

# Critical Insight 2: Output Inductors L5, L6 Operation Modes

## STORAGE Mode (Switch ON)

### Physical State:

Switch closed, output diode reverse biased

### Current Path (L5 example):

$L5 \rightarrow C1 \rightarrow S1 \rightarrow L5$  (series loop)

### Current Direction:

REVERSE (opposite to output)

### Equation:

$$dI_{L5}/dt = -V_{C1} / L5$$

### Sign:

**NEGATIVE** ( $I_{L5}$  becomes more negative)

### Energy:

Building magnetic energy in reverse direction

### Analogy:

"Winding a spring backwards"

## TRANSFER Mode (Switch OFF)

### Physical State:

Switch open, output diode forward biased

### Current Path (L5 example):

$C1 \rightarrow L5 \rightarrow D8 \rightarrow C_{out}$

### Current Direction:

FORWARD (toward output)

### Equation:

$$dI_{L5}/dt = V_{C0} / L5$$

### Sign:

**POSITIVE** ( $I_{L5}$  increases, releasing energy)

### Energy:

Releasing stored energy to output

### Analogy:

"Spring unwinding to do work"

**Fundamental SEPIC Mechanism:** This reverse-charge-then-release mechanism is fundamental to SEPIC energy transfer. Output inductors act as energy buffers, storing magnetic energy during switch-ON intervals and releasing it to the output during switch-OFF intervals. This enables the SEPIC topology to step up or step down voltage while maintaining input-output isolation through the coupling capacitors.