Supplementary Material

Tab. S1. Category system (excerpt) for the dimension and "Characteristics" (published in Detken & Brückmann, 2021)

Dimension	Categories	Definition	Examples (bold: indicators for choice of category)
Characteristics: Features and/or activities	physical activity or condition *	physical activity and/or state of humans and other animate beings	One needs energy for **running**. If one does not have energy, one **collapses**.
	electricity	closed electric circuit, device working on electricity (indicator for electric energy)	Energy means the strength of **electronic**. That is energy (clenches fists).
	light	emission of light	This has to do with energy, well, because it **shines** it has energy. It has to do with energy because it **shines** and has a battery inside, because that has also energy, like, inside.
	chemical	presence, appearing or disappearing of substances, growth	The energy comes back if one **eats** or sleeps.
	motion	motion of inanimate objects	The car needs energy to be **able to go**.
	functioning	ability to operate in unspecified ways	The camera would not **work** if it had no energy inside.
	temperature	temperature	This has to do with energy because it is **hot**.
	…	…	
	none	*coded if no characteristic is mentioned*	just like that, I don't know

Tab. S2. Category Systems for the dimensions "Nature of Energy", "Transfer Ideas", "Transformation Ideas" and "Conservation Ideas"

Dimension	Categories	Definition (italics: typical responses)	Examples (bold: indicator for choice of category, italics: interviewer's question)
Nature of Energy: Ideas about the ontology and causality of energy	Intrinsic feature	Energy as a feature of certain system elements *X has energy (because of Y)*	**There is** a flame, and therefore, it is an energy thing. He [human in drawing] **has energy** because he is the strongest.
	Feature of certain states	Energy as something system elements have in certain states, and otherwise not *X has energy, if it is/does Y, and no/less energy, if not*	If you switch it [the flashlight] off, it [energy] is not there, and if you switch it on, it is there. Energy is something **you simply have if** you are running. […] And then the energy goes away because you get tired.
	Causal agent	Functional notion of energy; energy as a kind of "fuel" that is necessary for processes. *X needs energy for Y*	The children **need energy** for running. The battery **needs energy** for charging things.
	Substance idea	Energy as a substance-like entity that is distinguishable from the system element that has energy *X has energy inside; X gets energy from Y*	The **energy is inside** the battery. Because the heart beats, I think, here **inside is energy** (points to own body). **Energy comes out** of the flashlight when it shines.
	Generated	Energy as a product *X becomes/makes energy*	The tree has to do with energy because I think **energy is made** in the nature. Food has no energy, (it has energy) only if you chew and digest it.
	Being energy	Energy is the same as a system element or a feature thereof. *X is (like) energy*	Because **energy is** air. **Energy is** current. Because it moves, this **is energy**.
	General, unclear	Residual category *X has to do with energy*	

Transfer Ideas: Ideas about how or from where entities "get" energy	Incorporation	A system element gets energy by incorporating an object that has or is (like) energy, such as food, a battery or fuel.	If you switch on a flashlight and use it, then you need to **insert** a new battery. […] There is **energy in** the battery, and one uses energy for that and then there is no more energy and the flashlight is not working anymore. One **gets energy into** the body if one eats something and then one has energy and can do a lot of things. […] *And you also wrote "food". Does food have energy or not?* I think **it has**.
	Flow/source	Energy comes from a source and/or moves with respect to the system element.	The force, your energy, is like your fitness. And my fitness, my energy, then **it enters here** (moves hand along arm) and then *whoosh*, I can beat with full force (beating gesture).
	Product	Energy is generated by an interaction/reaction, e.g., in the body from food.	One needs energy to do sports. Then… and energy is, I think, perhaps, if one eats or drinks, then **this becomes energy** in the belly, perhaps.
	Process	Energy is generated by a process or an activity of the energy-using system element, e.g., by resting.	*Where does the energy come from?* (hesitates) The energy is… **comes from… from yourself**, from oneself. *Ok, how does that work?* One **runs around**, though one is very tired, one **does sports**, later comes the force.
	None/unclear	Residual category (no/unclear answer or no relation with "getting energy").	
Transformation Ideas: Ideas about if and how characteristics as indicators of energy are correlated during processes	Causal relation	A causal relation between two characteristics is described, e.g., "if x, then y"; "the more x, the more y." No indication of transformation.	The current goes away, it becomes less. And **the lesser it is, the slower** it [the e-bike] moves. One needs force to do sports. And **if** one eats, **[then]** one gets force.
	Implicit/explicit transformation	One characteristic is converted into another characteristic or into energy. Energy changes its "guise" during a process.	It [energy] enters the battery, and then the battery has current, and then it can **send it [the current] out and there is light outside**.
	None/unclear	Residual category (no/unclear answer, segments with only one characteristic)	
Conservation Ideas: Ideas about what happens to the energy after a process	Gone/used	Energy is used up or gone when the visible process ends.	The energy is in the battery. And the car needs energy to be able to go. And the **energy is empty eventually**. *And what happened to it?* Because the car **expended** too much energy, such that eventually the battery is empty.
	Somewhere else	Energy might be somewhere else when the visible process ends.	The **exhaust is also a part of the energy**, it is just like – if you leave spilled water, it evaporates in the sun – it is like evaporated fuel. And then **it leaves here** (indicates path in the drawing)
	Conservation idea	Energy might be somewhere else but might be "reusable".	It [the energy] goes away from us. That means, it is not in our body anymore (points to his arm and then sideways). Perhaps **it goes into another body. Then it comes back**, if you worked well, ate well and so on.
	None/unclear	Residual category (no/unclear answer, segments that do not relate to energy after a process)	