GEODIS - GEOGRAPHIC DISPERSED AND INTEGRATED ENERGETICAL SYSTEMS

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Overview

The main objective of this project is to develop models and software to plan urban energy systems, integrating power and natural gas grids, demand side management, dispersed generation and storage, among others, taking in account the technological trends and the new society needs. The secondary objective is to carry out a study case to São Paulo Metropolitan Area-SPMA, applying those models aiming at checking them and feeding back to improve them.

The new possibilities for natural gas in metropolitan areas, fitting to new urban needs (mainly services reliability), taking in account new technologies (and novelties to the Brazilian markets), should be the one of the targets to be reached/explored. Dispersed and embedded gas fired generation, cooling systems using natural gas and the combination of both of them (cogeneration), in the private and public use (district cooling) will represent the main variable to be used to optimize the local resources, looking for getting maximum social satisfaction.

Even the importance of the transportation systems in the urban environment, this scope doesn't propose to develop detailed modelization for that. The focus is building electricity captive use.

Geographical Information Systems and Intelligent Systems will be the tool base of all modelization, in view of the attributes spatial characteristics and being necessary to put together different dimensions.

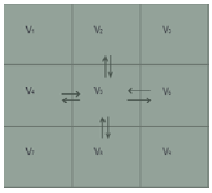
Methods

Looking for natural gas opportunities a new approach for urban energy systems planning is needed. The traditional planning models are based on some behind the times concepts, highlighting: the consumer has a passive behavior instead of active one; the utilities are not planned on integrated base, following each one its own priorities, independently of the whole interest; the social forces are neglected; the modernity is delayed, because the old assets have long span life, avoiding replacements, among others.

The proposed platform called GEODIS(Geographic Dispersed Integrated Energetic System) is an integration of six modules: Social Forces, Environment Mapping, Demand Forecast, Supply Design, Engineering, Integrated Analysis .

An important point to be highlighted is the GEODIS present development level. Since five years ago some relevant steps was done, basically in the following studies: Sao Paulo State Emissions and Energy Matrix, Sao Paulo City Natural Gas Master Plan, BaixadaSantista Metropolitan Area Power Production From Waste. It means this proposal is based on a solid conceptual and practical experiences.

The Monte Carlo method will be applied to generate area fails. For each lot, based on the neighborhood dependency, it will be possible to calculate the equivalent vulnerability. After all tosses, the vulnerability expectancy is done.



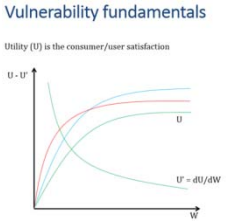
The Environment Mapping is basically a set of layers that will map different environmental attributes and constraints. The challenge is to build a final map that would be able to weigh all different attributes. For that, Fuzzy sets and/or AHP mathematical tools will be used.

The developed method claims in geoprocessing tools , GIS , the multicriteria analysis and traditional analysis for choosing areas for establishment of enterprises (which considers factors not embedded in the

pre - selection and multicriteria analysis and is based on knowledge and technical analysis of multidisciplinary teams with extensive experience in the subjects involved , but without giving up spatial analysis tools).

Results

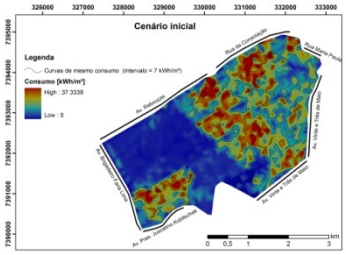
Vulnerability, resilience, fragility, tenacity are regular concepts in ecology. Looking at cities, those concepts can be adapted to be used in energy planning. The term vulnerability can be understood as the susceptibility of a system to a potential damage or transformation when subjected to a disturbance or environmental stress. In this context, the mathematical formulation proposed here, we will assess the vulnerability based on economic utility concept and use the same principles of the consumer behavior theory.

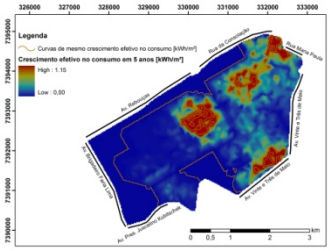


In megalopolis there are a deep dependence between neighbor areas, where servicefacilities supply wider regions than their own. So, the vulnerability of a society depends on the reliability of the local system and of the neighbor systems. It is necessary understand the matrix connecting services and needs (and correspondent risks/fail probabilities) to be possible evaluate the total expected vulnerability. Thus, the utility expectancy depends on according to the probability of system failure. So does the vulnerability.

Maybe the most important GEODIS model is this one. All the demand characteristics and forecast cenarios can be drawn. The methodology is based on field study building attributes characterization. Secondly, the spatial building topology is carried out. Finally, the atopoenergetic map is built.

Based on local historic data, plans and market information one can forecast spatial demand. The following figures present a sample of an applied study to RMSP.





Conclusions

An important strategy to reduce vulnerability is to increase load flexibility or/and dispersed offer. This decentralized analysis is the right way to capture the benefits of dispersed generation, demand side management, district cooling and others nonconventional energy services, because it can consider the satisfaction of the individual, looking at its ambiance.

The use of the proposed model serves to a sensibility analysis. One can compare distinct solutions for different local societies, taking in account their characteristics.

References

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