

ENERGY INDEPENDENCE

Energy independence involves consumers producing more of the energy we use.

Some people already do this using micro-generation technologies like rooftop solar panels.



Because electricity needs to be used immediately, any power not used is ‘exported’ (sold) to the national grid.

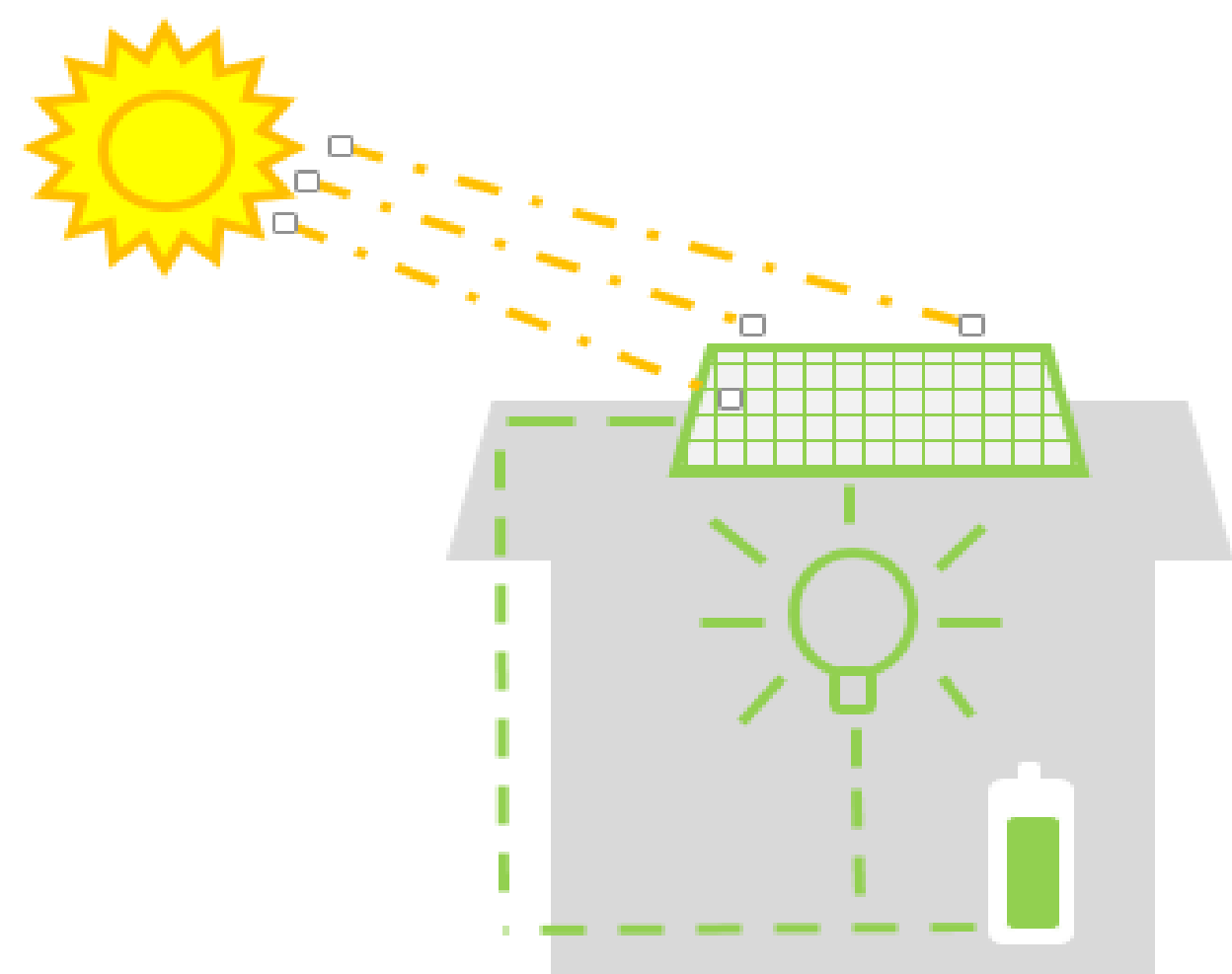
In this way each energy consumer becomes a ‘prosumer’. They produce and sell electricity when they are able to, and buy it from the national grid when they are not.

Installing energy storage could make our homes even more energy independent.

Instead of selling excess energy, householders could store it until it is needed using batteries, water tanks or heat batteries.

If energy companies start charging extra for using electricity during peak hours, household storage may help some people reduce their bills.

Energy independence might be useful if blackouts become more common or in remote places where energy supplies are unreliable.



Summary:

- Householders install micro-energy generation and storage technologies.
- By producing and storing energy, households may become less dependent on energy companies and the national grid.
- Protects customers from higher prices at times when less renewable energy is available.

VIRTUAL POWER PLANT

Virtual power plants involve using lots of household energy storage technologies together in a network to absorb and release energy as needed by the national grid.

‘Smart’ (internet connected) batteries, hot water tanks and other storage technologies would be provided to householders by energy companies who would act as ‘aggregators’.

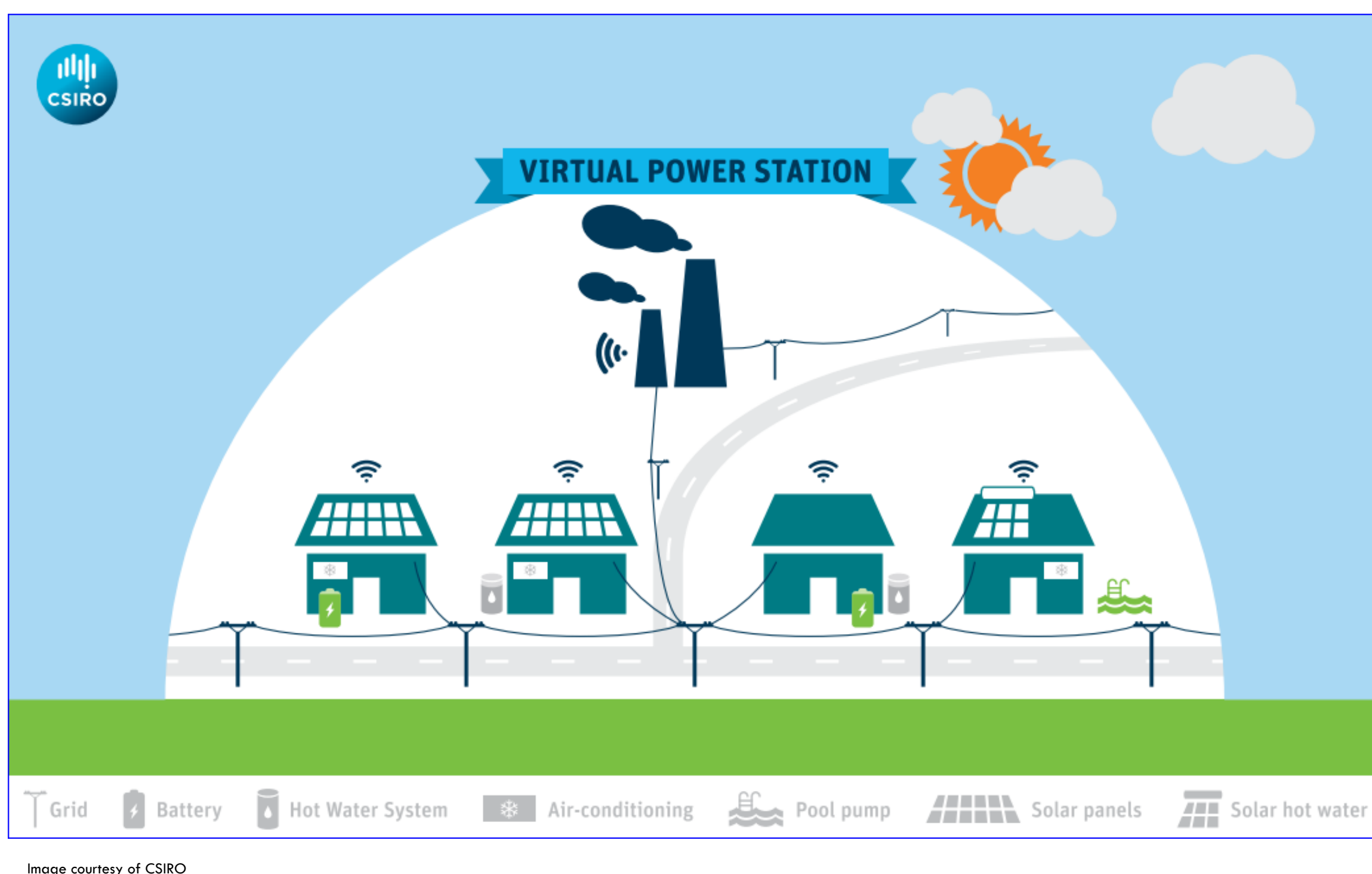


Image courtesy of CSIRO

Summary:

- Household storage provided and remote controlled by aggregators.
- Customers protected from time-of-use pricing.
- Customers and aggregators share financial benefits of providing services to the energy grid.



Aggregators would **remote control** storage devices, making money by providing balancing services to the grid- absorbing energy when supplies are too high and releasing it when they are low.

Batteries would be charged when energy is cheaply available (eg during the day), and **discharged into the grid** at peak times when prices go up (eg in evenings).

Households would benefit from **lower energy bills** or a share of the profits from aggregators.

Rooftop solar panels could also be used by aggregators to reduce the costs of charging.

COMMUNITY OWNERSHIP

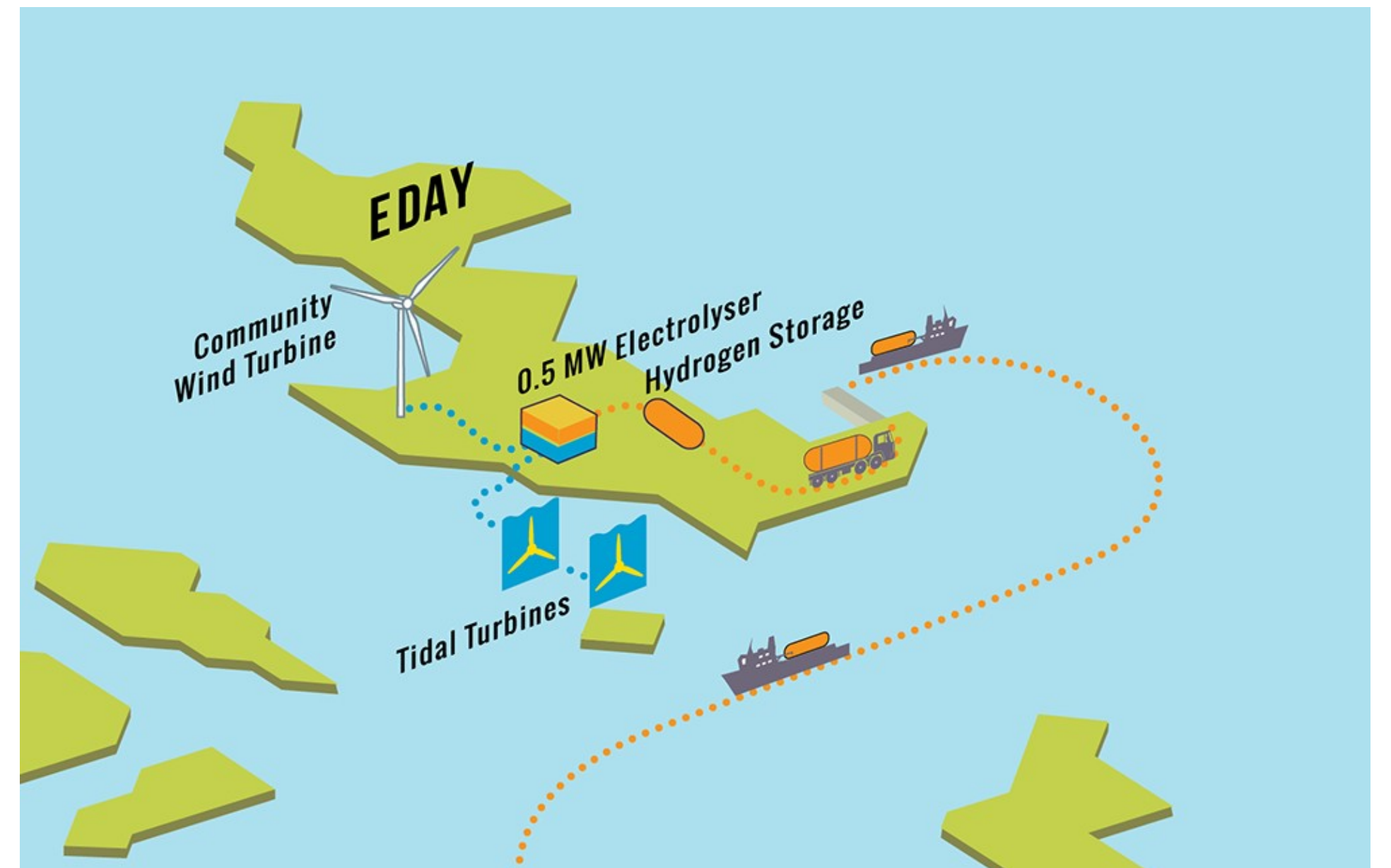
Some communities may club together to invest in batteries or other storage technologies.

This already happens in some rural and island communities, where **local people** form companies or community groups to invest in wind turbines or solar panels.

Some communities work with large energy companies to do this, others form new companies themselves.



Profits from the sale of electricity can be shared as **cash payments** to individuals, **or** used to **support local causes** and facilities.



The **Surf n' Turf** project on Eday in the Orkney Islands plans to store electricity from owned wind turbines as hydrogen which will be exported to generate peak time electricity in mainland Britain.

Image courtesy of: Iain Ashman and Community Energy Scotland (2017)

Community owned storage might work best in areas which already have locally owned wind turbines or solar panels.

If laws changed to make it profitable to **store and export electricity from the grid**, communities could also profit by buying grid energy when supplies are high and prices are low. They could then sell it back when supplies fall and prices rise.

Summary:

- Local citizens or community groups invest in energy storage technologies.
- Profits go to local people or causes.
- May work best in communities that own solar or wind electricity.

LOCAL ENERGY COMPANY

Local Authorities (councils) and energy distribution companies may take on a greater role in providing energy and storage services.



In recent years many local authorities have been installing solar panels on the roofs of **council owned buildings** like offices, schools, and council housing.

As more councils become involved in providing energy, some may begin to install energy storage systems as well.

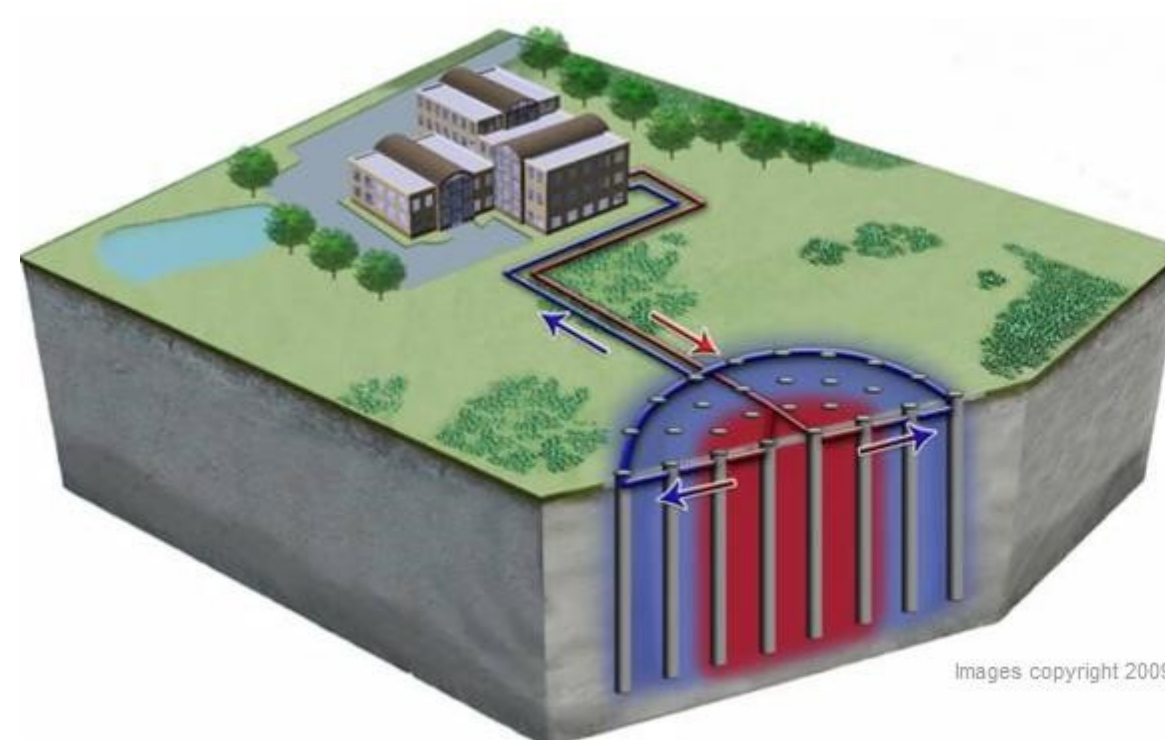
This could allow councils to profit by providing flexible electricity generation to the grid, or to provide **lower cost energy to local residents**.

In some cases councils could install batteries in blocks of flats or near to local homes.

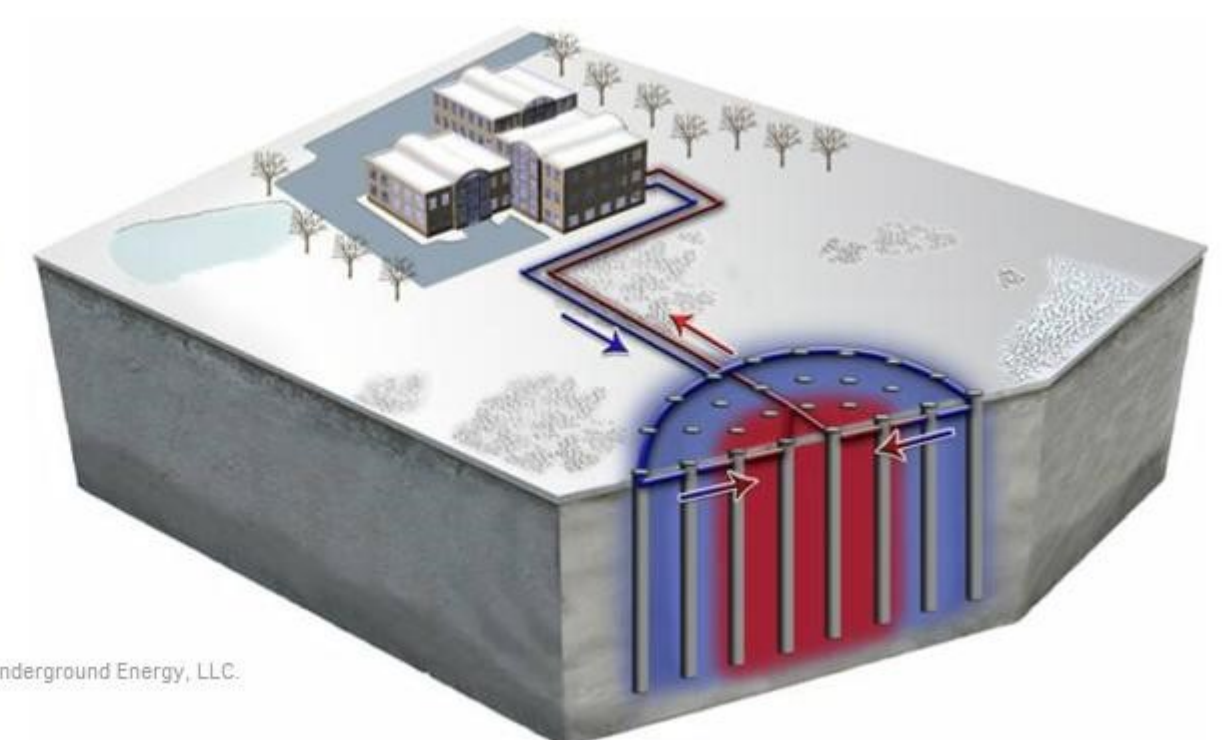
In other places, local authorities might build large underground heat stores, charged using landfill gas or solar energy during summer and used to top up **district heating** systems during winter.

Heat exchange between municipal buildings and a borehole thermal energy store. Thermal store warms up during summer (left hand side), and provides heat and hot water during winter (right hand side)

Image courtesy of: Underground Energy LLC (2009)



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Summary:

- Local Authorities own and operate energy storage.
- Storage could be used to provide income for the council.
- Alternatively it could be used to provide low cost heat or electricity to local residents.

TRADITIONAL CONSUMER



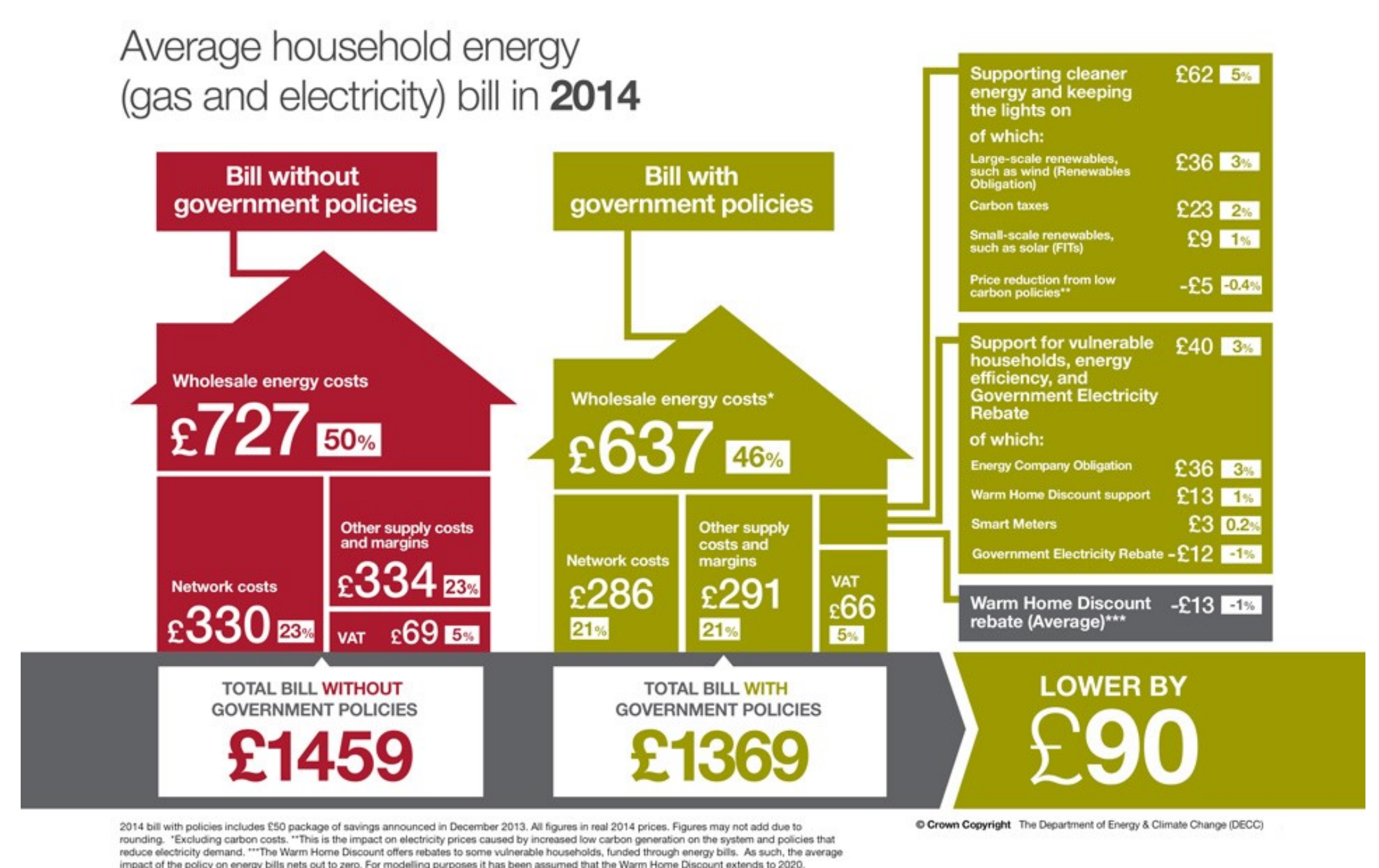
Citizens might notice upgrades to the electricity network taking place in their communities and across the country.

Apart from this, most people would only see the effects of energy systems flexibility as a **component of their bills**.

It is possible very little will change for energy customers.

Network upgrades (new cables, substations etc) and **bulk energy storage** (pumped-hydro, power-to-gas and compressed air) could reduce the need for the public to change their energy use.

People living close to new infrastructure might experience disruption, but **most of the population may not be affected**.



Breakdown of average UK energy bill in 2014. If energy system change all took place at the grid level, this would be where most consumers would notice it. Image: DECC (2015)

Summary:

- Energy systems change mainly takes place 'on the grid' away from the general public- people don't have to change their daily routines.
- Most consumers still buy their electricity from big energy companies.
- Communities close to new infrastructure may notice construction of new infrastructure (pumped hydroelectric and compressed air plants, new cables etc).

NEW ROUTINES

Instead of making the energy system more flexible, we could be more flexible in the ways we use energy.

Energy companies could use **information technologies** to adjust the rates they charge depending on the availability of wind or solar electricity.

This could encourage customers to **move energy intensive activities** (e.g heating and laundry) to times when renewable energy is readily available.

We could become more flexible in our **daily routines** and use **timers** on heating and appliances to use energy when it is most available.

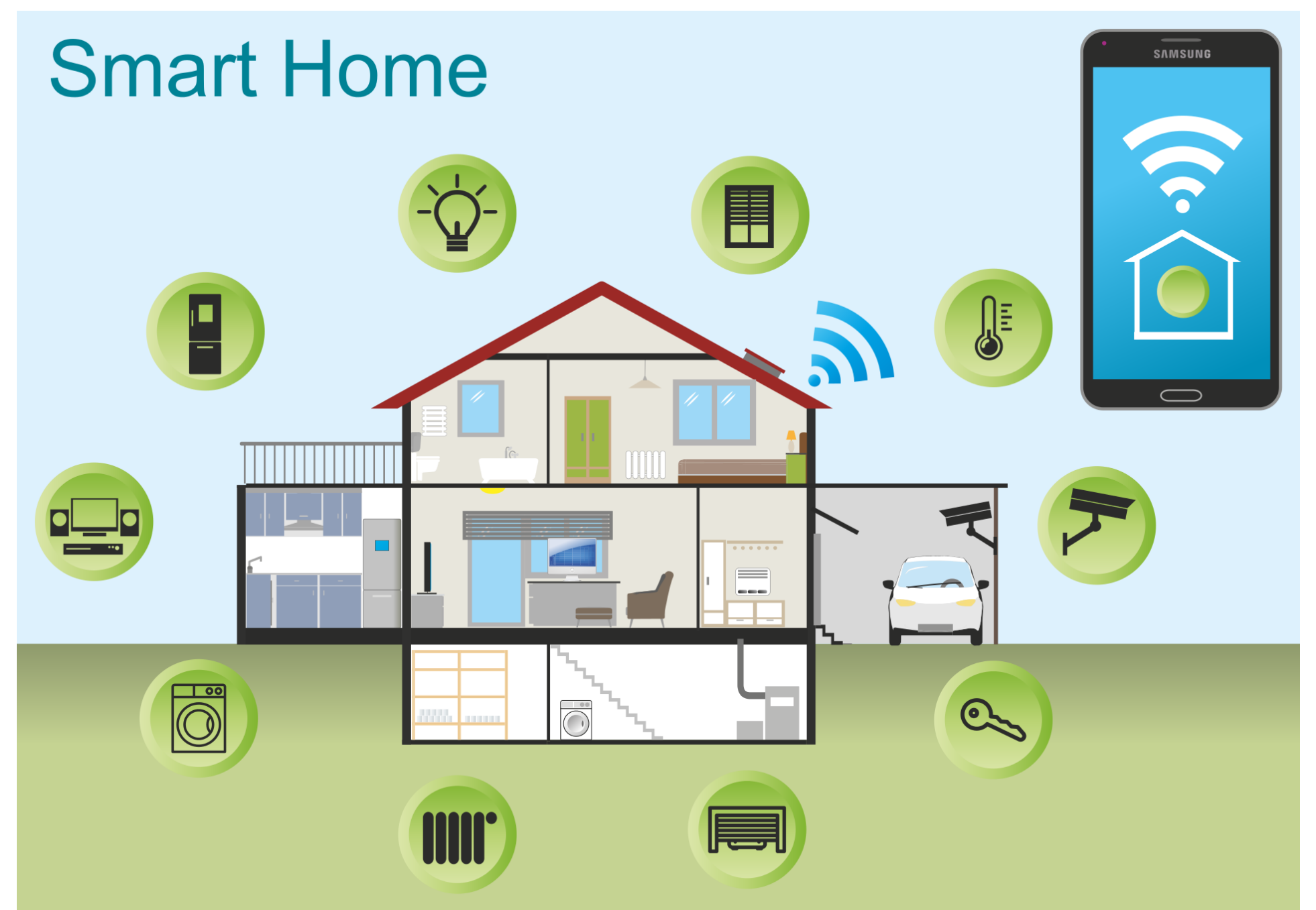


Image courtesy of Pixaline (2017)

Alternatively we could make household appliances ‘**smart**’. These could be **controlled remotely** using tablets and smart phones.

Smart appliances would **switch-on** when energy is freely available, and **pause** if prices go above a certain point.

Householders would not have to manage timings directly and would be able to over-ride smart functions and pay extra if they need to use energy urgently.

Summary:

- Electricity prices change depending on time of day and availability of renewable supplies.
- Consumers change behaviour or use smart appliances to use energy more flexibly.
- Routines change so energy is only used when it is available.

IMAGE SOURCES

CSIRO, Virtual Power Station [image].

<https://www.csiro.au/en/Research/EF/Areas/Electricity-grids-and-systems/Intelligent-systems/Virtual-power-station>, viewed May 2017.

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