THE PROMISING COMBINATION OF THERMOELECTRIC GENERATORS WITH IoT TECHNOLOGIES FOR AUTONOMOUS MONITORING SYSTEMS

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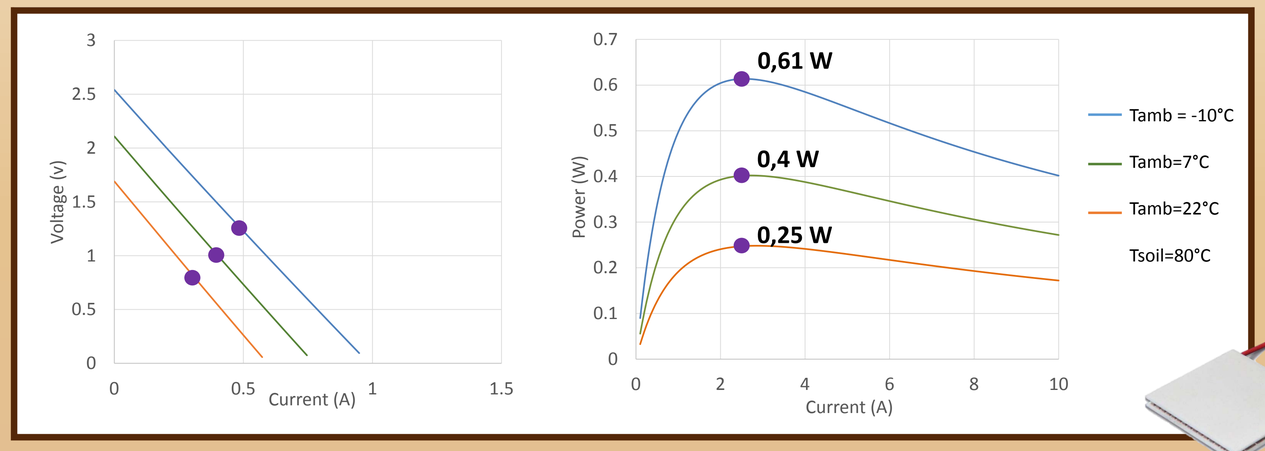
Abstract

Monitoring stations becomes essential in any volcanic system in the world but, because of their remote location, both the electricity supply and the communications represent a technological challenge.

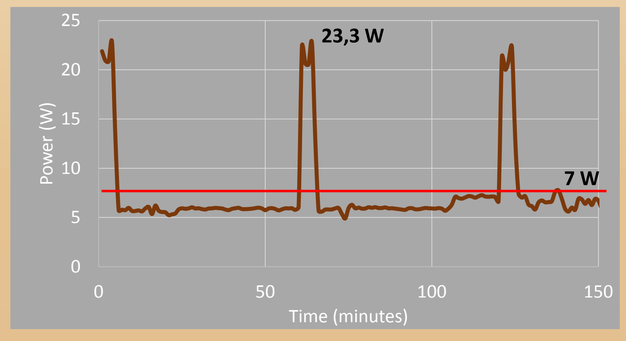
The present work studies the feasibility of an autonomous volcanic monitoring system powered by thermoelectric generators for one of the monitoring stations of the Teide National Park (Canary Island), where temperatures of 80 °C at few centimeters from the surface are found. The stable generation and robustness of thermoelectricity in combination with a new communication system based on LoRa (a low power wireless technology) make this solution a good alternative.

Approach to the problem

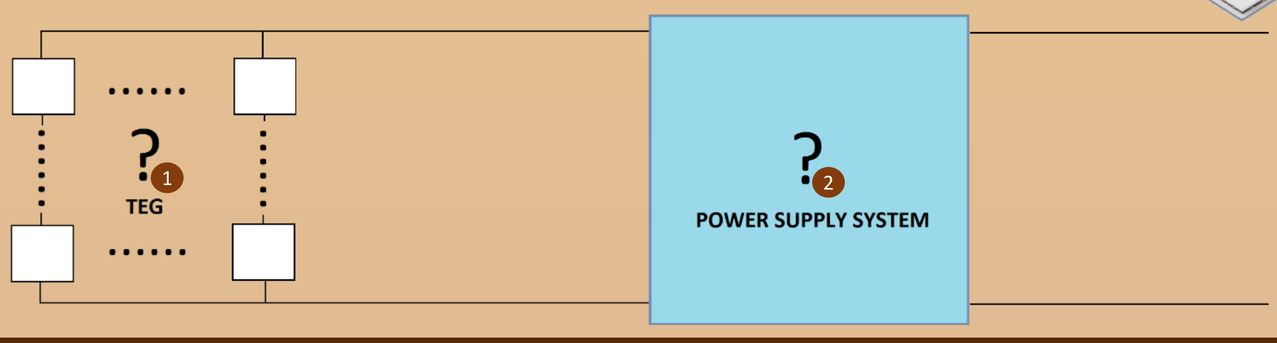
Generation per module:



Consumption profile:



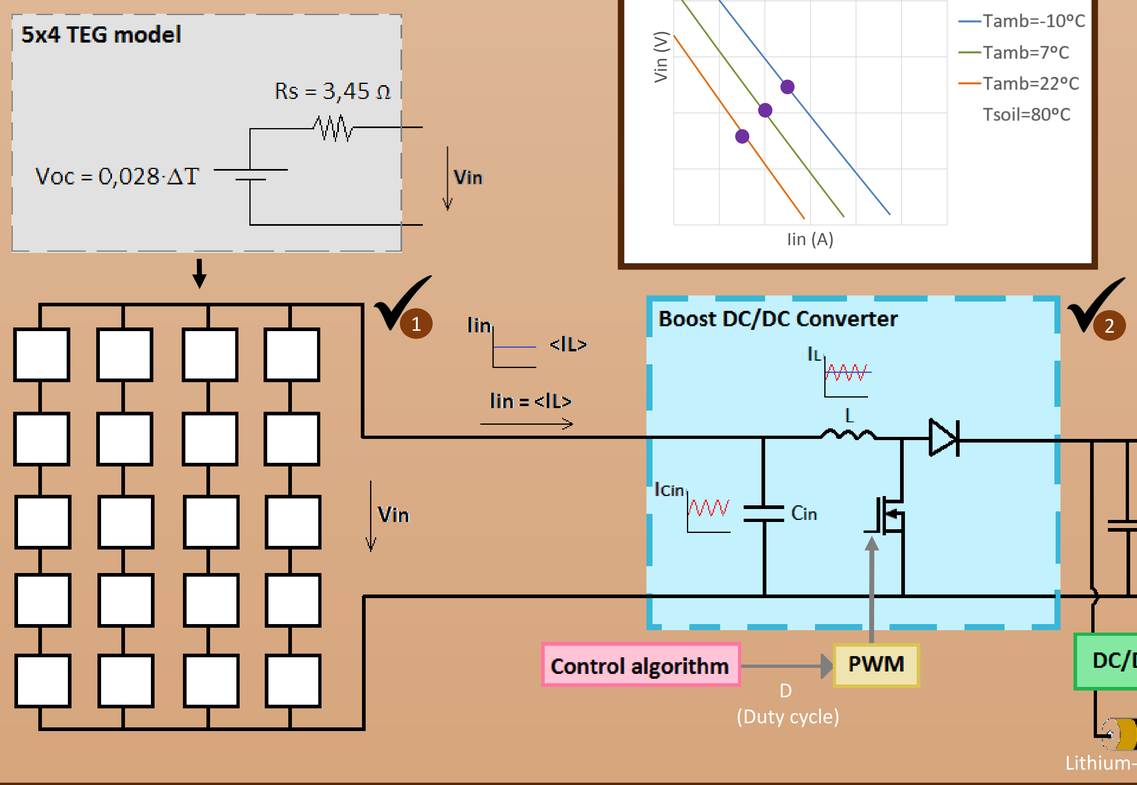
- Average power: 7W
- Supply voltage: 12V
- Variable consumption profile

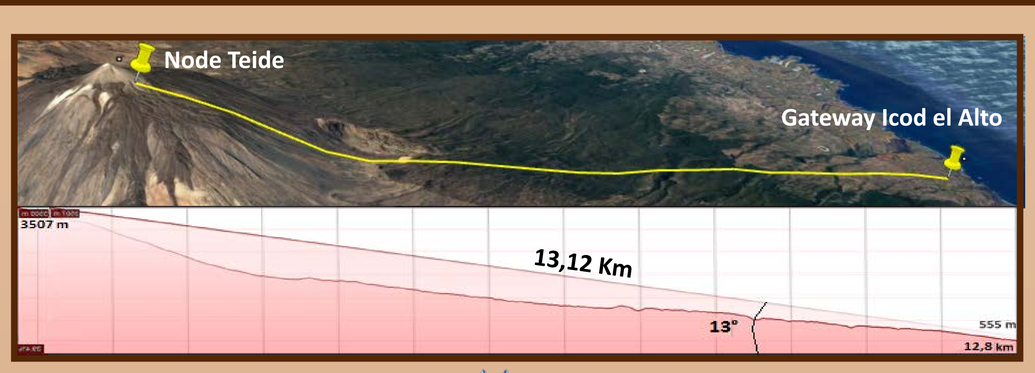


Proposed solution

- **5 modules in series** to increase the efficiency of the Boost DC/DC Converter while ensuring Vin < Vout.
- **3 branches in parallel** to cover the required power **and an additional one** to increase reliability.

Tamb (°C) /ΔT	P_{TEG}(W)
-10 / 90	12,2
22 / 58	5





Conclusions

- The current communication system (Gsm Router) has been replaced by a solution based on LoRa modulation, leading to a reduction of 97% in the total average power required by the Communication System.
- A mixed configuration (series / parallel) of 20 thermoelectric modules has been chosen in order to generate the required average power (with an additional branch to increase the robustness of the system).
- In order to optimize the thermoelectric generator (the most expensive part of the installation) the power supply system has been designed using a boost DC/DC converter and a lithium-Ion cell for storage.

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