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Design Strategy of Conventional Electronic for Wireless Sensor Node Powered by Vibration Energy Harvester

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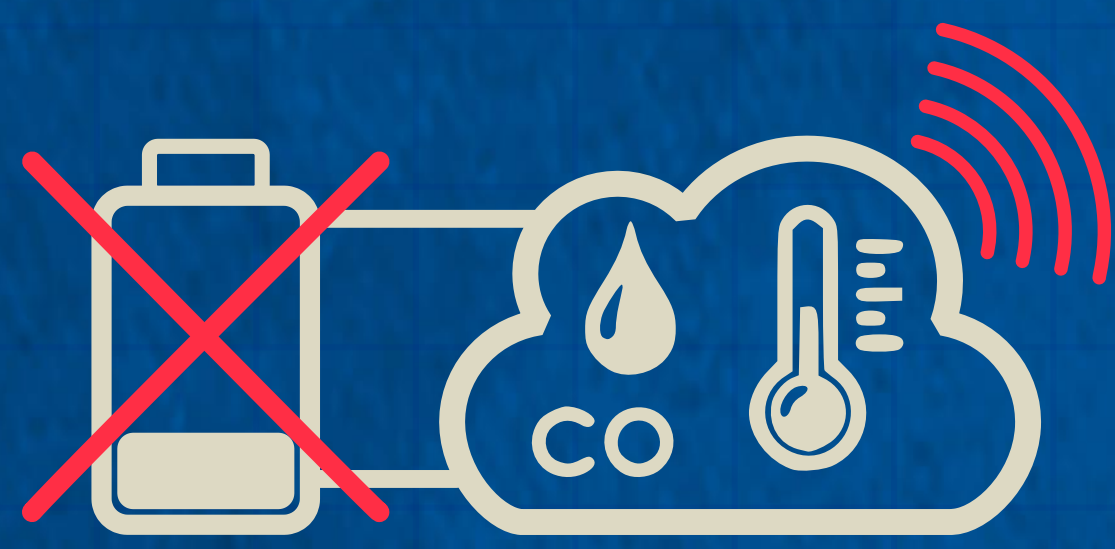
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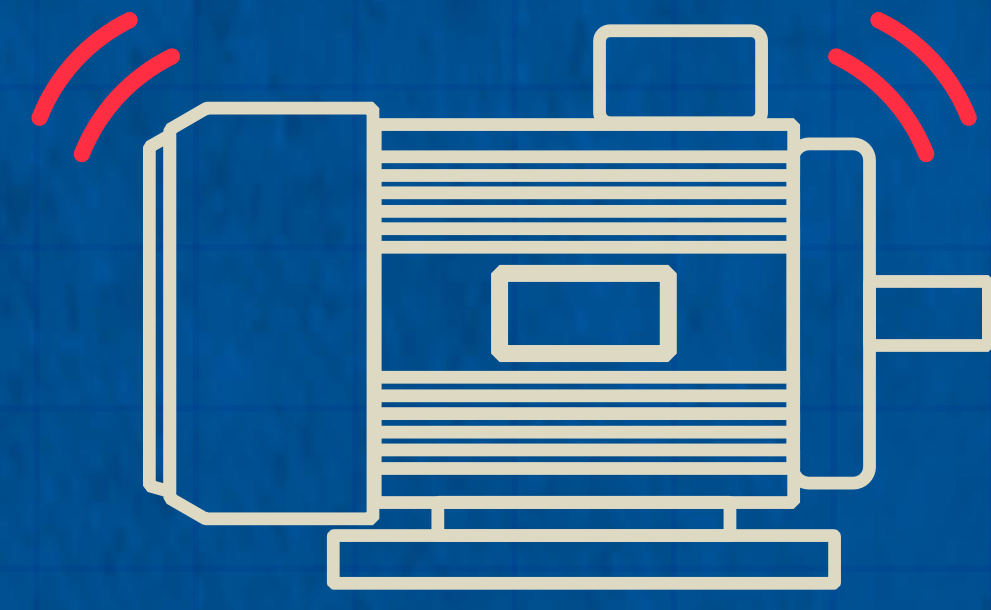
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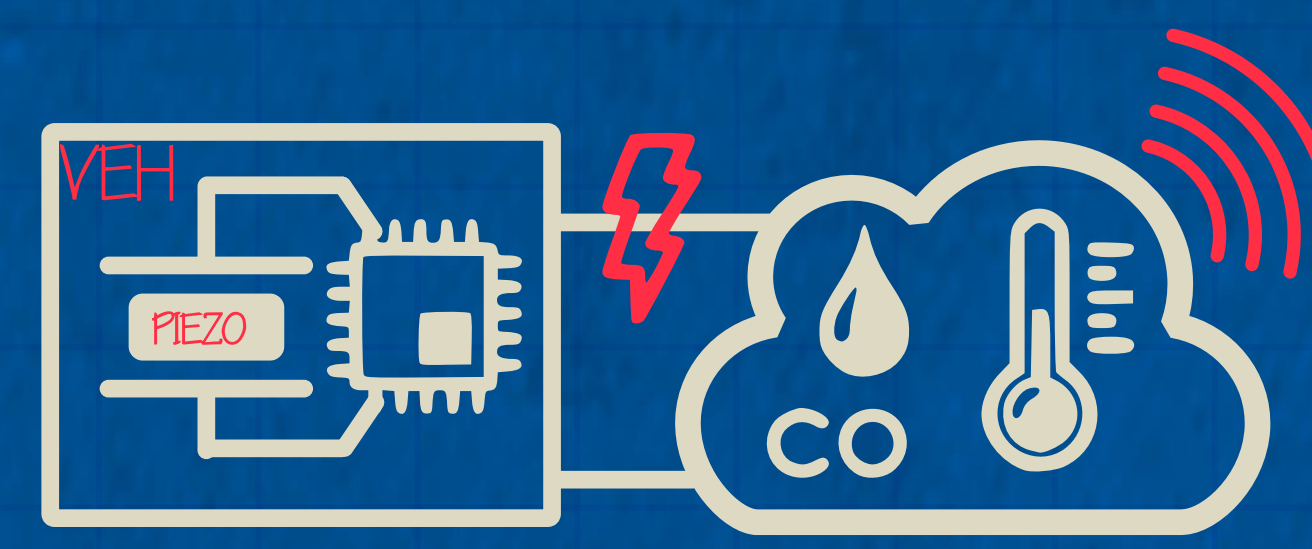
Problematic



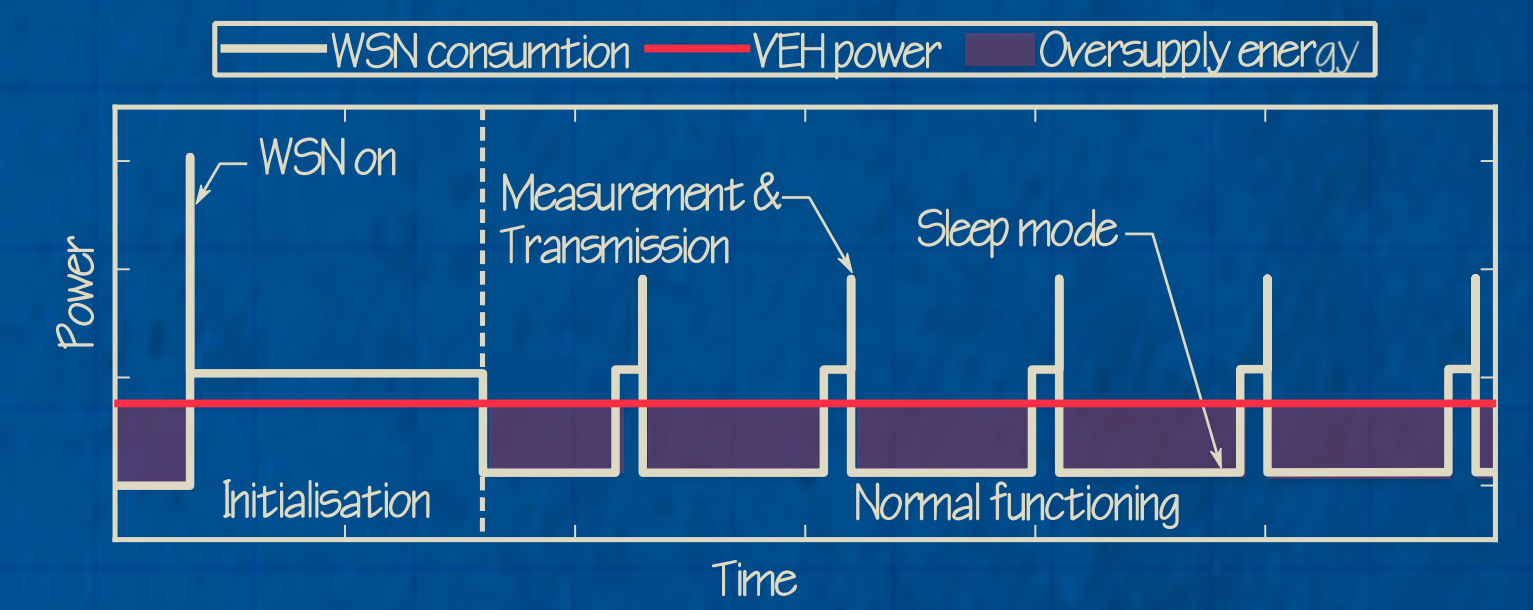
Remove WSN's batteries



Harvest industrial ambient energy

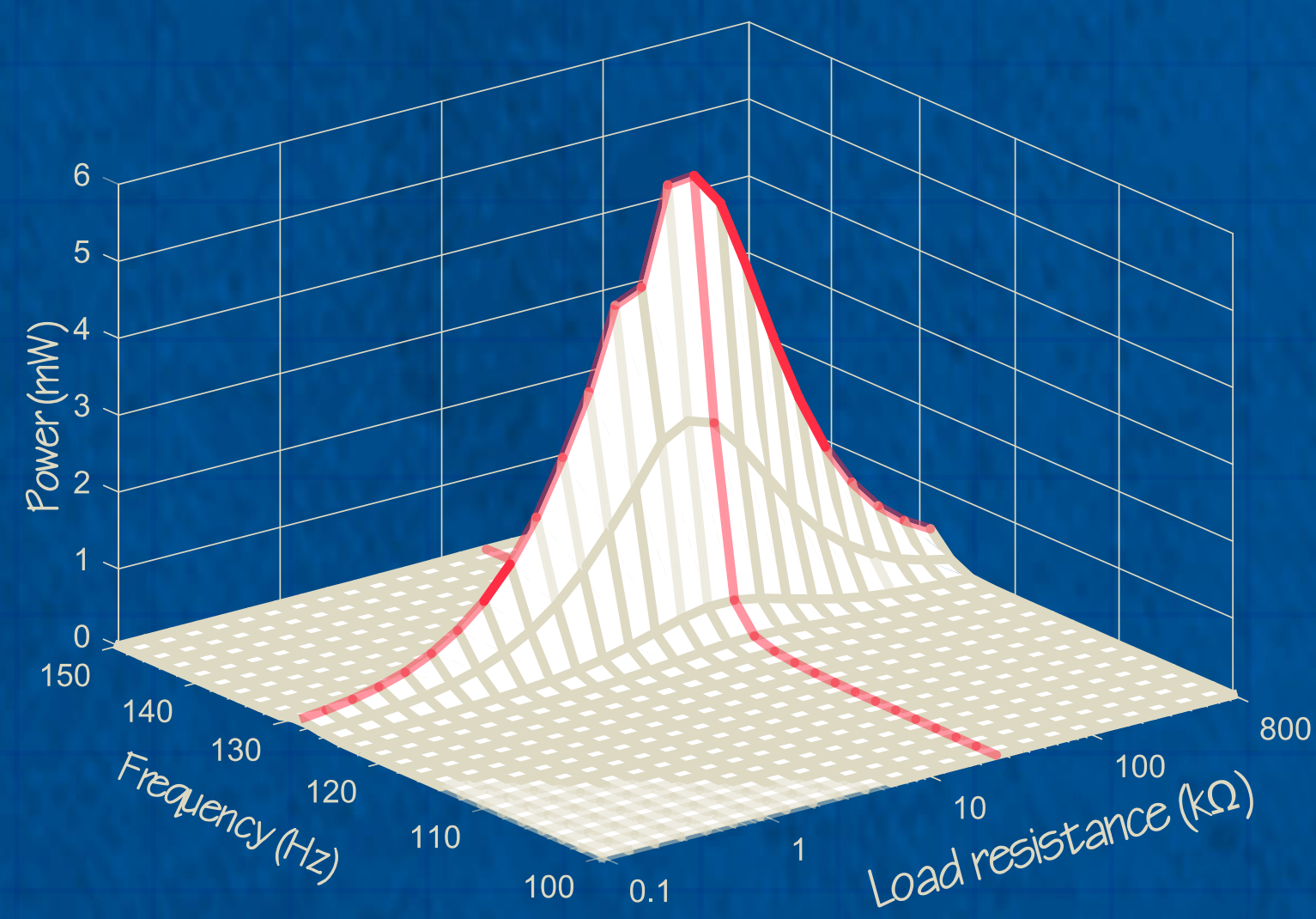


Supply WSN

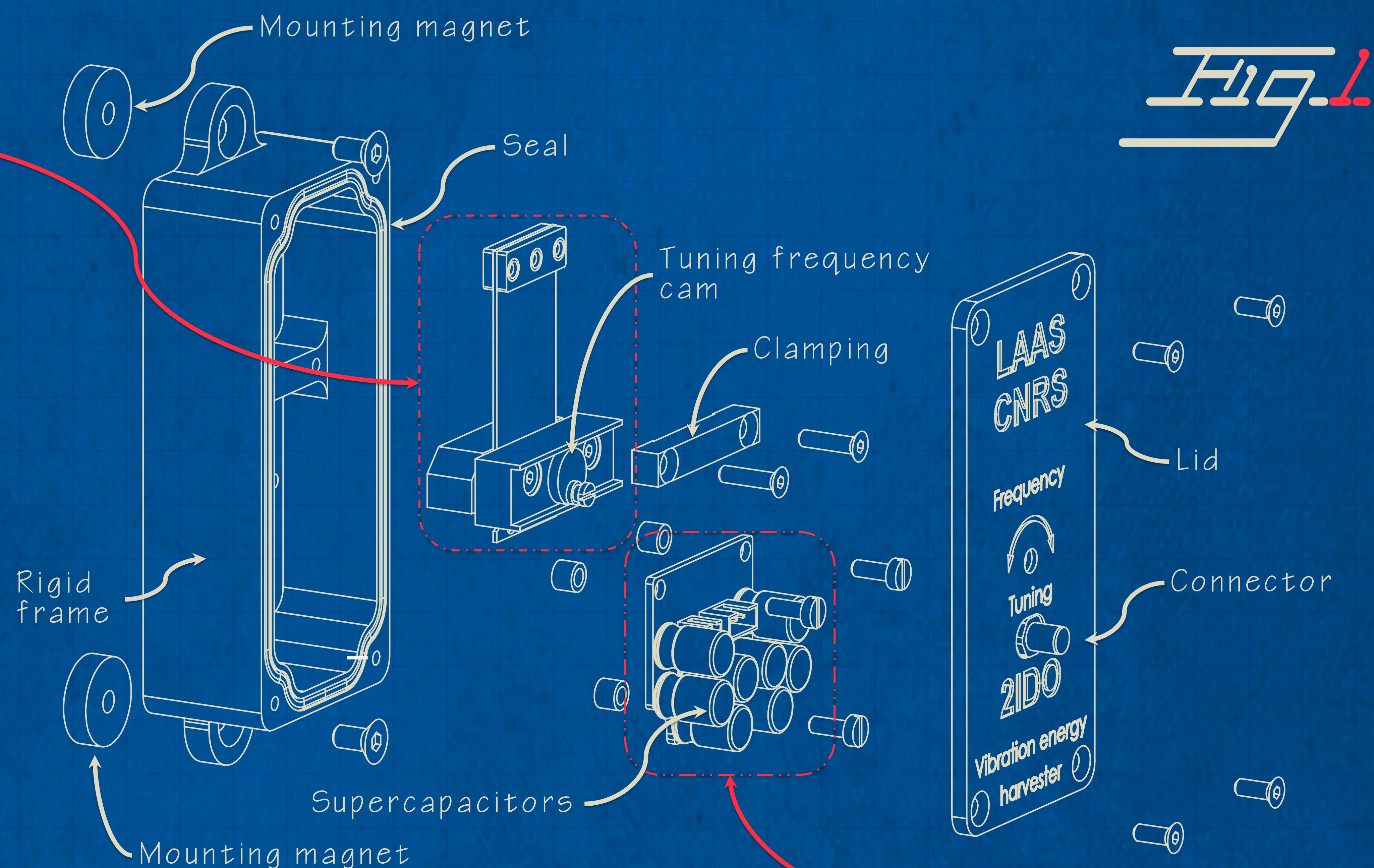


Manage energy for different phases

Adjustable piezoelectric generator



- Acceleration: 1.4g
- Resonance frequency: 128.8 Hz
- Optimal load resistance: 27.5 kΩ
- Maximum power: 5.8 mW
- Voltage: 18.81 V @ Pmax



Electronic management

Fig. 2

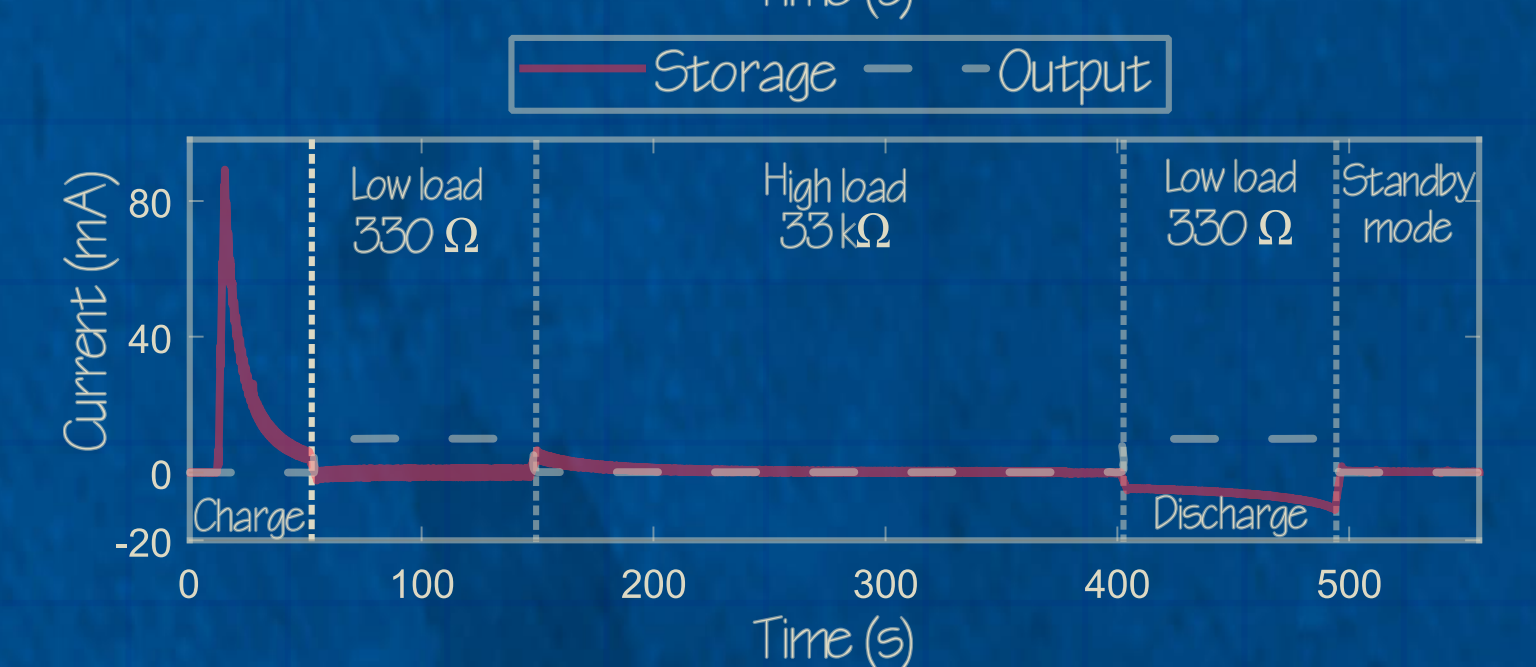
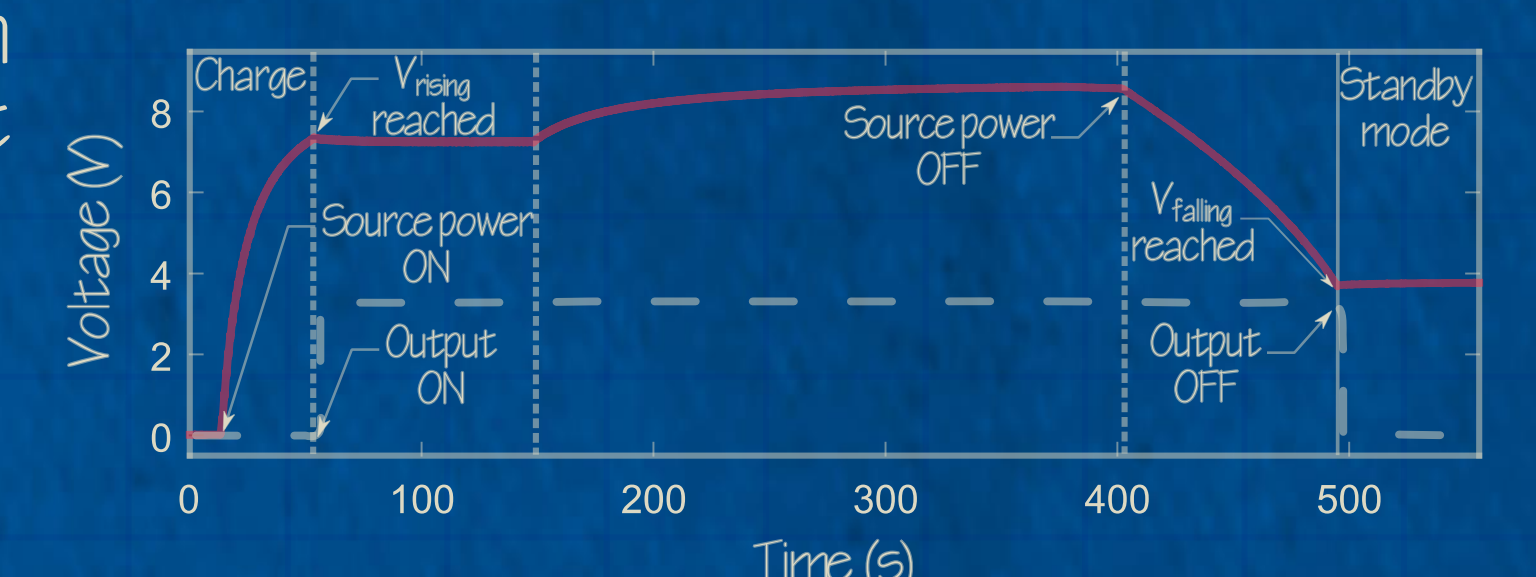
AC/DC buck converter with high hysteresis output activation set by resistors

- Voltage input: ± 20 V
- Current input: ± 50 mA
- Voltage output: 1.8 V to 3.6 V
- Current output: 160 mA max

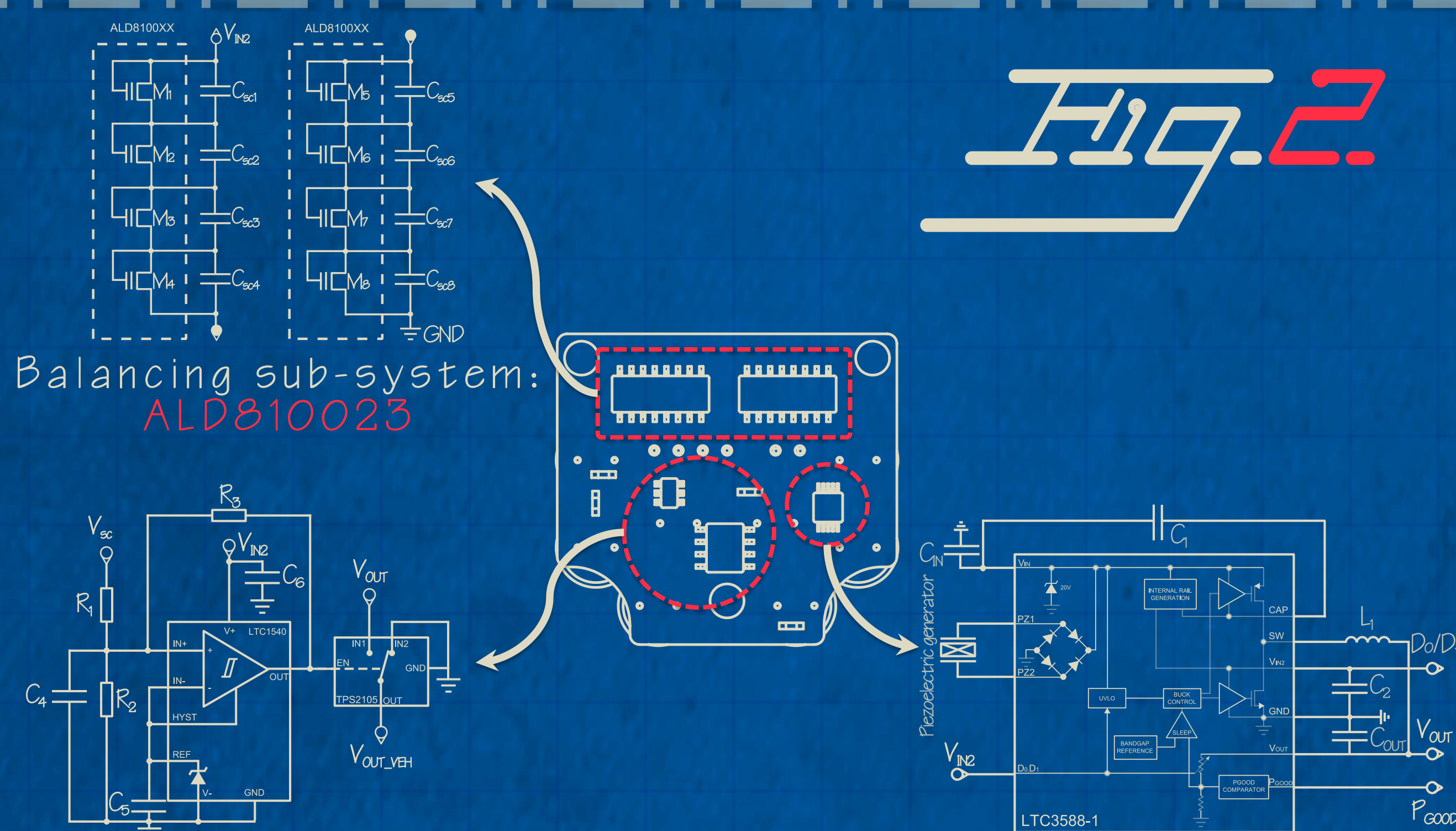
- Supercapacitors: 125 mF, 21.6 V
- Voltage equilibrium: 2.3 V

- V_{rising} : 7.36 V
- $V_{falling}$: 3.28 V
- Usable energy: 2.71 J

- Global efficiency: 80.2 %
- Maximum usable energy: 24.3 J



Overall operation: function generator source and resistive charge



Start energy tuning:
LTC1540 + TPS2105

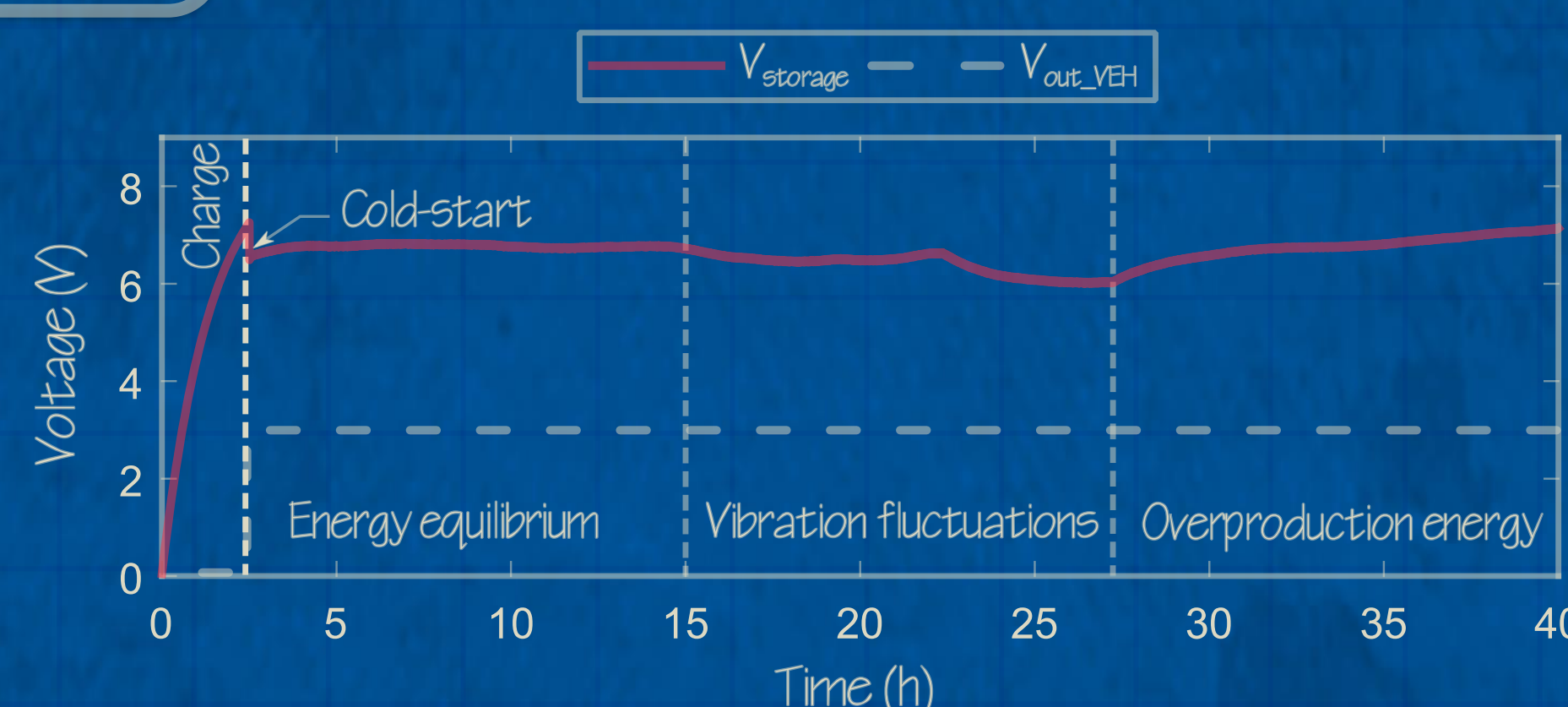
Extraction circuit:
LTC3588

Results & Discussion

Phase	Energy	Duration	Peak power
Initialisation	389.4 mJ	311 s	180.8 mW
Meas. & Trans.	3.2 mJ	110 ms	231.2 mW
Sleep	3.8 mJ	46.9 s	87.45 mW

WSN's supply voltage: 3.3V

WSN JN5148 Operation phases characteristics



WSN JN5148 supply by VEH: long duration test

With very simple tunable linear piezoelectric generator and reliable components from the market, we are able to harvest and store energy in an efficient way in order to supply sensors.

The high amount of stored energy can compensate vibration source fluctuations.