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Smart Grid: What's news?

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Abstract. As a direct consequence of the increasing demand of energy and the need to decrease pollution in order to cope with global warming, political, industrial and scientific interests have combined to understand the way ICT technologies can help to review all phases of energetic cycle, from generation (through renewable sources), to accumulation and transportation, until distribution. The union between ICT and energy is usually identified as "*Smart Grid*", to emphasize an expectation change in what will be the Power Grid of the incoming future. The aim of this study is to give some ideas about the experimentation of new techniques of energy acquisition through renewable sources (solar, chp, wind, etc.). These techniques would guarantee more accessible prices for production, improving performances, the overcome of those constraints that did not allow the exploitation of potential energy capacity of renewable sources. This grid will be made of devices forming a control cycle that will check the station of energy generation as much as the behaviour of single consumers.

Key words

Distributed Generation (DG), Renewable Energy, Smart Grid, Microgrids.

1. Introduction

Energetic sustainability has a straight link with renewable energies, which consist in inexhaustible sources, due to their capacity of regeneration within a period comparable to the consumption time. The main goal of energetic sustainability is "to reach a democratic solution for the global energetic crisis, decreasing the impact of CO_2 on global warming". Since Distributed Generation (DG) often involves renewable energy, it is important to facilitate integration of DG into existing networks.
They are based on the Active Network Management (ANM) concept, where automation, ICT and power electronics are used to integrate more DG by exploiting active resources instead of just reinforcing the network.
The concept of energetic sustainability linked with renewable energies is addressed in this presentation in section 2, which analyzes a method for the production of energy from combined heat and power, with particular application in residential (chp), in sections 3 and 4, which raises the problem of overcoming the obstacles that still prevent the sun to play a primary role in the production of clean energy on a large scale, through innovative techniques tested at two American universities: Stanford e MIT. In sections 5 and 6 will be evalueted in terms of benefits the contribution of ICT to facilitate the integration of DG into existing networks. Section 6 presents activities that are performed at the Departement of Electronic Engineering of Roma Tre University where, through measurements of electric parameters to check the network, is optimized the use of the network. The idea is combining the needs of production with those of the consumers so improving the quality of service.

Combined production of heat and electricity (CHP)

The "Oak Ridge National Laboratory" is among those laboratories which has already started a combined production of heat and electricity (CHP), reducing CO_2 emissions. The separated production mechanism of heat and electricity is named "*Cogeneration*" [1]. Cogeneration systems are usually made of a prime mover, converting fuel in mechanic energy, a generator, transforming mechanic energy in electric energy, and a heat recovery system, collecting rejected energy and converting in usable heat energy. Further improvements would allow to use cogeneration systems to produce heat and cold for residential usages. This system works with vegetable oil combustion through a power generator, which supplies home electricity. The rejected heat of this process is used to supply heating and hot water and furthermore to cool refrigerators. In addition the system that burns fuel absorbs CO_2 and consequently produces zero greenhouse gas emissions. This system is named "Micro-three-generation" [2]. This system will release energy only when needed due to an energy storage system. A potential use of Micro-three-generation is the "*Croton-Megalocarpus*" a bio-energetic crop that grows in east Africa [3].

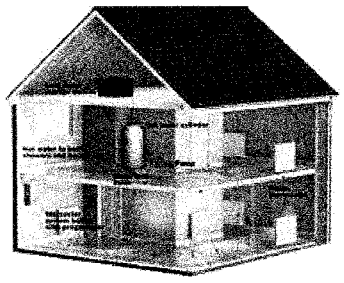

Fig. 1. Micro Tri-generation system to produce heat and cold in a residential

This biofuel grows on lands not addressed to traditional food crops or farming. Since the available areas for biofuel are 4,7 millions (estimate of Stanford University),