REQUIREMENTS AND PROSPECTS FOR CONSUMERS OF ELECTRICAL ENERGY REGARDING DEMAND SIDE MANAGEMENT: A CRITIQUE.

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ABSTRACT

Since the inception of oil crisis in the 1970s energy supply and utilization equations, particularly of the developed world have remained unbalanced. This has led to restructuring programs in electrical energy production and utilization. One of the tools devised for control and regulation of energy, especially in the United States was Demand Side Management (DSM). The paper assesses DSM as a tool for effective control of energy profile during peak period but with the introduction of programing to improve coordination. Loads are divided into DSM-able and non DSM-able. The paper is criticised on its title, introduction, methodology and context with the conclusion that classification of loads should be based on modules rather than items.

INTRODUCTION

The title of the article is 'Requirements and prospects for consumers of electrical energy regarding Demand Side Management'. The article was written by Yoseba Penya, Peter Palensky and Maksim Lobashov of the Institute of Computer Technology, Vienna University of Technology. It was published in the 2003 proceedings of the International Conference on Energy Economics. The authors of this article intended to introduce computer programing into Demand Side Management (DSM) by mathematical modelling of electrical energy consuming entities and storing them in a data base. In order to achieve this, loads were itemised into DSM-able and non DSM-able.

Summary of the Article

The article identifies some loads which are DSM-able and others which are not. The DSM-able loads, according to the article are refrigerators, heating systems cookers and large commercial loads. These are further classified into active, informative and non-informative loads, based on their level and method of interaction with the DSM network. The active devices are the DSM-able parts of the system. The informative devices only issue consumption prognosis but lack the ability to effect changes to their consumption pattern, while non-informative devices cannot directly take part in DSM arrangement because they lack any form of communication with the network. These are small energy consuming loads like lighting, TV, and other appliances. To DSM-ificate these loads, according to the article, they need a plug-in Virtual Device (VD) interface. The paper concludes that the DSM-fication of non-DSM-able loads could be more easily achieved by involving the producers and manufacturers of such consumer appliances and equipment in the DSM program development. This, according to the article will enable them incorporate the necessary information and communication interface that will enable full interaction with the central controller. The authors cited many learned journals, reports, conference proceedings and texts to support their claims.

METHODOLOGY

The paper sees Demand Side Management (DSM) as abstract, and as an optimization and scheduling problem. The scenario is that of some resources to be organised and distributed among some consuming entities so as to meet some requirements. The authors employ the use of algorithm that will be developed based on such information as predetermined future behaviour, the possible and estimated behaviour of the consumers. Consumers are grouped into DSM-able, DSM-proxy and non DSM-able. Attempts are made to DSM-ificate the non DSM-able. Possible activities in DSM-able environments are given in Table 1 below:

Table1: Classification of possible devices in a DSM environment

Type	**Description**
Active	Take part in the DSM process
Accurate prognosis	Probability = 1
``Probable prognosis	Probability < 1

Informative	Issues prognosis but cannot regulate consumption.
Accurate Prognosis	Probability = 1
Probable Prognosis	Probability < 1

Both active and informative devices can take part in DSM process but their levels of participation differ. Informative requires additional interface to be able to fully participate.

Review of the Article

Review Methodology

The article is going to be reviewed based on the perception and understanding of the writer. Relevant supporting authorities will be cited as much as possible while parts which are not so contentious in this writer's view are not touched. Some of the major areas of review are the paper title, introduction, methodology and the objectives of the paper.

The Title and Introduction to the Article

The title of the article appears not to fully capture the main intent of the paper. The importance of a good paper title cannot be overestimated. David (2009) opines that good titles help the readers identify the topic of the piece and shows whether it is something they should read. The first thing the reader will take note of in an article is the title (http://fastessays.co.uk 14/02/12). It states further that it is the key that presents and organises everything that follows. Another writer (http://Termpaperwriter-org/research-paper 14/02/12) is of the view that research paper title is as important as the whole paper itself. It adds that half of the success of a paper is traceable to the title and its ability to capture the reader. The intent of the writers is to introduce a programmable DSM scheme to reduce consumption of electrical energy. The article mainly describes the processes and methods of achieving this objective, therefore the article should have been captioned: 'Introduction of programmable Demand Side Management scheme to electrical energy consumers'. The general introduction to the article is not comprehensive enough for the

reader to succinctly grasp the overview of the article when read. It is an undisputed fact that writing an introduction is sometimes the hardest part of an article (http://www.ehow.com/how_2031742_write-article-introduction 22/02/12) It will pull the readers and therefore needs to be the best paragraph of the entire article. In the light of this a brief definition is given below. Demand Side Management can be addressed from three perspectives of utilities, consumers and energy efficiency. According to Hyunah (2010) policies on effective energy consumption are presented in terms of Demand Side Management. Battelle-Columbus Division and Synergic Resources Corporation (1984) in Eto (1996, p.2) sees it as a variety of utility activities designed to change the level or timing of consumers' electricity demand. Loughran and Kulick (2004, p.19) refer to it as a means of reducing the need for additional power plant construction. Demand Side Management is also recognised as a major solution in the fight against climate change (Bonneville and Rialhe 2006, p.2). This is because less primary energy is required, reducing greenhouse gas emission as a result of reduction in energy consumption and peak demand, the paper concludes. In late 1980s and early 1990s incentives were used by state regulators through the utility companies in USA to encourage participation in DSM (Eto 1996, p.9). This made a significant impact on energy saving and peaking capacity (Charles 2005, p.11).

DSM-able Consumers

On DSM-able consumers, the paper says:

> ''There is usually just a small number of really important energy consuming appliances which have a consumption high enough to be controlled, like water heating system, large office buildings or something similar, however might have thousands of independent small consumers like the lighting system or sun blind which enables them to take part in the DSM system…."

There appears to be no concrete definition or classification of DSM-able consumers either based on minimum or maximum load limit. For example, there are many non-cooker or non-heating loads which might be higher in load capacity than some cookers and heaters. There should have been capacity based rather than item based grouping of consumers to be DSM-able. In Korea, for example, the minimum peak load demand requirement to qualify for DSM program is 100kW (Hyunah 2010, p.3). In this writer's view, there should be no exclusion or restriction of consumers, particularly, lighting since it contributes significantly to the network peak demand. Lighting loads contribute more than 18% in Nigeria and some developing countries while the figure for developed countries is 8-10% (Garba 2009, p.9). In commercial buildings, lighting is reported to account for 20-40% of electricity bills, while it is equally regarded as a means of comfort and security (Bonneville and Rialhe 2006). According to the report on Philippine Energy efficiency Project (2009) one million compact fluorescent lamp (CFL) cost about $50M and can save up to 50MW of electric power. It states further that a 50MW power station will cost at least $50M to build. In Venezuela, about 1815MW peak load was saved by replacing 68.5M of incandescent lamps with compact fluorescent lamp (Garba 2009, p14

Removal of lighting from DSM-able consumers could therefore contribute significantly to in-efficiency of the program. Instead of item based classification, module based classification should therefore be used. Each module will be kilowatt based with additional information on priority rating at the peak period. All these information should be

programed into the prognostic and communicative model for the Demand Side Management scheme. In other words, all loads should be DSM-able.

OBJECTIVES

It should be noted that one of the major challenges confronting application of Demand Side Management is how to design methods that would maximise the efficiency and effective utilization of controlled loads (Strbac, 2008). Davito, Tai, and Uhlana, (n.d) noted that the first waves of DSM programs were limited by the available technologies then. At that time, measurements and verification efforts were cumbersome, which led to DSM programs being focused only on very large customers. A feasible solution to this problem, therefore, is the automation of the Demand Side Management scheme through programmable DSM-ification of consumers.

DSM-ificatiion of Consumers

DSM-ification, according to the paper is the process of enabling or accommodating new consumers into the DSM-able group. The methodology used for DSM-ification is described below:

- Replacement of original controller with a DSM-able one which, according to the paper requires the participation of the vendor in the development of the controller, an expensive venture.
- Establishment of 'a tight support' which translates into installation of embedded sensors that will deduce the state of the device and communicate to the controller.
- Establishing 'a loose support' which is the process of directly controlling the power cord of the device.
- Creating a DSM-proxy. This is a socket where the devices not covered by DSM would be plugged in with the flexibility of switching (on/off). It is described as coarse DSM-ification with loose support.
- Virtual device (VD): In this environment, a non-DSM consumer or a group of them will be represented in the DSM process by a Virtual Device which detects when a certain device is switched on or off with the help of a sensor. It will negotiate the possibility or otherwise of converting to informative ones, suitable for a DSM environment.

Each of these processes is faced with one problem or another, ranging from very high cost of procurement to ineffectiveness, according to the paper. The paper also notes that modelling all energy consuming entities and information storage in the data base is virtually impossible due to its complexities. In this writer's view, DSM-ification of all energy consuming entities is possible if the followings are taken into consideration:

- Proper definition of input data such as load required at different period.
- Division of consumers into modules and setting priority level of each module at peak period by ranking.
- Involvement of expert programmers and analysts
- Involvement of producers and manufacturers of energy using appliances, apparatus and equipment.
- Provision of adequate funding.

For this reason modular DSM-fication method is preferable. Modular DSM-ification through smart metering system will simplify the seemingly complicated system. Each module will consist of a number of sub circuits with rated load output programed to communicate with load components on each module and can communicate with the main controller as an active component, as proposed in the article. While the refrigerator, the heating system and the cooker can each constitute a module, lighting and other energy using appliances and apparatus will be grouped into sizable modules. Fig.1 below illustrates the suggested model.

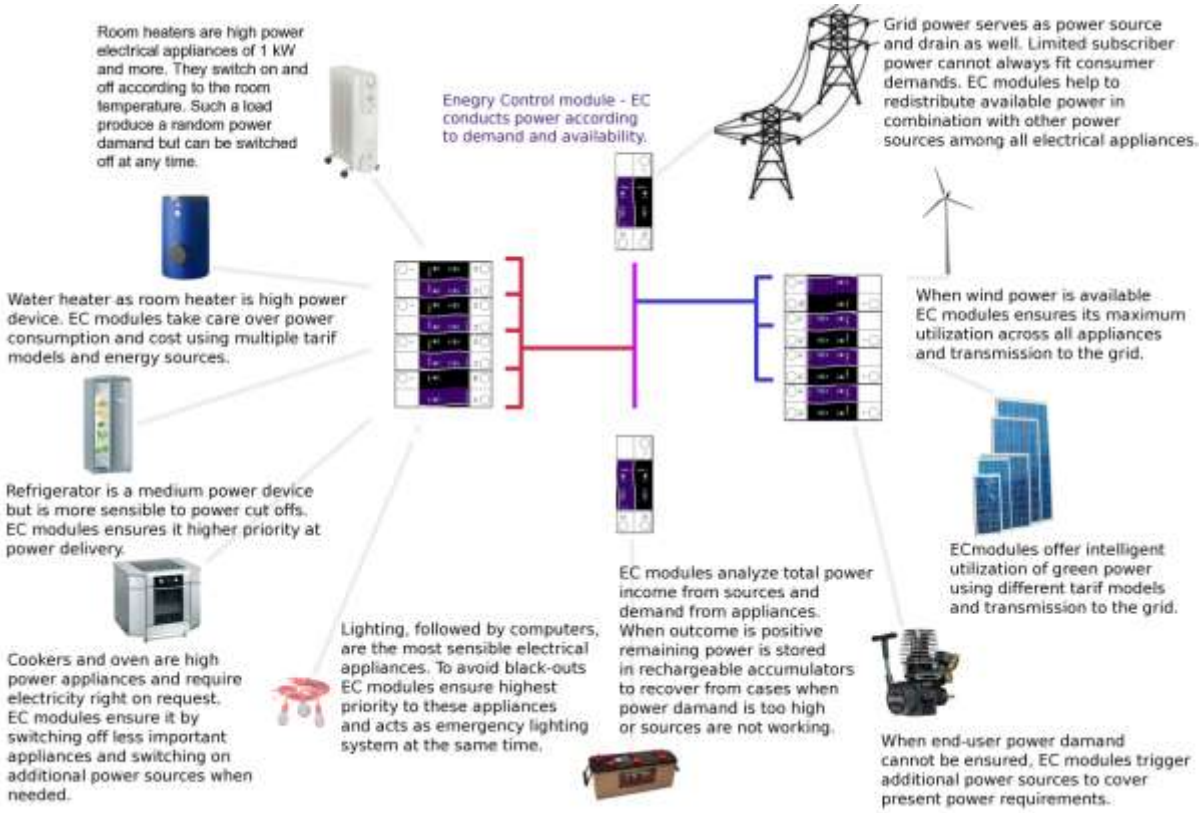

Fig.1 Modular representation of energy consumers (Adapted from Smart Distribution Boxes by Uros Platise 2010, p.5)

CONCLUSIONS

A critique of the original paper was first done in which the title, the intent and the introduction were discussed for the purpose of enrichment. The paper appreciated the need for Demand Side Management incorporation into the electrical energy consumer sector, realising the fact that if properly managed, there will be improved energy efficiency, system stability and considerable reduction in energy bills. The paper attempted to incorporate computer programming into DSM-ification of electricity consumer environment. Modern appliances, according to the article should be equipped with a network or just a communication interface which will have the capabilities of issuing both information and control commands, when required. The issue of incorporating producers and manufacturers raised in the paper seems to be gaining the required attention. Energy efficient lighting system through compact fluorescent lamps (CFL) and the recently introduced light emitting diode (LED) lamps can be seen as response to this call. Energy efficient fridges, television sets, kettles, hoofers and other appliances are already in the market also. The paper recommends further researches on

standard proposals on abstract protocols and profiles for DSM-able energy consumers. It equally recommends among others, DSM-clusters that group flats, buildings and possibly districts into a global energy management system. It believes the larger the DSM community the better the Demand Side Management of energy distribution network.

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