EYFS to KS3 Physics Progression Map for Energy

I have developed this document to support the teaching of **energy** from the earliest years of schooling. It shows how teachers can help children to take their physical knowledge and begin to make it explicit and abstract.

I recommend ensuring all pupils have had the physical experiences to help them 'feel' physics later in their studies. Expand on these sensations and experiences to help bridge the gap between physical and abstract. Use words, drawings and gestures to encourage physics thinking from the early years onwards.

The Big Idea of Energy

(This is heavily influenced by the Institute of Physics' Energy Stores and Pathways model).

Energy probably suffers from misconceptions from more than any other area of physics. There are two main ideas that lie at the heart of a physicist's concept of energy:

1. Energy does not **cause** anything to happen. Energy does not cause the book to fall when you drop it. Energy does not cause the light to switch on. There is always an underlying explanation why something happens (e.g. the force of gravity or the current in a bulb. When we say something like, "The energy in the cell causes the light to turn on," we are masking the real explanation.
2. Energy is an excellent accounting tool: it tells you what can be done, but not how. It lets you know whether something can happen (but not how). For example, then you charge a phone battery:

Why Teach Energy in Primary School?

There are strong arguments for not teaching energy at primary school at all. Energy is primarily about calculation and we do very little calculation in science at primary school. It is also irresistibly tempting to use energy as a tool for explaining physics (energy makes the bulb light up), but this conceals the real physics explaining the phenomenon. Let's focus on the phenomena.

If energy was not used so frequently (and incorrectly) in everyday English, these arguments would win. However, the word *energy* is very common and so young people are building misconceptions all of the time. Judicious teaching of the concept will help pupils build solid foundations, reducing misconceptions which will be very hard to shift later on.

EYFS, KS1 and Lower KS2

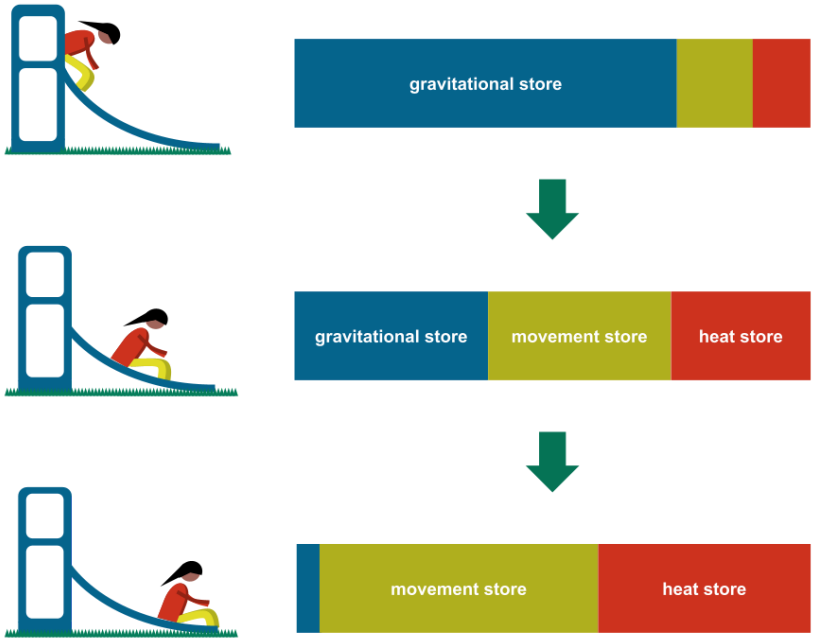
The key way that teachers of younger children can support learning the concept of energy is to avoid the implication that energy **causes** anything. Instead emphasise that energy allows something to happen, but doesn't explain how.

Feeling Energy (Hands on)	Talking Energy	Concrete Examples	Common Misconceptions	Thinking Questions
You can't feel energy, only work out it must be there when something happens. E.g. • You don't feel heat, only temperature. • You can't feel the energy in a wound up spring, but you know it is there when you set the wind-up toy off. • You can't feel the energy in a battery, but you can tell it is there if the torch lights up.	Avoid talking about energy **causing** anything to happen. Instead say that energy **allows** things to happen. E.g. • When you plug the lamp in, you **can** turn it on. • When you don't eat enough food, you won't have enough energy **to be able to** run far.	Energy is stored in: • sugary foods; • batteries; • wind up toys; • objects at the top of slopes; • hot things and • moving things;	Many people believe that energy causes something to happen, but energy only tells you if something is possible or not. Many people visualise energy as a type of substance, but it is only an abstract idea. We don't really know what energy is.	How do you know if energy is stored in the battery? (A: If the bulb lights up, there must be energy there).

UKS2

Feeling Energy (Hands on)	Talking Energy	Measuring Energy	Drawing Energy	Concrete Examples	Common Misconceptions	Thinking Questions
You can't feel energy, only work out it must be there when something happens. E.g. • You don't feel heat, only temperature. • You can't feel the energy in a wound up spring, but you know it is there when you set the wind-up toy off. • You can't feel the energy in a battery, but you can tell it is there if the torch lights up.	Avoid talking about energy **causing** anything to happen. Instead say that energy **allows** things to happen. E.g. • When you plug the lamp in, you **can** turn it on. • When you don't eat enough food, you won't have enough energy **to be able to** run far.	Scientists use energy to do calculations. There is no need to calculate energy at KS2, but you can show quantities using bar models.		Energy is stored in: • sugary foods; • batteries; • wind up toys; • objects at the top of slopes; • hot things and • moving things; Many people visualise energy as a type of substance, but it is only an abstract idea. We don't really know what energy is.	Many people believe that energy causes something to happen, but energy only tells you if something is possible or not.	How do you know if energy is stored in the battery? (A: If the bulb lights up, there must be energy there). How do you know that we haven't accounted for some of the energy in the diagram below?  A: the two bars aren't the same length.

KS3



The bar diagram shows that:

- *total energy is conserved;*
- *energy can be transferred from one store to another.*

At KS3, students use numbers to calculate using energy. Bar models are still very helpful to visualise the abstract concept of energy.

Use the idea of energy stores (where energy can be stored, such as the gravitational store, the kinetic store and the thermal store) and energy pathways (how energy is transferred from one store to another (e.g. light, sound and electricity).