CLAIMS

1. A downhole power generating system, comprising:

   a thermoelectric generator operable to convert a temperature gradient across a section of the thermoelectric generator into electrical energy and deployed in a wellbore; and

   a pressure control device positioned proximate the thermoelectric generator and having a fluid flow path for a fluid flowing through the pressure control device and across the section of the thermoelectric generator such that an absolute pressure of the fluid decreases when the fluid flows out of the pressure control device and across the section of the thermoelectric generator,

   wherein a temperature of the fluid changes as the fluid flows out of the pressure control device and across the section of the thermoelectric generator due to a change in the absolute pressure of the fluid, and

   wherein a temperature change across the section of the thermoelectric generator is due to a change in the temperature of the fluid.

2. The downhole power generating system of claim 1, wherein the temperature gradient across the section is based on a Joule-Thomson expansion relationship expressed as $\mu_{JT} = \left(\frac{\delta T}{\delta P}\right) H$, wherein μ_{JT} is a Joule-Thomson coefficient of the fluid, δT is a change in the temperature of the fluid across the section of the thermoelectric generator, δP is a change in the absolute pressure of the fluid when the fluid flows out of the pressure control device, and H is a constant.

3. The downhole power generating system of claim 2, wherein the thermoelectric generator comprises n-type and p-type semiconductors.

4. The downhole power generating system of claim 3, wherein the semiconductors are formed from at least one of silicon-germanium, SiGe, bismuth telluride Bi_2Te_3, and poly-silicon.

5. The downhole power generating system of claim 1, wherein the pressure control device is an inflow control device, an autonomous inflow control device, an inflow control valve, or a nozzle.

6. The downhole power generating system of claim 1, further comprising an electronic component electrically coupled to the thermoelectric generator and operable to receive electrical energy from the thermoelectric generator.

7. The downhole power generating system of claim 6, wherein the electronic component is a sensor operable to measure one or more fluid properties of the fluid, the one or more fluid properties comprising at least one of an absolute pressure of the fluid, a flow rate of the fluid, and a temperature of the fluid.

8. The downhole power generating system of claim 7, wherein the sensor is operable to measure one or more formation properties of a formation proximate the sensor.

9. The downhole power generating system of claim 6, further comprising an energy storage component electrically coupled to the thermoelectric generator and the electronic component and operable to:

store an amount of electrical energy generated by the thermoelectric generator; and

provide electrical energy to the electronic component to power the electronic component.

10. The downhole power generating system of claim 1, wherein the electrical energy is utilized to power the thermoelectric generator.

11. The downhole power generating system of claim 1, further comprising at least one fin coupled to the thermoelectric generator and operable to facilitate heat transfer between the fluid and the thermoelectric generator.

12. The downhole power generating system of claim 1, wherein the temperature change is indicative of a type of the fluid.

13. The downhole power generating system of claim 1, wherein the wellbore is a wellbore of an injection well, and wherein the fluid represents at least one type of fluid utilized to stimulating a formation proximate to the downhole power generating system.

14. The downhole power generating system of claim 1, wherein the wellbore form a wellbore of a production well, and wherein the fluid is a type of hydrocarbon resource that flows from a formation proximate to the downhole power generating system.

15. A method to provide power to a downhole electronic component, comprising:

deploying a thermoelectric generator into a wellbore, the thermoelectric generator being operable to convert a temperature change in fluid having a Joule-Thomson coefficient μ_{JT} flowing across a section of the thermoelectric generator into electrical energy;

forming a fluid flow path for the fluid to flow through a pressure control device having a fluid flow path for the fluid flowing through the pressure control device and across the section of the thermoelectric generator, wherein the temperature of the fluid flowing across the section of the thermoelectric generator changes due to a change in an absolute pressure of the fluid when the fluid flow out of the pressure control device and across the section of the thermoelectric generator;

converting an change in the temperature of the fluids flowing across the section of the thermoelectric generator into electrical energy; and

providing electrical energy to an electronic component electrically coupled to the thermoelectric generator.