EECE 2150 - Circuits and Signals: Biomedical Applications Fall 2018
Quiz 3

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The figure shows a simple model of two solar cells. Each is represented by an ideal current source and a parallel resistor. In this circuit, the two solar cells are placed in parallel.

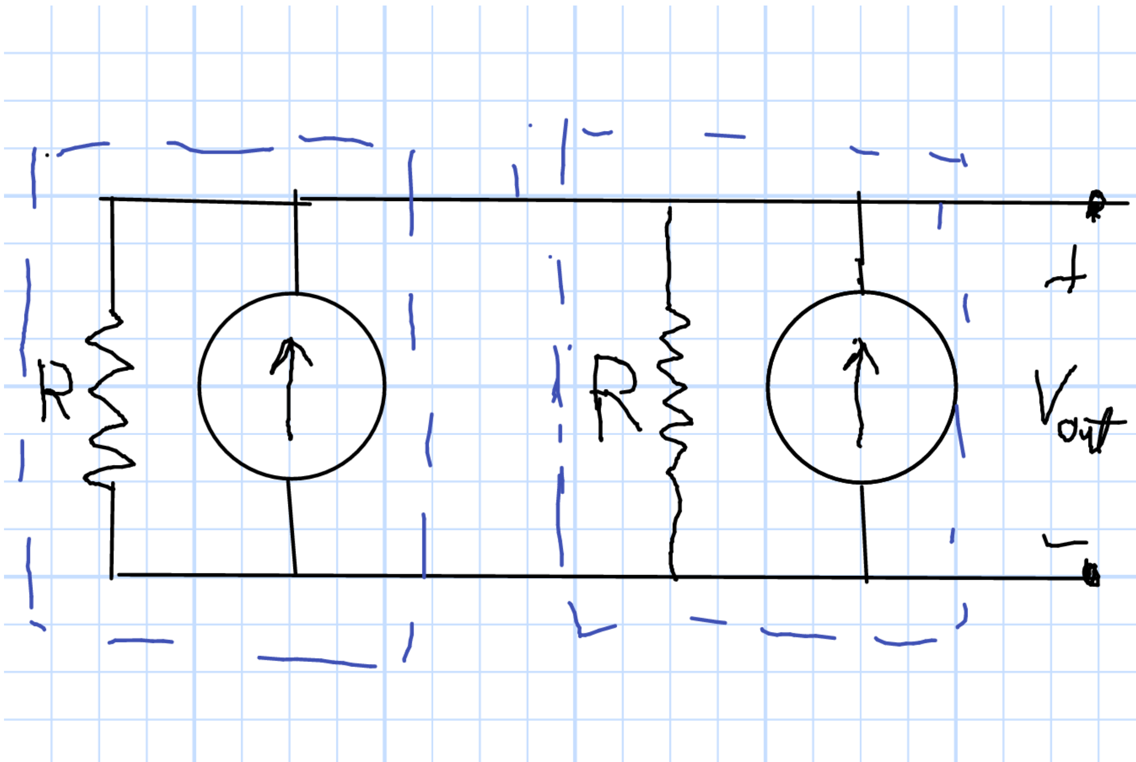
When illuminated by sunlight the current and resistance are high. Let's assume 0.2 Amp for each current and $100\,\Omega$ for each resistor.

1. Draw the Thévenin equivalent circuit for the two solar cells as seen at the terminals on the right.

2. What is the voltage across a $10\,\Omega$ load?

3. Now assume that light is blocked by a cloud to one of the solar cells. Now the current goes to zero and the resistance changes to $3\,\Omega$. What is the Thévenin equivalent circuit now?

4. When the light is blocked to one solar cell, where does the current from the other one go? Which solar cell gets hot?


R
R
+
V_{out}
−

1. Parallel currents add;

$$i_{sc} = 0.4\,\text{Amps}$$

Parallel Resistors;

$$R_T = 50\,\Omega$$

Thévenin Voltage;

$$V_T = v_{oc} = 0.04\,\text{Amps} \times 50\,\Omega = 20\,\text{V}$$

2.

$$v_{load} = v_T \frac{10\,\Omega}{60\,\Omega} = 3.33\,\text{V}$$

3.

$$i_{sc} = 0.2\,\text{Amps}$$

Parallel Resistors;

$$R_T = 3\,\Omega \parallel 100\,\Omega = 2.91\,\Omega$$

Thévenin Voltage;

$$V_T = v_{oc} = 0.02\,\text{Amps} \times 2.91\,\Omega = 0.0583\,\text{V}$$

4. The 0.02 A mostly goes through the parallel resistor of the dark cell. Thus the dark cell is the one that gets hot.

The actual behavior is more complicated than this, and as a result the numbers are different, but the concept still holds. Designers of large solar–power installations need to deal with this problem.