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WINGS TO YOUR THOUGHTS…..

Multi objective Optimization of Renewable Energy Mix for Building: A Review

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Abstract*: Building energy-saving is initially to reduce loss of energy in buildings in developed countries. Now commonly referred to "improving the energy efficiency of buildings", rational use of energy, improves energy efficiency in ensuring the conditions of building comfort. Building energy-saving specifically refers to that In the building planning, design, construction (reconstruction and expansion), the process of transformation and using, doing implementation of energy efficiency standards, using energy-saving technology, technique, equipment, materials and products, improving the performance of thermal insulation and heating, air conditioning refrigeration and heating system efficiency, strengthening the operation and management of energy systems, using renewable energy.*

Keywords: *Hybrid energy system; genetic algorithm; multi-objective optimization; life cycle cost; penetration of renewable energy.*

I. Introduction

Intelligent buildings and micro grids are important parts of the future smart grid. Energy efficiency in these buildings and micro grids usually refers to reducing the amount of energy required to provide specific products and services by adopting novel technologies or methods. For example, existing work includes improving the insulation of the building to reduce heating and cooling energy consumption, using fluorescent lights or natural lights to reduce energy usage while maintaining the same level of illumination, designing the buildings and subsystems according to their physical location and climate zones, and improving the energy conversion process to reduce energy waste during the process. Apparently, energy efficiency for buildings and micro grids can be a complex issue and many experts and researchers have been working on it from their own perspectives, and some related work can be found in the reference. For example, a building designer may be concerned about the inner structure that could affect the energy flow; a physicist or HVAC (Heating, Ventilation and Air Conditioning) expert may be interested in the thermal effects due to the physical structure of the buildings; the electrical and computer engineering experts may focus on deploying smart meters and computer networking systems to provide automation and collect data for further analysis and building retrofit.

In this work, with a networking perspective, we define the energy efficiency for buildings and micro grids as efforts not only using a specific technology or method, but a series of methods treating the individual building or micro grid as an integrated system, and applying related networking and control technologies to enable it to reduce unnecessary energy usage and to achieve a large-scale energy proportionality. Specifically, we focus on the energy efficiency issue not only in intelligent buildings but also micro grids formed by multiple locally-distributed such buildings. An intelligent building is generally defined as a building integrated with a building automation system (BAS) which provides functionalities such as computerized, intelligent, and networked distributed control to monitor and control the HVAC, lighting, safety and security, and other appliances while reducing energy consumption and maintenance costs. It also provides its occupants with a flexible, comfortable, secure, and productive environment. The intelligent building concept has a relatively long history since the development and expansion of computer and networking and communication technologies in 1980's,. Initially, it attracted a lot of attention from both academia and industry, and a number of researchers expressed their exciting vision about future intelligent buildings. However, the reality fell short and it turned out to be a relatively long and slow process, especially in the area of smart building controls and automation. There are many reasons behind this. First, the key in-building intelligent systems like energy management and control systems (EMCS) for building automation have been underutilized except for some large-sized buildings. Even in the buildings with such systems, only a fraction of the possible EMCS functionality is utilized. Second, it is about the cost. Generally, the initial cost of an intelligent building is higher than a conventional building and the benefits are mostly not visible at the stage of construction. Third, individual subsystems inside intelligent buildings are usually provided and maintained by different software or hardware vendors and they are often developed as proprietary products. The lack of standardization of the protocols prevents the necessary interoperability and interactions among the subsystems which are important to create a truly coherent intelligent building. Fourth, many subsystems such as building monitoring and control, elevator monitoring, and security systems are under separate construction contracts and they usually install and use their own communication systems. Better interconnection and integration of these systems without duplication is necessary to realize a fully intelligent building. Because of all these reasons the deployment rate of intelligent buildings has been slower than initially envisioned. However, two recent developments and trends have reactivated this important and promising topic, and accelerated the research and application of related technologies.

The rest of research paper is design as follows. The overall previous work is described in Section II. Section III describes problem formulation. Performance parameter describe in section IV. Finally, Section V describes the conclusion of paper.

II. Literature Review

In this section, we present a survey of the current research and development status of the intelligent buildings and micro grids in a combined perspective of energy efficiency and mobile Internet. We have attempted to draw an overall picture of the research status in this area and to discuss potential areas for further research that can potentially generate huge impacts on everyone's daily life as well as global environmental sustainability which is important not only for the current population but also future generations.

Jun Tan et.al 2016 proposed a framework for enabling the reliability-differentiated services in a residential distribution network with plug-in hybrid electric vehicles (PHEVs). A reliability-differentiated pricing mechanism is developed to satisfy the different reliability requirements of the customers while encouraging the customers to consume electricity in such a way that the reliability of the overall distribution system can be enhanced [1].

Ali T. Al-Awami et.al (2016) described electric vehicle (EV) integration into the distribution system has been a topic of great interest lately due to the potential challenges that it poses. In this paper, an adaptive voltage-feedback controller for an onboard EV charger is proposed, which, unlike other proposed methods, requires no real-time communication between the EV and the utility. The reduced charging rate takes into account the EV battery state of charge (SOC) and the owner's end-of-charge time (ECT) preference [2].

He Cai et.al (2016) described distributed control scheme has been widely investigated for micro grid systems in consideration of the multitude of the distributed generators. In order to address this problem, in this paper, a novel nonlinear hierarchical control approach is proposed, which enables the frequency and voltage regulation of an islanded AC micro grid via unreliable communication network [3].

AbinetTesfayeEseye et.al (2016) described a 24-hour ahead optimal energy management system (EMS) for an isolated industrial micro grid containing wind, PV solar, diesel generator, micro turbine and energy storage is developed and analyzed. The main goal of the micro grid EMS optimization model is to minimize the cost of energy production, maximize the economical benefit of the energy storage and ensure the renewable energy utilization to the maximum possible extent. [4].

FengjiLuo et.al (2016) discussed how different categories of the power applications can benefit from the cloud-based information infrastructure. For the demonstration purpose, this paper develops three specific cloud-enabled power applications. The first two applications demonstrate how to develop practical compute-intensive and data-intensive power applications by utilizing different layered services provided by the state-of-the-art public cloud computing platforms [5].

Virginia Pilloni et.al (2016) described Smart Home Energy Management (SHEM) systems can introduce adjustments in the working period and operations of the home appliances to allow for energy cost savings, which can however affect the Quality of Experience (QoE) perceived by the user [6].

Richard E. Brown et.al (2016) described Electricity became a household necessity with the advent of broadcast radio in the 1920s. There were no nonelectric substitutes for the radio, it served a strong public interest for the government to be able to quickly send information to its citizens, and it was therefore desirable to electrify as many homes as possible [7].

AmitRaje et.al (2016) described ultra-capacitors have a unique positioning among various energy storage devices. Their features can be leveraged for a large number of industrial applications. This paper presented some of the innovation, design and system integration initiatives that have led to pioneering practical industrial applications of ultra-capacitor technology in India in various domains such as Railways, Diesel Generators / Engines, Process Industries, Renewable Energy, Heavy Earth Moving Equipment etc [8].

Mingguo Hong et.al (2016) presented an energy scheduling algorithm for a small-scale micro grid serving small to medium size commercial buildings (the building micro grid) that includes conventional and renewable distributed generation resources, energy storage, and both linear and nonlinear loads. In the transaction-based control framework, the proposed algorithm can be used to aggregate device transaction bids and facilitate the buildings-to-grid integration [9].

Feifei Bu et.al (2016) described for hybrid AC& DC micro-grid, this paper proposes a new generating system based on dual stator-winding induction generator (DWIG). This generating system can realize bidirectional energy flow, reduce the number of converters and simplify the structure of micro-grid. This paper lays the foundation for future research for hybrid AC& DC micro-grid [10]

Ahmed T. Elsayed et.al (2016) described the weight of onboard equipment represents a major concern in transportation systems. In ship power systems, in addition to weigh concerns, some loads are frequently demanding high power for short time durations. The problem is formulated as a multi-objective Optimization (MOO), where two objectives are considered. The results show the feasibility and computational efficiency of the proposed methodology [11].

Amjadet.al (2016) described with the emerging of small-scale integrated energy systems (IESs), there are significant potentials to increase the functionality of a typical demand-side management (DSM) strategy and typical implementation of building-level distributed energy resources (DERs). The optimal dispatch problem is formulated as a mixed integer nonlinear programing problem (MINLP) and solved through an agent-based approach. Several computer simulations are also presented to show the effectiveness of the proposed approach over the conventional methods [12].

Gang Chen et al (2017) described physical power infrastructure is moving from the centralized structure to the distributed structure for enabling integration of distributed energy resources. Different from most existing economic dispatch algorithms, the finite-time convergence to the optimal value is achieved, which makes more sense in real applications. Several case studies are discussed and tested to validate the proposed methods [13].

Mahdieh S. Sadabadi et al (2017) proposed a decentralized control strategy for the voltage regulation of islanded inverter-interfaced micro grids. Toolbox, are carried out to evaluate the performance of the proposed control strategy in terms of voltage tracking, micro grid topology change, PnP capability features, and load changes [14].

III. Problem Formulation

Intelligent buildings and micro grids are important parts of the future smart grid. The adoption and development process of the intelligent buildings has been slow. There are multiple technical and non-technical reasons. However, two recent trends have accelerated the research and application of the technologies related to this area. First, skyrocketing energy price and the global need for reducing fossil oil consumption for environmental sustainability combined with the fact that buildings are a significant source of energy consumption, making buildings intelligent and energy efficient will have huge impacts on the total CO2 emission and hence global sustainability. Hence, combining energy efficiency and networking perspectives, is very much needed, we investigate the key research topics through a broad survey on the latest developments in intelligent buildings and our vision of micro grids formed by such buildings.

IV. Performance Parameter

There is certain performance parameter on which renewable energy is depending.

1. Load calculations of the reference building.

The envelope, lighting and equipment of the proposed building have been modified in the reference model and, consequently, a new load calculation is required for HVAC system sizing.

2. Choice of the system type

The heavy dependence of consumption on the system type and of this latter on the building features and requirements advises against choosing the same reference system in all cases. Consequently, either a table must be generated to assign the system type according to certain features of the proposed building.

3. Equipment sizing

Equipment size can exert a significant impact on consumption as a result of variable load operation. The performance path must not alter the HVAC system design of the proposed building but should avoid unnecessary oversizing when designing the HVAC system for the reference building. In addition, to avoid possible undersizing, the number of unmet load hours for both buildings must be checked and maintained below a certain limit.

4. Equipment efficiencies

HVAC equipment in the reference building should equal prescriptive limits. In this way, designers choosing performance records above minimum levels will have some energy credit. If there is no minimum requirement, trade-offs should be avoided assigning the same value in both buildings.

5. Other options

As long as the simulation tool allows it, the reference system should include those options required by the prescriptive path. Economizers and heat recovery are excellent examples.

V. Conclusion

The intelligent building is supposed to provide the environment and means for an optimal utilization of the building, according to its designation. This extended function of a building can be achieved only by means of an extensive use of building service systems, such as HVAC; electric power; communication; safety and security; transportation; sanitation, etc. Building intelligence is not related to the sophistication of service systems in a building, but rather to the integration among the various service systems, and between the systems and the building structure. This work examines buildings claimed to be "intelligent", according to their level of systems' integration. In this work we have worked on implementation of intelligent building that works on HVAC and elevation control.

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