ENERGY EFFICIENCY IN SMART GRIDS

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THESIS OBJETIVE

- To illustrate an interaction between the communication system and the energy grid, coherent with the concept of smart grid which employs the IEC 61850 communication standard.
- To demonstrate, in full scale, the potential of smart grid technologies and concepts to increase the capacity of networks to integrate Distribution Generation, aiming to facilitate the transition towards a more sustainable ECU energy system.
- To contribute to standardization by integrating technology from different manufacturers, accelerating the adoption of the smart grids paradigm.
- To demonstrate the integrated and synergistic use of active network management strategies and demand side management, including active customer participation, smart charging of electric vehicles and distributed storage.

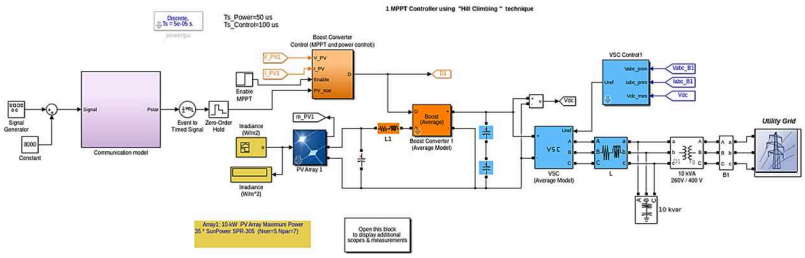

Fig.1Communication model couple with average model 10-kW grid-connected PV array

SIMULATION RESULTS

- Simulation results shown next have been obtained under nominal conditions for the communication system– recall that these are as follows (Router buffer: 20 packets, line delay: 0.1s, channel capacity:30000bytes/s). In this simulation we are considering only the one main flow of data. i.e. there are no perturbation flows.
- In real world power reference is a constant, at most it could happen that it varies step-wise. But in this case communication delays would not be quite obvious between the sent and received signal over network (as the signal is constant).
- This is why a scenario with a very slowly variable sine signal as power reference P_{star} is proposed here. Its period is set at T = 3 s. This signal is slowly variable in relation to both system dynamics (of order of hundreds of miliseconds) and grid frequency (50 Hz). Such a scenario is definitely not realistic, but it is more illustrative for our purposes.

MOTIVATION OF THE WORK

According to projections of global energy consumption for future decades, the tendency indicates an average increase three times the current demand. This is due to several factors such as globalization, an increase in levels of consumption in a society that fosters a consumerist lifestyle where development and sustainability depend on energy sources. [1]

The current energy model in the world is highly contaminating and inefficient, based on the intensive use of sources under extinction, which are socially unfair and have an increasing demand, without considering that over two billion people around the world do not have any access to this energy resource. [2]

Technologies based on fossil fuels cover approximately eighty percent of the world's energy demand. The use of these energy sources cause seventy five percent of greenhouse gas emissions, which with the current pace of contamination and consumption, would require us to have six planets Earth by the year 2050 [3].

RESEARCH PLAN

1. Literature Review of Smart Grids
2. Analysis of the current situation of power grids
3. Definition of deployment scenarios
4. Simulation of electrical systems using the IEC61850 standard
5. Dissemination of results through publications in international conferences, workshops and journals
6. Documentation

DISSEMINATION OF RESULTS (in the last 6 months)

- **Publication in journals:**

[1] **Cabrera, J.**; Araujo, G.; "Ahorro económico con el uso de las Smart Grid", CIEELA, March, 2016, ISSN: 1390-6577

- **Conference:**

[1] **Cabrera, J.**; "Smart Grid", Pontificia Universidad Católica del Ecuador, 2016.

NEXT YEAR PLANNING

1. Review and precision of the objectives
2. Real data gathering
3. Simulation of electrical systems using the IEC61850 standard
4. Publish results in conferences and journals

REFERENCES

[1] Pasquevich, D. M. (2015). La creciente demanda mundial de energía frente a los riesgos ambientales. AAPC, 12-18.
[2] Ministerio de Electricidad y Energía Renovable. (18 de 02 de 2016). MEER. Obtenido de www.meer.gob.ec
[3] Grupo Intergubernamental de Expertos sobre el Cambio Climático. (29 de 01 de 2016). WORDENERGY. Obtenido de https://www.worldenergy.org/wp-content/uploads/2014/06/Publicacion-Cambio-Climatico-implicaciones-para-el-sector-energetico-IPCCC-AR5.pdf