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OPERATION OF MICRO-GRID USING MULTI AGENT SYSTEM.



Engineering

KEYWORDS: Multi-agent System, Smart Grid, critical load , non critical Load , Energy Resources.

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ABSTRACT

This paper presents the control of a smart grid using a Multi-agent system (MAS).. The proposed Multi-agent system consists of three types of agents: Load Agents, Distributed Energy Resources(DER), current agent. In a smart grid load agent act as consumers. WTAG acts as producers or sellers control agent act as seller/buyer. The paper demonstrates the use of a Multi-agent system to control the smart grid in a simulated environment. Different condition are taken to validate the performance of the proposed system, Simulation results show that the proposed Multi-agent system can perform the operation of the smart grid efficiently.

1.INTRODUCTION

Now a day's Electricity supply to critical load is very high importance (prime importance). Recently electricity is supplied through large transmission network, which is not reliable. Smart Distribution network can be capable for supply reliable Electricity. Disconnection of distribution system from main grid during emergency (at the time of failure of main grid) is key point of this paper. The main objective is to design a multi agent system that makes a management of a distribution system, which secure critical loads.

A smart micro-grid can be defined as a low voltage distribution network with distributed energy resource (DER) units, The micro-grid can be made smarter by integrating advanced sensing technologies, control methods and communication techniques [1 - 3]. Smart grids can benefit customers through providing uninterrupted power, en-hancing local reliability, reducing transmission loss, and supporting local voltage and frequency.

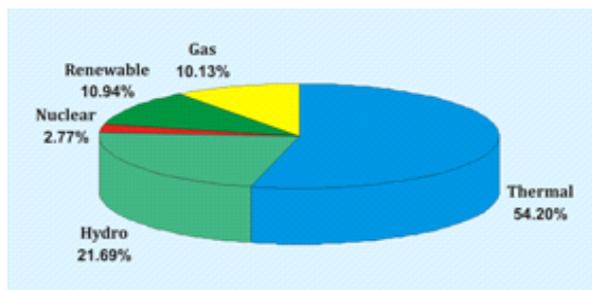
Significant research works have been carried out on operation and control of smart grid. Current trends to control and monitor the operation of

electrical power systems are however moving towards the use of an automated agent technology, known as multi-agent system. In recent years, multi-agent based approach is proposed/adopted to provide intelligent energy control and management systems in smart grids.

In India, a lot is yet to be done towards making power grids smarter and reliable, capable of taking self correcting decisions for optimal scheduling of generation resources. In this paper the operation of a multi-agent system for the control of a smart grid is described in an Indian scenario. Present power scenario of India is described in Section II.

2. PRESENT POWER SCENARIO OF INDIA

Now a days Indian power sector is facing challenges and despite significant growth in generation over the years, it has been suffering from shortages and supply constraints. The relationship between power consumption and national economic development has a great significance. All India region-wise generating installed capacity (MW) of power utilities is given in Table 1 [6] and the corresponding pie chart is shown in Figure 1.



Now a days India's electricity sector is active players in renewable energy utilization. As of March 2011, India had an in-stalled capacity of about 173.626 GW.[10]

Sector	Hydro	Thermal			Nuclear	R.E.S@	.Total	
		Coal	Gas	Diesel	Total			
STATE	27,257.00	47,257.00	4,327.12	602.61	52,186.73	0.00	3,008.85	82,452.58
PRIVATE	1,425.00	12,616.38	6,677.00	597.14	19,890.52	0.00	15,445.67	36,761.19
CENTRAL	8,885.40	34,045.00	6,702.23	0.00	40,747.23	4,780.00	0.00	54,412.63
TOTAL	37,567.40	93,918.38	17,706.35	1,199.75	1,12,824.48	4,780.00	18,454.52@	1,73,626.40

Table 1. Electricity generation in India (category-wise) as on 31.03.2011. (Source: DMLF Division, CEA)

3. OPERATION OF SMART GRID BASED ON MULTI AGENT SYSTEM.

3.1. Multi-Agent System

A multi agent is set of number of agents working together to perform specific task. There are many application of multi agent system, now a day's one of commonly known application is in e- commerce. A software agent can works as a buyer and seller of some goods on a website by providing attractive price. For good performance of agent task, it is necessary to give preference in to the agent system. The agent also communicates with other agent on the internet and will actively participate in auctions. A set of this type of agent forms a multi agent system.

Other application of multi agent system in telecommunication and network management, manufacturing system , aircraft maintenance, traffic monitoring, decision support system, power system, military logistic planning, video games and simulation of real world etc....In this chapter application of multi agent in smart Distribution network is introduced.

3.2. Agent Model of the Proposed Smart Grid

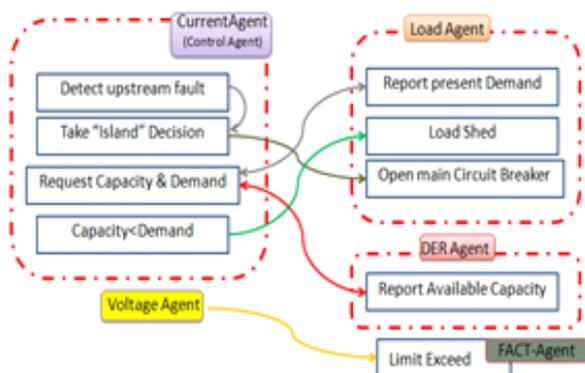


Figure 2. Agent model of the proposed smart grid

A smart distribution network possesses advanced sensing technologies and control methods to synchronize with main grid. The smart distribution should have following characteristics[1]:

- Provide good power quality which is necessary for 21st century.
- Accommodate all generation and storage options .Consumer friendly.
- Self-healing.
- Operate efficiently

Building of a voltage agent for smart distribution network is The main focus of this paper . particular, we will focus on application concept of agents in a smart distribution network .smart distribution network is defined as an energy system in which loads and distributed energy resources(DER) can operate in parallel with the main grid. The conventional electric power systems, can be control of by Supervisory Control and Data Acquisition (SCADA) systems [2],[3] Current scenario to monitor and control the operation of electric power systems are changed by the use of an automated agent technology, which is generally known as a multi-agent system. A multi-agent system is a combination of several agents working with together to achieve desired goal of the system. The multiagent system has become a powerful tool for developing complex systems. multi agent system which consist of PV generators, batteries and controllable loads is discussed in [4], [5], [6]. the restoration of a power system in shipboard distribution system with help of multi agent system is discussed in [7], when upstream fault or main grid outages detected by voltage agent it immediately react to allow the distribution network to operate autonomously in an island.

IV.RESULT DISCUSSION :

Case Study: Transition from grid-connected to islanding mode.

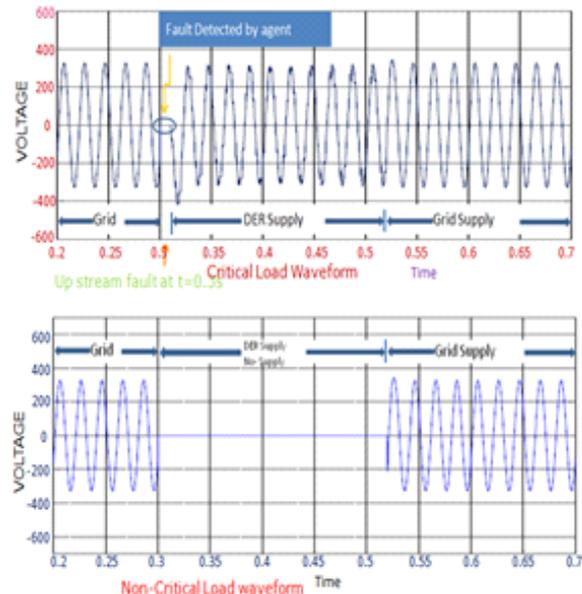


Figure :3 Current and voltage waveform : transition from main grid

to islanding mode.

Once the control agent detects the fault at $t = 0.3$, the voltage agent informs the user agent and the DER agent, both of which exchange information and determine the amount of loads to be shed and the amount of power to be produced internally in order to stabilize the distribution network. Depending on the pre-defined load priority set by a user and the available internal generation, the user agent disconnect non-critical loads due to unavailability of extra power. main circuit breaker close at 0.52 sec due fault clear at 0.5 sec , critical load waveform shown in figure 3.

IV. CONCLUSION

This paper discusses the application of voltage-agent in smart distribution network.. Agents exchange their messages via TCP/IP protocol. The application implementation process is illustrated through a real-time simulated case study, which indicates that the voltage-agent can disconnect and stabilize the smart distribution network from the local utility when upstream outages(faults) detected. This illustrates the capability of a voltage-agent as a technology for managing the smart distribution network operation. This work aims at demonstrating a application of voltage-agents in a smart distribution network.

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