## INTEGRATING SMART GRID AND CLOUD COMPUTING

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### ABSTRACT

*Smart grid can be integrated with cloud for better power management in cloud data centers. Cloud data centers are powerful computer system which acquire huge amount of electrical energy for running. This consumption of energy can be effectively managed by introducing smart grids. Smart grid works in the manner by collecting information of the energy utilized by the data center and process it accordingly for getting the maximum throughput will less energy utilization. Smart grid monitors on electricity distribution. This paper is brief study on introducing smart grids in cloud data centers for much more economical cloud model. The paper also proposes a method for better implementation of smart grids in cloud data centers. The paper also highlights some applications of smart grid for an economical model.*

*Key Words: Smart Grid, Data centers, power grid.*

## Introduction

Organizations are divided into several parts and units. The overall energy required for running those units is countable with high requirement. The Energy used by the organization is produced by natural and artificial sources. The production and consumption of energy are day to day activity of life cycle. There are several organizations which are monitoring the overall consumption of energy by different organization. Energy efficiency helps in saving companies fund in economical way. The amount of energy saved by the organization can be utilized by other organization. In terms of I.T organization it is more important to save energy and use this energy more efficiently. Cloud organizations are made up of data centres which consume huge amount of energy (Tebbutt D. et.al, 2009). The energy consumption can be monitored by introducing smart grids in clouds. Smart grid monitors the power consumption by organisation and also interact with market, energy bulk generation unit etc for distributing information about energy flowing through the system. This information can be help in making more energy in greener manner which helps in consuming environmental resources for power generation. Smart grid helps in delivering energy to individual units in economical and secure manner. Clouds infrastructure is very strong and utilizes high amount of electricity, this electricity is managed by smart grids. If smart grids are properly managed by cloud computing then this will lead to a better system for cloud computing and which also save a huge amount of money and manpower. Maintains of I.T assets are also been reduced by introducing smart grids (Fang X. et.al., 2010). The information getter by smart grid can be managed by clouds.

## Smart Grids in Cloud

Current cloud computing environment does not consider the power

constraints. The heating and cooling is not considered by testing the data centres environment. Large Data centre can acquire as much electric power required for running a small town. The power consumption of data centres are totally depends on the overall data processed by data centres. Data centres are not configured with energy and powers source management. Data centre are not configured with this kind of services. Data centres act as a house for several component such as networking components, data storage component etc this all component utilizes the energy and it's important to manage this electricity. A data centre can occupy one room of a building, one or more floors, or an entire building. Most of the equipment is often in the form of servers mounted in 19 inch rack cabinets, which are usually placed in single rows (Sawyer R.L., 2011). A smart grid is an electrical grid that uses information and communications technology to gather and act on information, such as information about the behaviours of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity. The smart grid uses of technologies that improve fault detection and allow self-healing of the network without the intervention of technicians. This will ensure more reliable supply of electricity, and reduced vulnerability to natural disasters or attack. Implementing cloud industries, with smart grids two-way communications and advanced sensors, will improve the efficiency, reliability and safety of power delivery to cloud data centres.

## Smart Grid and Cloud Architecture

The proposed architecture for introducing smart grid in cloud is shown in figure 1. This shows an interaction between cloud data centre and smart gird. Smart gird in cloud will monitor the overall energy consumed by cloud data centres. Data centres and smart grid integration will increase huge amount of power which is been utilized unnecessary by different components and services of data centres. Underlying all these technical approaches is a common challenge. But the next level of data centre energy optimization will lead to green computing environment. Seeing more and more integration of energy data into the way data centres are run today with a huge loss of power which can be consumed by the proposed model.
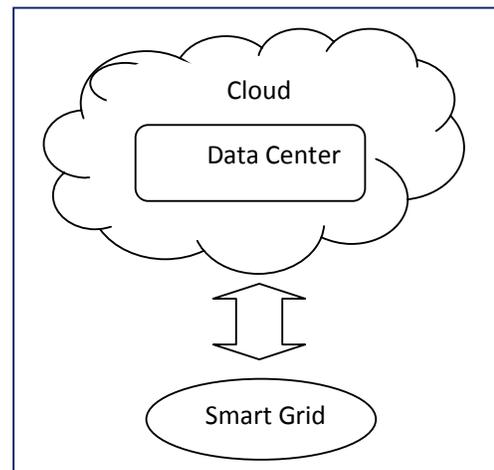


Figure1. Smart Grid and Cloud Data Centre Interaction

The proposed architecture integrates smart grids in cloud environment which work in manner to the electricity used by different data centres for particular organization and which requires a lot of effort to manage. The number of electricity consumed by smart grid will be used with several other organizations. This results in saving of natural resources. Many different concepts have been used to model intelligent power grids. They are generally studied within the framework of complex systems. In a recent session the power grid was considered within the context of optimal control, ecology, human cognition, glassy dynamics, information theory, microphysics of clouds, and many others. But if appeared in cloud computing can make smart grid works in saving huge amount of energy. With smart grids customers can choose their electricity suppliers, depending on their different tariff methods, the focus of transportation costs will be increased (Birman K.P. et.al, 2011; Kim H. et.al, 2011). Reduction of maintenance and replacements costs will stimulate more advanced control. Smart grid precisely limits electrical power down to the residential level, network small-scale distributed energy generation and storage devices, communicate information on operating status and needs, collect information on prices and grid conditions, and move the grid beyond central control to a collaborative network.

## Features of Smart Grid

Smart grid comes with a verity of features some of which in terms of cloud computing is explained below

### A. Reliability

In terms of reliability after implementation of smart grids in cloud will result higher in performances and low power usage. The smart grid will make use of technologies that improve fault detection and allow self-healing of the network without the intervention of technicians. This will ensure more reliable supply of electricity, and reduced vulnerability to natural disasters or attack.

### B. Load adjustment

Smart grid consist feature of load adjustment which helps in reducing the different load from different data centre attached to cloud computing network. The total load connected to the power grid can vary significantly over time (Tebbutt D. et.al, 2009; Fayyaz S. et.al, 2012). Although the total load is the sum of many individual choices of the clients, the overall load is not a stable, slow varying, average power consumption. Imagine the increment of the load if a popular data starts access by the millions of user which will draw current instantly. This situation can be handled by smart grid load adjustment.

### C. Advanced services

Smart grid consist some advance feature As with other industries, use of robust two-way communications, advanced sensors, and distributed computing technology will improve the efficiency, reliability and safety of power delivery and use (Popeanga J., 2012). It also opens up the potential for entirely new services or improvements on existing ones, such as fire monitoring and alarms that can shut

off power, make phone calls to emergency services, etc this all can be implemented in cloud environment.

### *D. Efficiency*

The efficiency factory is also been considered in smart grid for power distribution in cloud data centres. A smart grid aims to manage these situations which require an efficient system (Hongseok K. et al., 2011). Electricity distribution can harm various devices evolved in the network and need to be managed in reliable and efficient manner so for the same smart grid are managed to design this type of situations.

The overall improvement of the efficiency of energy infrastructure is anticipated from the deployment of smart grid technology, in particular including demand-side management, for example turning off air conditioners during short-term spikes in electricity price. The overall effect is less redundancy in transmission and distribution lines, and greater utilisation of generators, leading to lower power prices.

## Conclusion

Smart grid will change the power management ability of cloud data centres and will lead to an extent of the power usage in cloud data centres. The management of the power is based on smart grid which will help in increasing the power efficiency of clouds. This results in huge amount of power saving in cloud computing environment and will save natural power or energy resources.

The amount of energy saved can be utilized by other stations. Managing the energy requirement of cloud is similar to manage the energy utilized by a small town. The energy saving will progressively help in all aspects with higher performance rate of cloud data centres.

## Acknowledgments

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