Step Two
In the Renewables advanced settings (click the three dots next to the Renewables slider), scroll down to the “Storage R&D breakthrough cost reduction” and “Storage breakthrough year” sliders. The “Storage R&D breakthrough cost reduction” slider represents the percent that a research and development (R&D) breakthrough suddenly reduces the supply cost of energy storage. The values represent a decrease in cost from the point when the breakthrough occurs.

The cost of storage for renewables is explicitly modeled in En-ROADS, and as renewables become a significant part of energy supply, storage must be cost effective to enable further expansion.

Sensitivity Testing

Assume 25 percent, 50 percent and 75 percent in "Storage R&D breakthrough cost reduction” while keeping “storage breakthrough year” equal to 2030 (same as the Business As Usual (BAU) scenario). Next change the “Storage breakthrough year” to 2025 and 2020.

Assumption	Decrease in CO_2 ppm Concentration in 2100	Cumulative avoided gigatons of CO_2 by 2100
25%	2	14
50%	3	31
75%	5	50
100%	7	71

Changing the storage breakthrough year to 2025 or 2020 only decreases the CO2 ppm by an additional 1 ppm and slightly increases the avoided gigatons of CO2.

Assuming Tesla Battery Day was a storage R&D breakthrough cost reduction of 50 percent and the breakthrough year is 2020, then the values are 4 ppm less CO2 and 33 gigatons CO2 avoided.

Max potential for electric demand response technology: You can adjust the assumptions in the model about how much energy storage capacity can be met by demand response measures (rather than innovations in batteries, for example). Demand response measures include shifting energy use toward the times when energy supply is at its peak (for example, when the sun is shining for electric grids dependent on solar). Scroll down to “Maximum potential—electrification, retrofits, and storage” and open the sub-menu by clicking on the triangle next to it, then scroll down to the “Max potential for electric demand response technology” slider and select a value.

Assume Max potential for electric demand response technology increases to 100%. Instead of storage costs increasing and leveling off at about $20/MWh, they increase to about $14.5/MWh, then decrease.

As a result, the Renewable Primary Energy Demand increases 1.77 exajoules or 3.8 percent by 2035 compared to BAU assumption of 50 percent Max potential for electric demand response.

Sensitivity Testing

Using a Max potential for electric demand response of 75 percent increases Renewable demand by 1.49 exajoules or 3.2% by 2035 compared to BAU. This means business and industry may limit their investment and still achieve a significant start on increasing renewable energy demand.

CO_2 Concentration in 2100 decreases by only 1ppm and 11 gigatons CO2 are avoided by 2100.

Breakthrough commercialization time for storage: You can adjust the assumptions in the model about the breakthrough commercialization time for storage. Scroll down to “Breakthrough commercialization time” and open the sub-menu by clicking on the triangle next to it, then scroll down to the Storage slider and select a value. This slider adjusts the number of years for a breakthrough in technology to reduce costs of storage for renewables to reach its full cost reduction potential.

Changing this assumption to shorten the time for a breakthrough in technology has no effect on CO2 concentration nor on gigatons of CO2 avoided. When combined with other assumptions about batteries, this might enable an improved outcome.