Use less energy, waste less energy

Energy conservation reduces energy use. Efficiency reduces the energy needed for a given service. Both approaches can lower demand; changing the energy source alone is a different action.

CONSERVATION

Turn off a light when the room is empty.
Reduce unnecessary use.

EFFICIENCY

Use an LED that provides the same light with less power.
Use less for the same service.

1. HEATING AND COOLING: REDUCE THE LOAD

Use a lower heating setting in cold weather and a higher cooling setting in warm weather, within safe and comfortable limits. Insulation slows heat transfer; sealing leaks reduces uncontrolled air exchange. Together, these measures reduce how hard heating and cooling equipment must work.

2. APPLIANCES AND WATER: TARGET THE ENERGY USE

Choose efficient appliances for the same task, and avoid leaving lights or equipment on unnecessarily. Use less hot water, for example with shorter showers: less water must be heated. Water conservation can also reduce the energy required for pumping and treatment.

3. CONSERVATION LANDSCAPING: WORK WITH THE CLIMATE

Place vegetation to reduce unwanted heat gain and exposure to cold winds. Deciduous trees can shade a home in summer while admitting more sunlight after leaf fall. Windbreaks can shelter buildings in cold, windy conditions.

Plant type and placement matter: plan for the local climate, seasonal sun and prevailing winds rather than assuming every tree position saves energy.

Conservation versus efficiency: US EIA, Energy Efficiency and Conservation.
Thermostats, appliances and home upgrades: US DOE, Home Energy Checklist.
Shading and windbreaks: Oklahoma State University, Landscaping for Energy Conservation.

Scope: College Board AP Environmental Science CED, Topic 6.13, p. 133.

Conservation beyond one household

The same principle scales up: reduce unnecessary travel and building demand, then use efficient technology to provide the services that are still needed.

1. TRAVEL: FEWER TRIPS, MORE PEOPLE PER VEHICLE

Walking and cycling can replace short motor-vehicle trips. Public transportation and carpooling can reduce energy use per passenger when they replace separate car journeys. Combine errands and avoid unnecessary idling. Shared transport savings depend on occupancy, route and the vehicles being compared.

2. FUEL ECONOMY AND HYBRIDS

For the same distance, a vehicle with higher miles per gallon uses less fuel. Hybrids combine an engine with an electric motor. Regenerative braking recovers some kinetic energy that would otherwise become waste heat; stop-start systems reduce engine idling. Braking does not recover every joule of energy.

3. BATTERY ELECTRIC VEHICLES (BEVs)

A BEV uses a rechargeable battery and electric motor rather than burning fuel in an engine. Electric drivetrains convert a larger share of their input energy into movement than conventional gasoline drivetrains. No tailpipe exhaust does not mean zero total impact: the electricity source and production of the vehicle and battery also matter when comparing systems.

4. GREEN BUILDING DESIGN

Design buildings to need less heating, cooling and artificial lighting: use appropriate insulation, efficient windows, daylight and seasonal shading, plus efficient equipment and controls. Good design combines features for the local climate and the building's use. Adding solar panels supplies energy; it does not by itself reduce the building's demand.

Fuel economy and wider conservation measures: College Board CED, Topic 6.13.
Electric drivetrains and upstream emissions: DOE/EPA, All-Electric Vehicles.
Regenerative braking and stop-start: DOE/EPA, How Hybrids Work.
Building upgrades: US DOE, Home Energy Checklist.

Scope: College Board AP Environmental Science CED, Topic 6.13, p. 133.

Calculate the energy saved

Compare the same service over the same time period. Here, one 60 W lamp is replaced with a 10 W LED providing the same useful light. Both run for 5 hours per day for 365 days.

1. ENERGY = POWER × TIME

Convert watts to kilowatts: divide by 1,000.
Annual operating time = 5 h/day × 365 days = 1,825 h.

Original lamp	0.060 kW × 1,825 h	**= 109.5 kWh**
Efficient LED	0.010 kW × 1,825 h	**= 18.25 kWh**

W and kW measure power; kWh measures accumulated energy.

2. ABSOLUTE SAVINGS AND PERCENT REDUCTION

Annual electricity saved = 109.5 - 18.25
= 91.25 kWh per lamp.
Percent reduction = (old use - new use) ÷ old use × 100%
= 91.25 ÷ 109.5 × 100% ≈ 83.3%.

Use the original consumption as the denominator, not the new value.

3. EXTENSION: COSTS AND THE ENVIRONMENT

At an illustrative electricity price of $0.20/kWh, the annual energy-charge saving is 91.25 × $0.20 = $18.25 per lamp. If the upgrade costs an extra $5, simple payback is $5 ÷ $18.25 per year ≈ 0.27 years, or about 3.3 months.

This simplified calculation ignores maintenance, financing and changes in use or prices. Emissions avoided also depend on which electricity generation is displaced; kWh saved is not itself a mass of CO_2.

Efficiency and reduced demand: US EIA, Energy Efficiency and Conservation.
Lighting upgrades and operating time: US DOE, Home Energy Checklist.
All lamp ratings, hours, prices and upgrade costs above are illustrative assumptions.

Scope: College Board AP Environmental Science CED, Topic 6.13, p. 133.