Assume just 2 voltage levels: 
$V_L$, $V_H$.

At $V_L$, $x$ units of work take $x\delta$ units of time.

At $V_H$, $x$ units of work take 
$x*\text{slow}(V_L)$ units of time.

Associate, statically, with each task a voltage level such that:

(i) All tasks meet their deadlines,

(ii) Energy consumption is reduced by as much as possible (for a static algorithm).
$$\text{Slow}(v_t) = \frac{2}{10}$$

\[
\begin{array}{c|cc}
 T_i & P_i & T_i \\
 \hline
 T_1 & 1 & 10 & 0.1 \\
 T_2 & 3 & 15 & 0.2 \\
 T_3 & 8 & 30 & 0.2 \\
 \hline
 \text{Total} & \text{5} &
\end{array}
\]

$$2, 6, 8$$

$$\sqrt{\frac{2}{10} + \frac{6}{15} + \frac{8}{30}} = \frac{21}{30}$$

$$\times 1, 6, 16$$

$$\frac{3 + 12 + 16}{30} = \frac{31}{30}$$

→ Relax the constraint that the entire task must be run at the same voltage level

→ Reclaim time released by tasks that don’t consume their WCET.
\[ T = \frac{5T_1^2}{P = 8} \]

Let \( f \) = fraction of the work done at low voltage, \( v \).

\[ \Rightarrow \text{well} \text{ up to } 5f \text{ units done at } v \equiv 10f \text{ seconds} \]

\[ s(1-f) \text{ at } v_h : 5(1-f) \text{ seconds} \]

Total time taken = \( 10f + 5(1-f) = 5f + 5 \).

\[ 5f + 5 = 8 \]

\[ \Rightarrow \frac{f}{f} = \frac{8 - 5}{5} = \frac{3}{5} \]
Actual → 4 units

\[ 3 \times \left( \frac{v_b}{v_a} \right)^2 + 1 \]

\[ 2 \times \left( \frac{v_b}{v_a} \right) \]

\[ v_a = 1 \text{ unit} \]

\[ 2 + 2 \left( \frac{v_b}{v_a} \right)^2 \]
\[
\begin{array}{c|c|c}
\text{e}_i & \text{p}_i \\
\hline
\text{T}_1 & 2 & 10 \\
\text{T}_2 & 1 & 10 \\
\text{T}_3 & 5 & 10 \\
\end{array}
\]

\[
\text{slow}(y_v) = 2 \hspace{1cm} \frac{\text{if } \text{T}_1 \land \text{T}_2 \land \text{T}_3}{10}
\]

\[
\begin{array}{c|c|c|c}
\text{t} & \text{t} & \text{t} & \text{t} \\
\hline
2 & 4 & 6 & 9 \\
0 & 10 & & \\
\end{array}
\]

\[
\omega_3 = 4, \quad \omega_1 \\
\]

\[
\sum f_\ell \hspace{1cm} 10f_\ell + 5(1 - f_\ell) = 6 \\
\Rightarrow \hspace{1cm} 5f_\ell + 5 = 6 \\
\Rightarrow \hspace{1cm} f_\ell = \frac{1}{5}
\]
Assume the processor is the dominant energy consumer and that at high voltage, it consumes 100 Watts.

\[ V_h = 3.3 \text{ V}; \quad V_l = 1.65 \text{ V} \]

1 unit of work at low voltage is consumed

\[ \frac{(1.65)^2}{3.30} \times 100 \text{ joules} \]

\[ = 25 \text{ joules} \]