WHITEPAPER

Energy transition

Energy management with KNX

The energy transition and what KNX can contribute

Now more than ever, with global warming, other climate changes and the geopolitical situation, the energy transition is becoming more important every day. For several years we have become more aware of the need to build a durable future, and recently to become more self-sufficient as well. The need to reduce our carbon footprint, reduce the emission of greenhouse gases and also become less dependent on fossil fuels we often import from less reliable countries, has become more urgent than ever. This requires a complete energy transition, which is happening right now all around the world.

In the unprecedented energy crisis we are currently facing, with high energy prices and capacity issues on our energy grid, energy management has become a high priority for building owners.
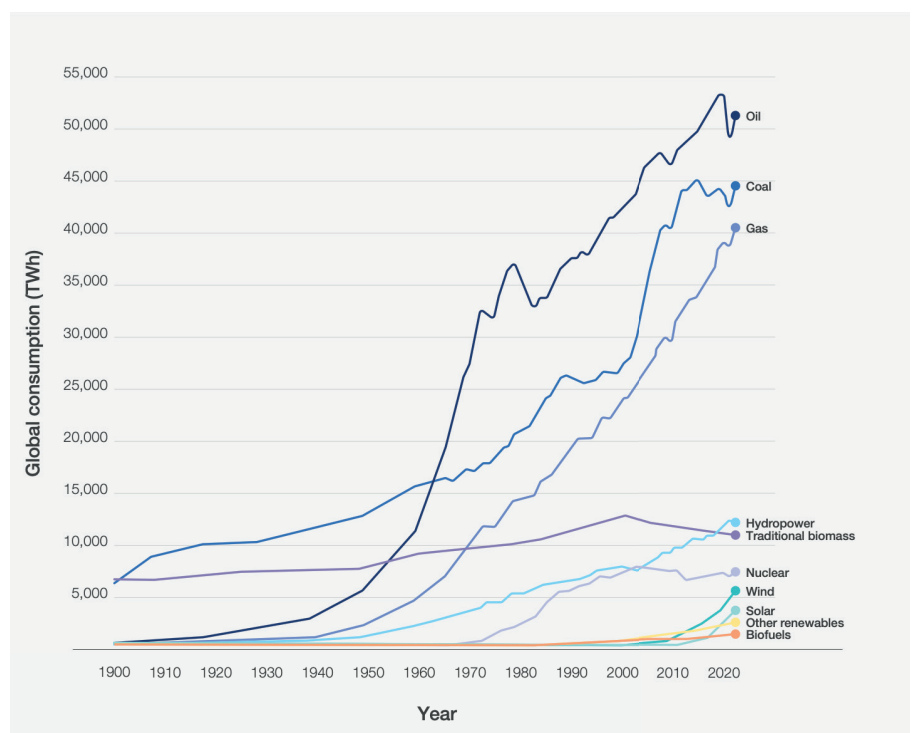
Energy transition

The main goal of the energy transition is the reduction of CO2 and other greenhouse gasses so global heating can be tempered. In addition to this goal, there are other benefits and goals, for example, lower emissions of other dangerous gasses and fine particles, becoming more self-sufficient, and less dependent on the import of fossil fuels. In addition to moving away from fossil fuels, we need to focus on the use of other raw materials as well. We should recycle more, reduce the use of materials and try to make products more durable. This is not only the case for the production of electricity, of course. There are many other industries and situations where this is an important topic, but that would be out of the scope of this document.

So, in short, the energy transition is the move from non-renewable energy sources to renewable energy sources.

Worldwide energy consumption by source, displaying a large dependency on fossil fuels.

There is still a long way to go, to make the world less fossil fuel dependent.

Source: Our world in data, 2022

Realisation

On a more global level, the energy transition is realised by political choices, resulting in updated, or new laws and policies, as well as tax changes to stimulate climate-friendly initiatives and the energy transition specifically. This is established through international commitments, for example the Paris Agreement, European laws, federal laws, and national laws. These can have enormous impacts, beneficial as well as disadvantageous.

On a more direct level, this is realised by personal choices. These might be influenced by media attention, price increases or stimulated by (local) government policies and subsidies, but still: they are choices made by you and me.

On a more practical level, we need to move from gas, oil and coal fuels to renewable energy sources. For the most part this will be to solar, wind or hydro-power generated electricity. This can be done on a grand scale, for example by solar farms, or enormous wind parks on the sea, as well as on a smaller scale, more locally, by placing solar panels on your own house or office.

@CharlieChesvick/ Gettyimages

Challenges

Unfortunately, there are many challenges to overcome, during this energy transition:
· Costs for production (gas/coal is in many scenarios cheaper).
· Costs for the transition itself.
· The realisation of durable production facilities.
· Grid unbalance (periods with a lot of solar / wind energy or a limited supply).
· Mobility (electric cars need batteries for example).
· Move to all-electric installations.

These challenges are not only a cost issue, but there are also practical problems to overcome, like the grid unbalance. In almost all the challenges mentioned above, a real smart building with flexible energy management can help. We will look into that in a moment.

So, what can be done in a general way to overcome these challenges?
· First of all, of course we should reduce consumption. A reduction is always better than a change of power source.
· Second of all, sustainability is required on all playing fields.
· Next, we should all provide our own power, for example by putting solar panels on our roofs.
· Furthermore, store energy when you produce too much and use it when there is a limited supply.
· If possible, use energy in the moments there is plenty and reduce when there is a limited supply.
· And; optimise processes that use energy in the building.

This is where energy management can contribute, to the building owner and user, but also to the electricity grid provider, and to the energy transition in general.

Energy monitoring and management

Understanding what is going on in a building, or more specifically an installation, is key to being able to manage the installation effectively and efficiently, but it is the first step. It is important to know what individual parts in the installation are doing, and how much energy is used, specifically for parts of the installation where controlling the details can have large effects. With individual lights, it is useful to change to LED. However, turning them on only when there is solar power available, is not very useful. A heat pump however, can use quite a lot of energy and if controlled correctly there is a lot to gain, while the comfort for the user is not affected. Other data, coming from other sources, from inside or outside the installation can be useful here as well. For example, weather sensors on the roof, but also spot price information and weather forecasts can be used to optimize energy management.

This should of course be focused on the complete building, controlling blinds and shutters predictively can be much more effective than cooling the building afterwards. In addition to energy monitoring, all this data can be used for other building management as well, like maintenance, monitoring faults etc.

So, these individual parts in the installation need to be managed. This can be done by the user, but it would be much more efficient if this could be automated. This is where energy management plays its part. A good energy management platform can use this internal and external data, to manage the installation efficiently, while being subject to the user's wishes. Keeping the level of comfort high is important to keep the user on board as well. A good management system reduces energy and costs, while keeping the level of comfort high.
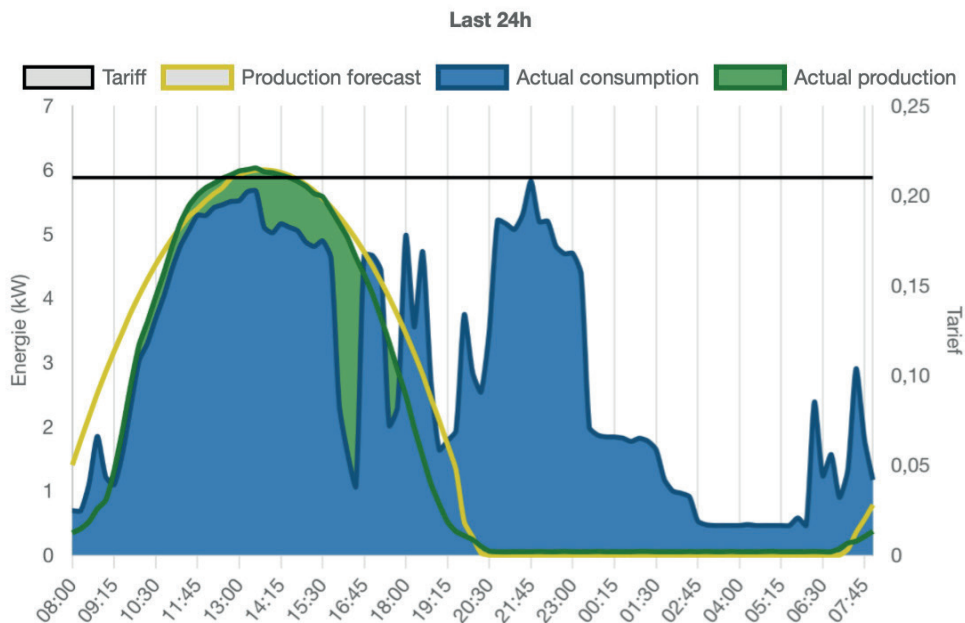
What KNX can contribute

With the open KNX standard, ISO/IEC 14543, it is much easier to make all kinds of data available within one system. There are many KNX products, such as gateways, to get data from electricity meters and sensor data from the building. There are all kinds of direct KNX meters as well. You can measure temperatures, get heat pump settings, collect solar panel production and basically anything else you need. Additionally, for products that do not support the KNX protocol directly, there are many bridge products available to link all kinds of energy-related endpoints to KNX quite easily. For example, car chargers, heat pumps, general heating systems, but also home appliances.

So KNX is basically the carrier to make all the data available. There are also many solutions available to make this data visible in charts, display them on screens, make them available on mobile apps, or publish them automatically in a report for example. The more aware a user is about their energy usage, the less energy they use. You can link your energy storage systems to KNX as well, and of course control the endpoints which use the energy, such as a heating system. For example, change the setpoints, or turn off an appliance.

And finally, you can add an energy manager to control these endpoints based on the data collected, keeping in mind maximum usage limits, storage systems, and your own production to predict future production based on weather forecast information and possible dynamic energy tariffs.

A manager makes all the difference. Instead of just being aware of what is going on in the installation, you can actually manipulate all the different parts of the installation to really benefit from all the collected data. If you know when your solar installation is going to produce a lot of energy upfront, you can, for example, delay the charging of electric cars, or lower the heat pump setpoint a little when the energy prices are in the top 20% of the day. Enable a filtration pump when the energy is cheap, or when there is over-production from a wind turbine. Combining all the available data, analysing this automatically, making predictions, and controlling the different endpoints and installations, is what a real energy manager should do.

Last 24h

Legend: Tariff · Production forecast · Actual consumption · Actual production

A real-life example of how energy prediction can contribute to a smarter energy managemant. The predicted power production is fairly correct in comparisment to the actual production.

Privacy and security

One of the key benefits of KNX is that KNX is all local, which results in better privacy and security. To keep your installation and information safe, it is best to use products and solutions that support this. That means that a cloud solution to control and manage energy in your building is not ideal. A local controller that manages energy, would be a better choice with regard to security and privacy.

Another problem with cloud-hosted solutions for management is that they are in most cases controlled by the energy grid owner as the first and foremost important stakeholder, and not the owner of the installation.

Practical example

A working solution to show the benefits is available by xxter. xxter developed a Smart Energy Manager which uses the KNX standard, and other sources to make the installation more self-sufficient, and thus can really reduce the energy bill. Using the built-in weather forecast service, together with other information, like the location and orientation of the solar panels, the energy manager of xxter can very closely predict the production of solar panels or a wind turbine. In combination with the automatic retrieval of spot prices and other data, the xxter Smart Energy Manager can automatically schedule all configured endpoints, while keeping in mind the user's preferences. For example, each afternoon the dishwasher will be finished before dinner, and in the morning the electric car is fully charged, before leaving for work. When the user needs the endpoint to be ready sooner, priority can be requested. xxter combines all this functionality together with the built-in OCPP charger functionality, full support for energy storage and dashboard functions, while keeping all usage data local and secure.

Key benefits of a KNX-connected Smart Energy Manager

- Know what is happening in your installation, and visualise the energy consumption, production and storage.
- Take control of what endpoints are allowed to run, and when.
- Lower energy consumption and subsequently your energy bill, by smart controlling your installation.

This all results in a less unbalanced grid, less energy consumption, a happy environment, and a lower energy bill.
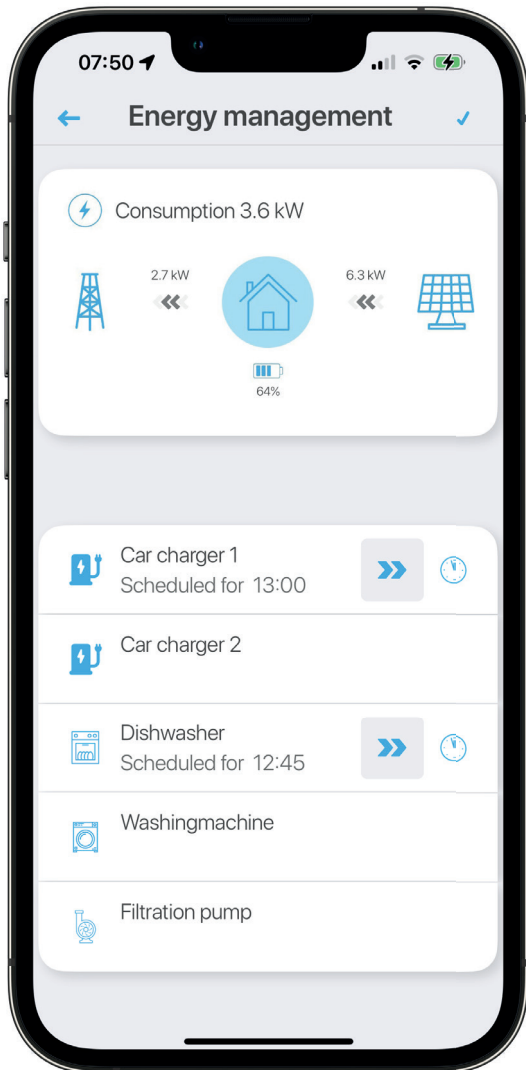
The xxter Smart Energy Manager

- Automatically enable or start endpoints at the most efficient moment in time.
- Lower or raise the temperature of your heat pump, or change the setpoint based on available production or energy prices.
- Forecast energy production
- Smart charge your energy storage, load when there is over capacity and use the storage when energy is expensive.
- Easily visualise energy flows, consumption, charging and production.

This is realised by using the following data:
- Location settings
- Actual production, storage and consumption meter data
- Weather forecast data, to predict solar / wind production
- Energy pricing data, this can be a scheduled tariff, or spot prices (hourly changing prices)
- Installation-dependent settings
- User preferences, like priority settings for certain endpoints

More information: xxter.com/energy

About the author

Harm Elzinga is founder and CEO of xxter bv. He has more than 20 years experience in the smart building industry, and is a long time KNX enthousiast.

xxter is a KNX member for many years and specializes in visualisation, voice and smart solutions for KNX.