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Polygeneration Systems in Bolivia: Integrated Energy Technologies for Rural Development - "Multiservice Micro-turbine Plants"

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-Introduction

Bolivia is a country with a lot of natural resources and many sources of energy; however, a considerable number of poor communities and small towns in rural areas do not have access to basic services. Furthermore, many of these places are dispersed in big areas and faraway from the National Interconnected Electric System, for this reason it is difficult provide energy services.



Fig 1: ITAU - Natural Gas Plant in Bolivia (Jhonny Villarroel Schneider 2013)

On the other hand, Bolivia has extended Natural Gas pipelines along several regions and thus it can be used in order to cover some of the needs. Bolivia has one of the biggest reserves in the South American region and thus it is considered as one of the primary fuels in this study in spite of being non-renewable.

A Natural Gas-Micro Turbine can contribute in different configurations with more than mechanical power, depending on the need of the end-user. There are, however, two issues that need to be further addressed, and these are: i) -Reduce the cost of the Micro-Gas Turbine technology and ii) -Optimize different configurations with several energy services included in the power plant, depending on the local requirements. The latter includes electricity as well as climate, comfort and environmental impact that have influence in other energy-related requirements. Thus, Multiservice Micro-Turbine Plants are an interesting alternative in order to satisfy many of the needs that exists in rural areas in Bolivia because it can provide electricity and heat.

According to the region in Bolivia, there are different requirements besides electricity, for example; in the cold region that is called "Altiplano", hot water is required while the region called "Llano" is tropical and very hot and the inhabitants can use a combined refrigeration system in order to have conditioned air. Clean water, steam, etc. are other products that could be required depending on the application. The main objective of this project is to try to take advantage of the natural gas in the most effective way by providing different products using a micro turbine as prime mover.

(This idea is general this project just started we are working with the specific focus of it.)

-Methodology

- Based on the regions in Bolivia, establish the requirements of two scenarios:
 - The requirements of the cold region.
 - The requirements of the hot region.
- Identify the potential needs to be provided by the microturbine plant and perform a thermodynamic analysis of the selected cases.
- Perform a thermoeconomic optimization using different tools for Modeling and Simulation.
- Identify the scenario in which a microturbine polygeneration plant is feasible in Bolivia.

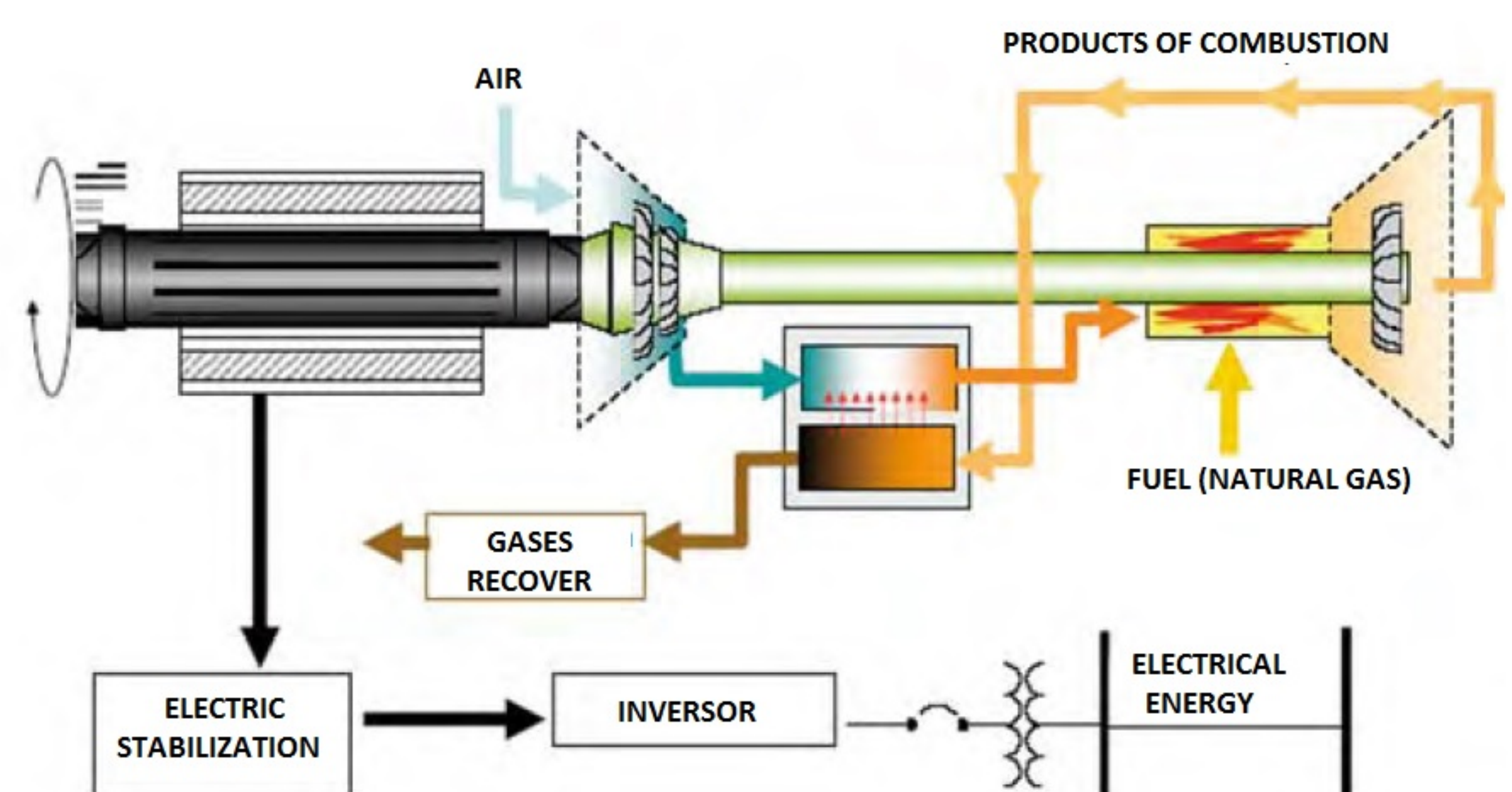


Fig 2: Schematic diagram of a simple Micro Turbine.(www.fundaciongasnatural.org; <http://es.scribd.com/doc/205828369/Ficha-A3-02-12-2010-pdf>)

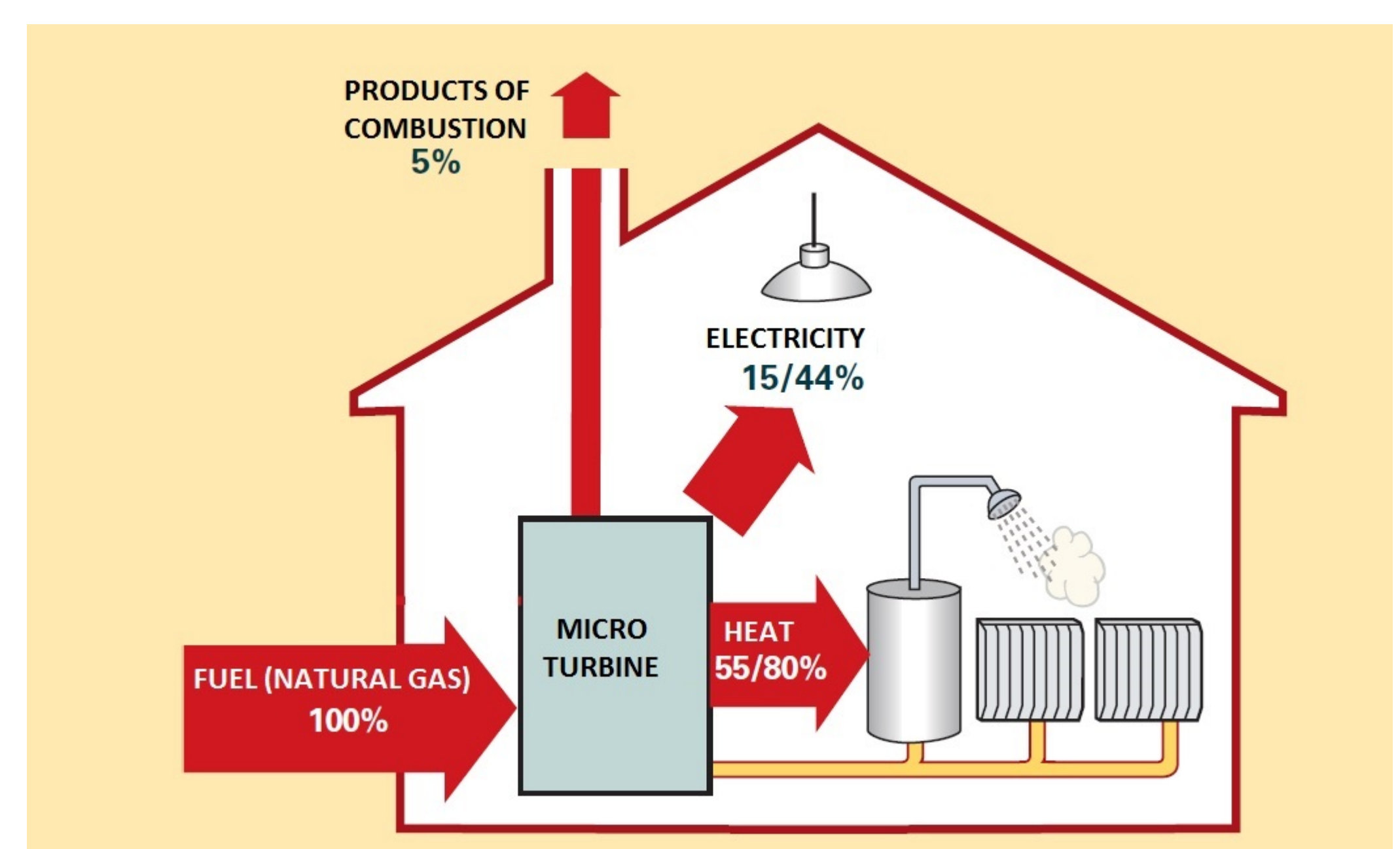


Fig 3: Schematic diagram of uses of a Microturbine (www.fundaciongasnatural.org; <http://es.scribd.com/doc/205828369/Ficha-A3-02-12-2010-pdf>)

-Expected Results

- We will identify the most important energy-related requirements in two regions in Bolivia.
- We will have a thermoeconomic optimization model for a better use of microturbine in its different alternatives of use.
- It will be possible to have an analysis of the scenarios in which a Microturbine Polygeneration Plant is feasible in Bolivia.

-Funding

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