Energy Storage Options: Approximate Performance Ranges

Technology	Description	Scalability	Discharge Time	Efficiency	Life Expectancy or Max Cycles
Pumped Hydro	Uses gravitational force by pumping water to a higher elevation for storage during off-peak hours and later generating energy by releasing water to the lower elevation through turbines.	Fixed Size, Low Scalability	6-24 hours	65-85%	30-75 years
Compressed Air	Pumps air into a natural underground storage site during off-peak hours where it is later released and heated with the resulting expansion used to run a generator.	Very Scalable	4-24 hours	50-85%	20-40 years
Lithium-ion Batteries	Common utility scale low-duration batteries where ions flow from the anode to the cathode during discharge, generating electricity. The direction of the ion flow is reversed during charging, with resulting inefficiency.	Very Scalable	1-4 hours	85-90%	2-10 years
Lead-acid Batteries	Consist of lead plates in a sulfuric acid solution. The lead oxidizes the plate, making an electrical current. Mostly used for backup power, not grid power or grid stability.	Very Scalable	15 min – 4 hours	70-80%	2-10 years
Flow Batteries	A type of electrochemical cell that separates the two electrolytes via a membrane. Ion exchange occurs during circulation of the Anolyte and Catholyte at the membrane.	Mildly Scalable	1-8 hours	65-85%	2-10 years
Hydrogen	Produced by the electrolysis of water or steam methane reforming	Very Scalable	0-8 hours	25-45%	5-30 years
Flywheels	Stores energy by using motors to accelerate a rotor to a high speed, and maintaining the power as rotating energy. Stored kinetic energy is later used to drive the motor in reverse and generate electricity.	Low Scalability	1s – 1 hour	85-95%	20 years
Liquid Air	Uses electricity to cool air until it liquefies, stores the liquid air in a tank, brings the liquid air back to a gaseous state (by exposure to ambient air or with waste head from an industrial process) and uses that gas to turn a turbine and generate electricity.	Very Scalable	2-24 hours	<50-55%	30+ years
Pumped Heat with Rankine Cycle	Pumped thermal electricity storage works by turning electricity into heat using a large-scale heat pump. This heat is then stored in a hot material, such as water or gravel, inside an insulated tank. When needed, the heat is then turned back into electricity using a heat engine. These energy conversions are done with thermodynamic cycles such as the Rankine (steam) cycle.	Very Scalable	3-6 hours	<50%	20-30 years
Pumped Heat with Brayton Cycle	Pumped thermal electricity storage works by turning electricity into heat using a large-scale heat pump. This heat is then stored in a hot material, such as water or gravel, inside an insulated tank. When needed, the heat is then turned back into electricity using a heat engine. These energy conversions are done with thermodynamic cycles such as the Brayton (gas) cycle.	Very Scalable	3-6 hours	55-62%	20-30 years
Gravity Storage	A certain mass (such as water) is moved from a lower point to an upper point by a pump or other means. Increasing the height increases potential energy. To release the energy, the mass is dropped to convert potential energy into electricity through an electric generator.	Very Scalable	15 min – 8 hours	80%	60+ years

Source: World Energy Council, Kiewit