Energy Management

Sailplane's Total Energy is stored two places:

- Height or Potential Energy: mgh

  Since PE is the height of a glider, the glider sink rate, seen on a TE vario, is related to how fast the glider is gaining or losing energy.

- Speed or Kinetic Energy: $\frac{1}{2}mv^2$

  High speeds are accompanied by high sink rates, but give us the option to move out of areas of high sink fast.

Gliders gain and lose energy depending upon how fast they are flying (polar sink rate) and how fast the air they are in is going up and down. What coombination of speed and altitude depends upon where we are and what we are trying to achieve.

- Ridge: fly low here the lift is strong and fly fast.
- Thermalling: thermal at min sink speed and gain altitude (PE) faster.
- Pattern: altitude and airspeed.
- Approach: transition from pattern to landing.
- Landing: no altitude and minimum speed.

Thermal soaring is basically a game of getting energy by climbing to offset energy lost while gliding. At high altitudes, most of the glider's energy is stored in PE.

PE = 3000 ft 95 % of TE
KE = 60 kts (155 ft) 5 %

In **ridge** soaring the exchange between KE and PE is more prevalent than when thermalling.

PE = 100 ft 19 %
KE = 100 kts (431 ft) 81 %
Changes in terrain elevation can quickly effect a gliders PE.
Plan ahead if terrain is rising: you must gain altitude. KE $\Rightarrow$ PE
Bail out to the valley to get PE if necessary.

The objective when **landing** is to end up at the correct place with as little energy as possible.

PE = 0 ft
KE = 45 kts (69 ft)
We want to touch down at MCA
A 10 % increase in touchdown speed is a 20 % increase in landing roll.

In the **pattern** we want enough energy to be safe but not so much we cannot land on the runway. We do this by carrying airspeed and altitude.

PE = 700 ft 84 %
KE = 55 kts (130 ft) 16 %
We use the spoilers to control the loss of PE (altitude).
Turns in the pattern should be made as steep as possible.

Bank angle	10	20	40	60
Altitude Lost	167 ft	80 ft	33 ft	17 ft
Margin above Stall	14 kts	14 kts	9 kts	stalled

In the final **approach** and flare we dissipate PE and KE and let the airspeed come down to landing speed. All of this should be done gradually with the wings level.

The three most important things about flying the pattern:

- Airspeed control.
- String in the middle.
- Steep turns.

When the wind is blowing (turbulent) we add one half the wind speed to our pattern speed as a safety margin above stall, but we also add altitude because of an increase sink rate, more sinking air, and the headwind on final.

The key to energy management is to evaluate the conditions and ***plan ahead*** so you are not caught with no energy.

Low Altitue + Low Airspeed = Broken Glider