ReDREAM
change your energy

3 Things about the energy transistion that's architects, home builders and decorators should now.

WHY THE ENERGY TRANSITION IS A CONCERN FOR YOU

As providers of builders, you play a fundamental role in the energy transitions. Buildings are the artefacts that consume more energy and thus play a central role in the energy transition.

The EU strategy for the energy transition aims to secure safe, green energy for all. The implementation of this model will ensure that we reach the target of decabornization which in turn will improve the health and sustainability of our societies. It will ensure social cohesion and resilience of our communities, which seems more important in view of recent geopolitical threats.

Buildings can contribute to the energy transition in four ways.

1. First, if they are designed and built so that less energy is used for climatization or lightening.
2. Second, if energy self-generation technologies such as PVs or residential windmills are embedded in buildings.
3. Third, if more efficient and clean technologies are used for climatization. Innovative heating systems such as geothermal or aerothermal are fundamental in this change. With these systems, the energy contained in the air that surrounds us is extracted to use it later by transferring it to rooms or running water. These systems are considered clean and efficient: an aerothermal heat pump uses 75% renewable energy and 25% electrical energy. Heat pumps and PVs is a winning combination in terms of efficiency.
4. Buildings designed only powered by electricity instead of using fossil fuels like gas for heating.

FURTHER BENEFITS OF THESE ENERGY TECHNOLOGIES FOR CUSTOMERS

Nonetheless, customers may not be willing to adopt these technologies: the cost of technology acquisition is high, and consumers may think that it is not worthy. However, they often ignore the further benefits they can get from acquiring and installing these technologies. Being knowledgeable of these benefits may help create a better selling proposition that reassures consumers of the advantages of investing in clean and efficient energy technologies.

If consumers self-produce their own energy, it may well be the case that they produce more than they consume. In this case, they can get further benefits by injecting this electricity into the grid and selling it at a price well below market price (if the country allows doing it). This can help reduce even further the energy costs and contribute to recover faster the investment.

They can also store their self-produced energy with ad hoc batteries. This stored energy can be later used when production is low to operate home appliances. However, the economy of scale makes grid-level batteries more appealing than distributed ones since the latter are more expensive. In addition, although batteries help to shift the surpluses of renewable energy, they create other negative environmental impacts, due to the chemical leakage from them. In short, batteries could help store energy but at the moment they do not seem a scalable and affordable solution. Beyond batteries, energy can be stored in electric vehicles (cars, bikes or motorbikes) or in other devices. For instance, thermal energy can be saved inside the building and later use it for heating or cooling the house: they actually work as an air battery. Thus, combining PVs with these electric vehicles will further help make the most of the produced energy.

A third alternative is to share this energy generated with other people, for example citizens near a city hall, the next-door neighbour or a nearby store. This last solution is named collective self-consumption and allows residential, industrial and commercial buildings to share the energy generated by themself with surrounding consumers. If neighbours sharing building form a community, they can give away to each other the energy they are not using and, reciprocally, receive the energy that their neighbours are not using. This last alternative is very efficient: because it is generated in the same place that is consumed, it avoids losses along the distribution network. It is also cheaper, because prosumers do not have to pay distribution and transmission fees. Public organizations can form part of these energy communities: you could give your surplus energy to the local school, the local library, or the local council. These establishments can use the donated energy to power the streetlamps, for instance. This would bring down their costs and liberate the budget for undertaking other projects that improve the quality of life of our communities.

NEW ENERGY SERVICES EMBEDDED IN BUILDINGS

As we increase the amount of self-produced green energy, we are going towards a model of distributed energy production. However, this model demands that we change the way in which energy is consumed. Renewable energies are clean, abundant, and cheaper to produce than brown energies. However, they are intermittent. This implies that the generation is not stable; when most users need a lot of energy (because we are all at home, with lights and heaters on, preparing our dinners in the oven) the produced energy may be insufficient for us all.

This intermittence of renewable energy demands a major change in how we consume energy. Consumers need to adopt a more active role for this new energy model to work. This new role is commonly referred to as demand response or flexibility. This label puts the emphasis on the fundamental change: consumers need to be flexible in their use of energy and need to respond to generation cycles.

Energy is different from other goods in that, so far, cannot be entirely stored. Moreover, demand and production need to match exactly every second. Ensuring this continuous match requires a very complex system that integrates a very large number of components, including sources of electricity generation with different sources of energy, forecasting algorithms that estimate the amount of available primary energy, transformation, electrical transmission and

distribution lines, electrical machines, protection, control and management systems, electrical circuits inside homes, businesses, and industries. All these components are interconnected making up what has been called the Electrical System.

Demand response or flexible demand is one of the elements of this new Electrical System. There are different ways in which demand response can enable synchronization of production and demand.

One way is through tariffs. The price of energy is greater when there is more demand, and cheaper when there is less demand. When there are more demand renewable energies may not be sufficient and we need to use “dirtier” sources of energy. So, at peaks energy production is more expensive because it is also more polluting.

Tariffs aim to shift demand from the peaks to the valleys, so to ensure that renewable production can meet the energy requirements of all.

However, tariffs may limitedly shift demand. A family with children will not cook dinner at midnight only because prices are cheaper, or energy is cleaner. Similarly, if you are working at home you cannot unplug your devices or switch off the heating. Our practices and daily chores limit our ability to shift demand.

Another alternative is to use smart plugs or smart devices. If users have a smart washing machine they can program the washing cycle for the time of the day when energy is cheaper. The same can be said for other appliances whose operation can be postponed or shifted, like charging your electric vehicle. This can be done at the times when energy is cheaper and cleaner.

Although smart devices can help users shift demand to synchronize with production, they demand consumers’ engagement: consumers need to be attentive to energy cycles and to plan in advance the operations of their appliances. This attention and planning may not be feasible for all consumers; they have enough work and family burdens to add this chore to everything else.

It seems that these two solutions demand too much involvement on the consumers’ side which limits the possibility of mainstreaming these alternatives to make the new energy model work.

There is a third way to synchronise demand and production: flexibility by design.

FLEXIBILITY BY DESIGN

Flexibility by design is enabled by technology. Most of the “fixed” appliances do not need to be on all the time to perform their function. For instance, a freezer does not need to be on 24/7. One could switch it off for shorter periods and it will not break down and the food will not be ruined.

Of course, consumers cannot be switching by themselves on and off their freezers or electrical heaters. They have better things to do. A potential solution is that technology makes this operation on their behalf.

If users provide information about

- Their house (how big it is, how insulated it is, where it is located),
- Their electrical devices (say, number of heaters, immersion heater, EV charging post)

- Their practices (when they are at home and need to be warm)

a smart technology can calculate when the heater needs to start working for residents to be comfortable; it can also calculate when the heater can be interrupted because the thermal inertia will maintain the house's warmth. Then, this smart technology will make these decisions on your behalf.

Because the heater is not operating all the time, users save money and save energy. This technology prevents wasting energy without compromising their comfort.

This is also the alternative that demands less active involvement from the consumers. This smart technology has two parts: an algorithm operating in the back end and a website that users can control.

Similar to Netflix or Amazon, the algorithm needs some initial information to start working. Thus, in the case of flexibility by design, during the first two or three weeks, the device will gather users' information about hours and days you are at home, whether you need a warmer house at a given time… With these inputs and information collected from other sources (e.g., external humidity, temperatures in your city, prices of energy), the smart technology will learn to manage users' heating and optimize the energy required for maintaining comfort.

If users also have self-production, the algorithm will adjust production to energy demands. If users also have smart appliances, it will coordinate the operation of the washing machine, say, so that it runs when it is more advantageous for users. The same can be said of electric vehicles and smart chargers: it will charge the vehicle when energy is cheaper and cleaner making sure that it is charged at the time consumers will use it.

With this automatization consumers are making the best use of energy. It is like this device that can be added to the shower and that pre-heat the water so that it starts pouring when it is already hot. With these systems, we avoid wasting water.

These smart technologies for flexibility are similar but they present another advantage: the energy that you are not "wasting", can be sold back to the grid if required. With flexibility by design technology, the device will interrupt the heating for short periods, while maintaining the room warm (the thermal inertia does the trick). These interruptions liberate kilowatts that can be given back to the grid to power someone else's heating. In some countries, users can be even paid for this saved energy when is given back to the grid.

Alternatively, if users form part of an energy community, they can give back this energy to their fellows. Or, if users want to, they can even partner with energy poverty communities and give back their energy surplus to those that most need it.

This is a smart technology indeed: it avoids waste, it saves resources, it reduces your bill, and it helps neighbours and communities.

TO CONCLUDE

This technology will be mainstream soon, as the energy system is more and more like a distributed model. You and your customers may be the pioneers of the energy transition, reaping the benefits that the new energy technologies and services may have for your company and your customers.

By self-producing energy, your customers may not only have a secure, resilient, and clean supply of energy but also can make extra gains by selling any surplus they may generate.

Or they may make the most of their produced energy by storing it in batteries or electric vehicles or by sharing it with their community.

To maintain the stability of the grid, customers will be required to have a flexible use of energy. Flexibility by design can enable this flexibility in a convenient, hassle-free way, while maintaining adequate levels of comfort. Moreover, in some countries, customers can also get an extra income by selling their flexibility to the system.

Economic gains, greater comfort, zero emissions, and independent and resilient sharing communities are good arguments to champion the energy transition.

Be a pioneer and spread the word!

Explore more about the ReDREAM project:

www.redream-energy-network.eu