particularly around equipotential bonding, circuit protection under fault conditions, and operating an electrical supply external to owner's demise (legal implications).

Homan O'Brien suggests

In the light of the foregoing Homan O'Brien suggests the following:

- Diversity of 0.85 allowable on heat pumps for commercial projects;
- Allowance of 5.5kW for a dwelling with a heat pump;
- Allowance of 5kW for an apartment with a heat pump
- Possibility of 2nd ESB meter in dwellings/apartment complexes for EV, if requested, to allow for separate provider under current policy as an option;
- Diversity of 1 (No Diversity) on EVs at a value of 1.7kW/unit to be developed further over the coming years following review;
- Smart grid control to level out afternoon valley in demand. This is currently under review;
- Recommend 30% MIC connection for EVs with the infrastructure capable of increasing to 100% load;

- Additional equipotential bonding requirements required for ETCI compliance if EV's located in basements. Discussion with ESBN planning required;
- Dynamic load management systems for EVs.

Going forward, decarbonisation technologies are undoubtedly the solution to the engineering question. ■

References

[1] Minister for Communications, Climate Action and the Environment Denis Naughten; Minister Naughten announces increased funding for home and community energy upgrades and new grants for families in Turf Cutting Compensation Scheme.

"Ireland has committed to reducing its greenhouse gas emission by at least 80% 2050. Our current emissions arise from how we heat our homes and businesses, how we transport ourselves and our goods around the country and how we generate our electricity".

[2] Pat O'Doherty, Chief Executive of ESB – Ireland's Low Carbon Future - Dimensions of a Solution .

"The future, as set out in (ESB) report "Ireland's Low Carbon Future - Dimensions of a Solution", includes a decarbonised electricity system providing the energy for the heat and transport sectors which will enable very different customer engagement through new technologies. Doing this successfully will address up to 60% of Ireland's total emissions providing, a brighter future for the communities and people we serve. ESB intends to lead that transition."

