Why risk profiling is key to making large-scale decarbonization financially executable

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For most building owners, the scale of investment required to make net-zero a reality is now unaffordable. Even when external financing is available, high-interest rates are frequently accompanied by a lack of capital. The reason for this is that projects are frequently viewed as a risk by building owners and project investors. Outside of engineering circles, the technical risk of decarbonization is poorly understood, and poor communication between stakeholders prevents adequate project costing explanations, leaving funding out of reach; this article explains why risk profiling is critical to making large-scale decarbonization financially feasible.

The phasing out of fossil-fuel-based heating is internationally recognized as fundamental to combating the climate crisis. For new city development projects, heat pump solutions have become the default alternative. But the situation is more challenging for existing building stock. Too often, large-scale infrastructure changes are required, which are not practical. If we are to keep global heating under 1.5°C, innovative technical and financial solutions will need to be adopted at scale.

The installation of heat pumps in conjunction with ultra-low temperature district heating and cooling systems, also known as 5GDHC, offer a way forward. Such projects support the large-scale energy transformation in dense urban areas for both new builds and retrofits. 5GDHC systems work by connecting several buildings with low-temperature water (typically 10-20°C) using one or several energy sources supplying the grid. This means that buildings in the grid area can easily access the best available energy source, maximizing space, flexibility, and energy efficiency. Each connected building has decentralized heat pumps installed to raise or lower the water temperature to the individually required level. This results in one infrastructure for both heating and cooling systems.

For the peak capacity demand hours, heat pumps connected to the grid can supply buildings with 70°C, making it easier to replace gas. Building energy efficiency measures can then be done gradually, thereby not impeding the shift to climate-neutral heating. Heat pumps and the thermal inertia of buildings are an untapped source of demand-side management potential, which is useful to balance the increasingly renewable and volatile electricity supply.

Step-by-step transformation of the built environment is possible with 5GDHC systems. Each building can be connected whenever suitable and local systems work very well autonomously with no need for coordination over large areas. But improving the way homes are heated is just one piece of the puzzle and must be considered in conjunction with energy efficiency projects and on-site renewable energy generation. Not only do joined-up projects accelerate decarbonization, helping building owners with legislative compliance, but they increase project Return of Investment (ROI) as the technologies work together in a synergistic ecosystem.

At the moment, the scale of investment required to make net-zero executable is prohibitive for most building owners. Even where external finance can be found, high-interest rates are too often coupled with insufficient funds. The reason for this lies in the fact projects are too often seen by building owners and project investors as a shot in the dark. The technical risk of decarbonization is little understood outside engineering circles, and poor communication between stakeholders prevents adequate explanation of project costing, leaving funding out of grasp.

In recent years, mathematical models have been developed that translate technical risks into financial ones. This makes projects understandable across the value chain, as well as enabling project performance to be guaranteed by third-party insurers. Such financial risk metrics are achieved through stochastic energy modeling. Here, multiple outcomes for a given retrofit option are mapped according to likelihood and magnitude. These account for the human 'chaotic' factor and the variable performance of technology to produce an 'as used' energy forecast. The risk of this can then be analyzed according to an insurer's criteria in preparation for underwriting.

Managing performance risk and enabling guaranteed cash flows is key to both convincing building owners in project success and attracting infrastructure capital. It also enables a multi-technology approach in which heat pumps act as a gateway for greater energy efficiency measures. Suppose such projects' predicted energy sav-

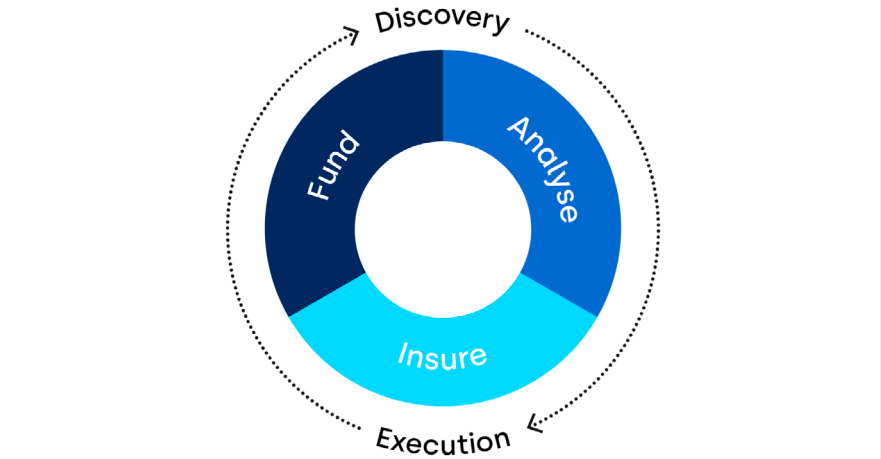

Figure 1: Positive feedback loop created for heat-pump driven retrofits through combining data analytics, insurance, and efficient funding.

ings could be insured. In that case, they can effectively pay for themselves, helping address the split incentive between landlord and residents prevalent in the social housing and private rented space.

But private finance is desperately needed for such retrofits due to the poor balance sheet capacity of landlords. Decarbonizing UK social housing stock alone, approximately 18% of all houses, will cost over £100 billion. While the British government has so far pledged £3.8 billion, private ESG (environmental, social and governance) infrastructure funds will be crucial to plugging the funding gap and helping the UK, as well as others, meet the terms of the Glasgow Climate Pact. The way to attract such funds is by quantifying, mitigating, and insuring heat pump technology in conjunction with other active and passive energy efficiency measures. Retrofit projects for thousand property portfolios have already been scoped using this methodology, with insurance and financing giving the green light.

The deployment of large-scale financing solutions for heat-pump driven retrofit projects is in an early phase but has significant opportunities to accelerate decarbonization in the built environment. Such solutions lead to the creation of positive feedback loops, where generated profits are poured back into green retrofits, which increases demand on the supply chain. As this happens, prices come down, resulting in economies of scale and greater ROI, in turn making projects more attractive to investors.

Thinking of decarbonization at scale will be fundamental to aligning supply chains and the training of employees. This issue is clearly seen in the UK, where heat pump installation is stymied by lack of workers and materials. According to an analysis by EY, there are currently only 1,200 heat pump installers in the UK. Given government targets, we should be aiming for 10,000 installers by 2025.

Combining innovative private financing and technology will make decarbonization financially executable. But initial projects will need to be authority-led, encouraged by government grants in conjunction with large-scale private finance, which is ready to go. Parallels can be drawn between the deployment of heat pumps in decarbonization projects and the progress of wind turbines over the past few decades.

The first development of utility-scale wind turbines was set up by NASA in the 1970s using government funding. Thirteen experimental turbines were erected. Inspired by their success, the creation of the world's first wind-farm went ahead in New Hampshire, US, with 20 turbines. Although this wind farm proved ineffective, it paved the way for many of the technologies used today. While government grants helped get wind power off the ground, the technology fundamentally had to stand on its own two feet with private capital to flourish. Today, the largest wind farm in the world consists of 7,000 turbines located in China, with a planned installed capacity of 20 GW.

The same journey will be true in the deployment of 5GDHC. Smaller, government-sponsored projects have already been achieved and show the trans-formative potential of this solution. Slowly but surely, the private sector is embracing these projects, made possible through risk analysis and mitigation. A domino effect is building. And once this happens, climate-neutral buildings will be financially possible at scale.

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https://doi.org/10.23697/f5qt-1233