Power conversion issues with energy harvesting

Some typical applications of less conventional power generation through energy harvesting include:

- Wave energy
- Human (or some other kind) movement (e.g., piezoelectric generator)

Common problems: Need for small volume (high density)

Power source: low frequency (pulses in the order of Hz) vs. low voltage (≈ 1V)
Consider a synchronous boost for improved efficiency. We need MOSFETs with very low Rds(on).

The control circuit must be powered from the higher voltage output.

Hence, we need a starting circuit.

Starting procedure:
1) Switch is closed and L is charged.
2) Switch is released.
3) Current flows from the inductor.

Resistor - limits the current through the inductor during startup.
Flows to the output capacitor

The output voltage increases if the controller and gate drive can be powered.

Now consider a source like this:

* e.g. a wave among
  a resonator, both in and out

![Graph showing a waveform with peaks and troughs](image)

Power converter output $\leq 14 \text{Vdc}$ (to charge a battery).
Let's stay...
Additional problem - efficiency of intermediate stages with low input at \( V_{in} < 1V \) an indicator with \( R < 0.1 \) is too high \( \rightarrow \) very low efficiency

Solution: multiply boost

As a result overall efficiency is about 60\%