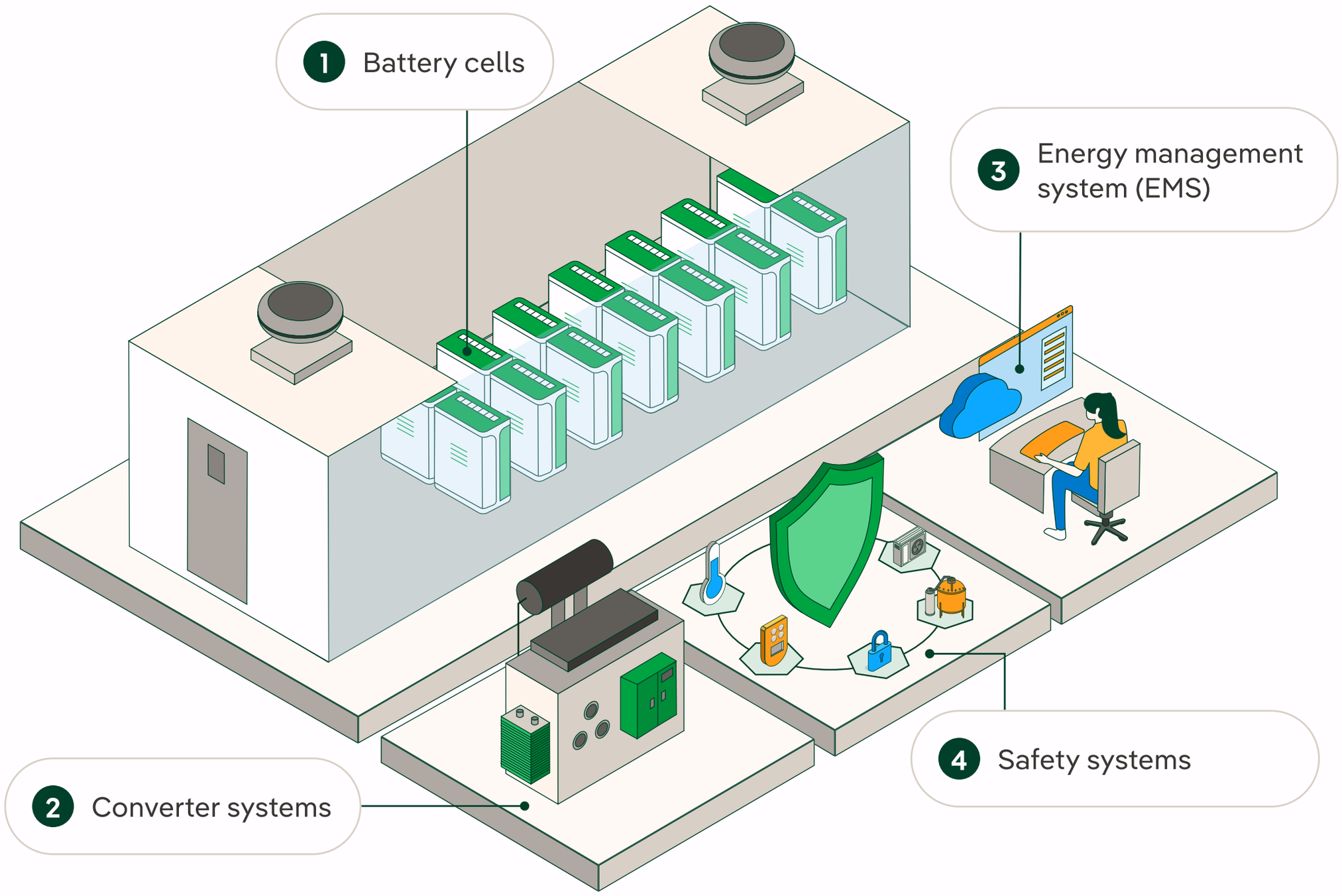
Off-grid Battery Energy Storage System (BESS): The key components

An **off-grid electrical system** combines local energy generation, **battery storage** and smart management to ensure a continuous supply in remote locations. The energy generated by solar panels, wind turbines or even micro-hydropower stations is stored in a **BESS,** which then regulates delivery according to consumption demand. This approach allows homes, communities and small businesses to operate completely **autonomously,** even in extreme weather conditions or during prolonged **supply interruptions.** These are the key components:



1. **Battery cells:** The core of energy storage, usually lithium-ion or, increasingly, lithium iron phosphate (LFP) due to its greater safety and longer service life.
2. **Converter systems:** Ensure conversion between the direct current (DC) stored in the batteries and the alternating current (AC) required for household or commercial devices.
3. **Energy management system (EMS):** A combination of software and hardware that schedules, monitors and optimises charging and discharging cycles to ensure efficiency and reliability.
4. **Safety systems:** Off-grid systems are often exposed to extreme conditions, such as large temperature variations, and to infrequent maintenance. For this reason, safety subsystems – including fire protection, thermal management, ventilation, heating, gas sensors and suppression systems – are especially important.