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Load-Scheduling for Residential Hub Structure for Electricity Distribution

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Abstract—This paper presents models of residential energy hubs which can be readily incorporated into automated decision making technologies in smart grids, and can be solved efficiently in a real-time frame to optimally control all major residential energy loads, storage and production components while properly considering the customer preferences and comfort level. Novel mathematical models for major household demand, i.e., fridge, freezer, dishwasher, washer and dryer, stove, water heater, hot tub, and pool pumps are formulated.
Also, mathematical models of other components of a residential energy system including lighting, heating, and air-conditioning are developed, and generic models for solar PV panels and energy storage/generation devices are proposed. The static and dyanamic Programming of minimizing energy consumption, total cost of electricity and gas, emissions, peak load, and/or any combination of these objectives, while considering end-user preferences. Several realistic case studies are carried out to examine the performance of the mathematical model, and experimental tests are carried out to find practical procedures to determine the parameters of the model. The application of the proposed model to a real household in Ontario, Canada is presented for various objective functions.

Keywords— *Demand response, mathematical modeling, optimization, residential energy hubs*

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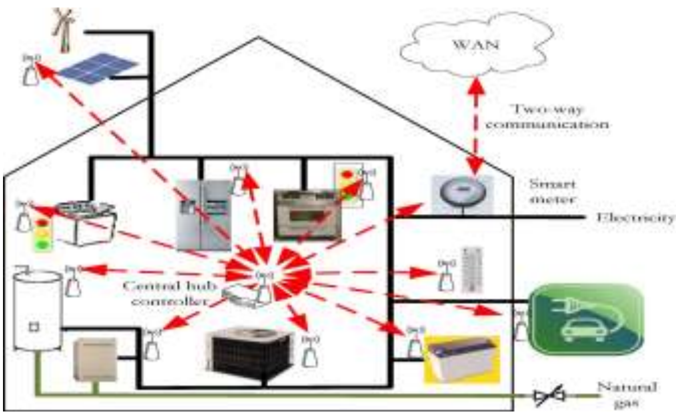
I. Introduction

A smart grid is an electrical grid which includes a variety of operation and energy measures including smart appliances,energy efficiency resources,electronic power conditioning and control of the production and distribution of electricity are important aspects of the smart grid.This smart grid technology is organized in Europe as smart grid European technology platform.generally,smart grid technology is used in electricity service industry also this term focused on the techniqual infrastructure. the digitally enabled electrical grid that gathers, distributes, and acts on information about the behavior of all participants in order to improve the efficiency of electricity services or it is a technique used to calculate the total power required for all devices in three conditions and scheduled the power as per our requirements. The objectives of smart grid are: fully satisfy customer requirements for electrical power, reliability and economic of power supply and adapt to power market development. For residential consumers' class, the representative daily curves by utility and by consume range were defined.

An energy hub in the system is any location where energy system activities such as energy production, storage and consumption of different energy carriers take place (e.g. a house, office, farm or manufacturing facility). The proposed structure of an Energy Hub Management System (EHMS) comprises a macro energy hub and a micro energy hub. The macro hub is envisaged to receive data from the external environment (i.e. electricity process, market demand and weather forecasts) and also from the micro hubs. The micro hub will monitor and control the local devices and send relevant data to the macro hub. The proposed mathematical model in is focused on a residential micro hub with the objective to optimize the energy cost, energy consumption or emissions depending upon customers' choice of operation. At the macro hub level, the mathematical model would ideally incorporate several such micro hubs receiving information from utilities and micro hubs. We study the problem of minimizing the long-term average power grid operational cost through power demand scheduling.



Residential hub structure.

The energy hub is a concept recently developed in the context of integrated energy systems with multiple energy carriers. *Hub* is defined as a center of activity; hence, *energy hub* is any location where energy system activities, namely, energy production, conversion, storage, and consumption of different energy carriers, take place . In this work, households are considered as multi-carrier energy hubs with energy demand, generation, and storage capabilities. Major household appliances consume a large portion of a house total energy demand, and some of those can be scheduled without a major effect on customer comfort while reducing energy costs and emissions. Currently, smart appliance controllers are available that allow the customer to enter daily, weekly, as well as seasonal schedules for various device operations. Also, the operation of appliances can be controlled in a house using home networking systems developed to enable remote appliance control. These systems usually comprise several dedicated controllers which communicate with a central appliance controller when plugged into any electric socket in the house, and allow ON/OFF control of appliances. The user can thus program different schedules and events and implement rule-based decision making within the central appliance controller.

In this context, an intelligent decision making core is proposed in this paper to optimally control residential sector energy hubs. The intelligent core is proposed to be an integral part of EMSs, based on the mathematical model of the hub. Fig. presents an overview of the residential energy hub which includes various appliances, energy storage systems (e.g., batteries), energy production systems (e.g., solar photovoltaic, wind power), a smart meter and two-way communication links between these components. The proposed mathematical model and associated optimization solver will reside in the central hub controller. This controller uses the mathematical model of each component in the hub, parameter settings and external information as well as user preferences to generate the optimal operating decisions for all components in the energy hub over the scheduling horizon, as shown in Fig. The device database includes all the technical characteristics of the components (e.g., rated power, storage/production level), and external information includes energy price information, weather forecast, solar radiation, and CO emissions forecasts. The scheduling horizon and the length of each time interval in the optimization models can vary depending on the type of energy hub and activities which take place in the hub.

There is difference between local scheduling and global scheduling occurs. local scheduling performed by the processor of the operating system.In local scheduling processor process the operation or assignment according to the time slices of the processor. On the other hand,global scheduling is the process of deciding where to execute a process in a multiprocessor system and global scheduling carried out by a single central processor or it may be distributed its work amongs the distributed processing elements. which are classified into two types or groups:

1.static scheduling 2.dynamic scheduling

In static scheduling,the assignment done before program execution begins. In information regarding task execution times and processing resources is assumed to be known at compile time.A task is always executed on the processor to which it is assigned;that is static scheduling methods are processor non preemptive.typically,the goal of static scheduling methods is to minimize the overall execution time of a concurrent program while minimizing the communication delays.with this goal in mind,static scheduling method.

II. STATIC SCHEDULING SUFFERS FROM MANY DIS ADVANTAGES.

In dynamic scheduling,scheduling distributed in redistribution of the processes amongs the processor during the execution time.this is exactly opposite to that static scheduling.in this type of scheduling,heavily loaded processor transfer its function to the light loaded processor so that work should get completed within given time period without any load,this also leads to avoid the load shading.purpose is to improve the the efficiency of work and to improve the performance of the application.
The load balancing operations performed in cetralised system by using the single processor or may be load get balanced in distributed amongs all the distributed elements,purpose is only to balanced the load.

III. CONCLUSION

This paper gives the idea about the static and dynamic scheduling,priorily identify which scheduling is best for managing the concurrent load.and also gives the idea to handle the load by scheduling the concurrent system and in residential hub system. Also this idea is basically we can used for appliances also to scheduled the them by deciciding the priorities between them by means of time scheduling and power scheduling.we can handled the load by single processor or also by distributed elements.

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