Energy Trading Using Blockchain Technology

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Abstract- Blockchain is a decentralised system which is immutable in nature . This will ensure that every action taken by a network participant is transparent to the regulator. The problem which will be dealt with in this research paper is "Energy Trading". It is the buying, selling and moving of energy from where it is used excessively to the place where it is actually needed. Electricity and natural gas are traded as commodities. Markets of commodity are frequently volatile since the price of energy varies from time to time i.e, whether it is day or night. Using Blockchain, the platform of this project offers auditability , digitalized , efficient and smart energy contract. The platform will have sub modules. Current focus is on Smart Contract Management (SCM).The development of SCM module will perform the following action :Create, Modify, Execute. The actors involved will be : Buyer , Seller , Banker and authorities .

Keywords- *Blockchain (BC); Bitcoin; Crypto-currency; IoT; Proof of Work (PoW); Distributed Digital Ledger*

I. INTRODUCTION

Suppose your firm "A" on a daily basis needs a power supply of 1200kW. Due to some unavoidable reasons you keep your firm closed one day, and your neighbouring firm "B" on that same day certainly needs more energy than it consumes daily, this is the place when energy trading comes to play. Now firm "B" will request firm "A" to share the energy that is not of use to firm "A" and further firm "A" can share the energy and charge firm "B" the same amount at which firm "A" bought the energy resources. Through this project we will make the entire transactions of the energy resources terming this process to "Energy Trading". Energy trading is thus the online selling, buying and sharing of energy resources.

The part of this project will be completed using smart contract [1-2]. To improve compliance, mitigate risk and increase efficiencies across the enterprise, smart contracts address the very core of Contract Lifecycle Management (CLM) solutions – automating the contract lifecycle. Smart contracts are self-verifying and the agreements are self-executing which function autonomously.

The purpose is to manage smart contract. Smart contract is a protocol[3-5] that does not require any third party intervention . The transactions are of kind that can easily be traced and are not reversible. Smart contract aims at providing security more efficient than the traditional contract law which also reduces the extra contracting charges involved in the traditional contract law.

Multisignature accounts, payment channels, escrows, time locks, atomic cross-chain trading, oracles, or multi-party lottery with no operator etc. are some of the examples provided by bitcoin[6-7] using Turing-incomplete Script language that allows the creation of custom smart contracts [1]. Ethereum is also one of the prominent smart contract framework which is implemented using Turing-complete language [2].

II. METHODOLOGY

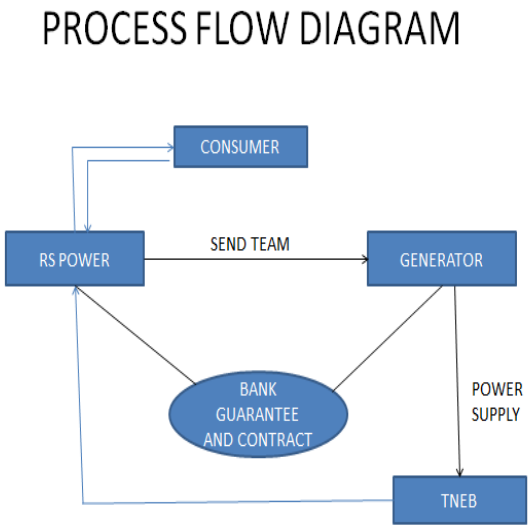

Fig.1: Process Flow Diagram

Actors Involved

1. **Buyer:** The company will act as buyer. They will sign a contract with the generator for electricity. Generally company signs contract for 3 years. These energy supplies can be wind energy, hydro power, green energy such as from sunlight, wind etc. The contract is of 3 years which is approved by Tamil Nadu electric board (TNEB).
2. **Generators:** Different industries that produces electricity. They produce electric power from sources of primary energy. Different generators having different capacities like 22kV, 33kV, 110kV and 220kV etc. according to the generator capacity contract has been signed. Consumers generally use 230kV and 110kV. While the transmission of electricity there is a line loss that happens and according to this line loss it is decided which generator is there for which consumer to reduce cost.
3. **Consumer:** Consumers are the companies which consumes the electricity, RS Power act as the third party between the generator and the consumer. Company signs contract with the consumers. Consumers are generally MNC's like TCS, Wipro, etc. They signs a contract of 20 years from the consumers. Different consumers having different price it depends on several reasons such as line loss, uses and many more. Company gets a margin of 7 paise/unit electricity. 7 paise is a fix margin for RS power.

4. **Tamil Nadu Electricity Board:** Tamil Nadu Electricity Board is a power generation and distribution company owned by Government of Tamil Nadu, India. It was created as a regulated monopoly under section 131 of the Electricity Act as a successor of the erstwhile Tamil Nadu Electricity Board. Since it is the only company who has the write to generate electricity and distribution too, R.S. power plays the role of middle tier of distribution while if some company wants to consume more than the limit R.S. power provide them higher limits of consumption with specific rates and contract with a constant amount of commission.

III. DISCUSION

RS Power is a middle tier supplier of electricity to those organizations or consumers who want power supply according to their respective usage. RS Power have 20 years of contract with their consumers wherein they have to renew their contract after every three years with TNEB (Tamil Nadu Electricity Board) to get an uninterrupted contract of generators which causes a continuous supply of energy to the customers. The generators provided by TNEB are of varying capacity like 100kw, 250kw depending upon its usage. Mainly the generators are available in 22kw, 33kw, 100kw and 250kw while the demand of the consumers varies between 110kw to 230kw. If any kind of line loss(suppose the consumer has demanded a power supply of 100k units, 96k units are for consumers and the remaining 4k units are reserved for line loss) happens. Based on the loss, the company plans which generator is there for which consumer. Each consumer has different price. 7 paisa (fixed) is the trade margin per unit. Every month the overall statement is sent to TNEB. Billing cycle is done every 5th of month. For example: the month of January would have a period of 12 December to 12 January.

IV. CONCLUSION AND FUTURE WORK

Energy and trade goods mercantilism blockchain technology has the flexibility to remodel the energy and trade goods mercantilism market area leading to market efficiencies and vital value savings for traders.[10] While blockchain technology remains within the comparatively early stages of development, the potential uses are broad and promising. The money services sector has semiconductor diode a lot of of the charge so far as it relates to trading and risk management, but EY and leading energy and commodity trading shoppers ar operating to develop powerful applications victimisation blockchain technology for the energy and commodity transaction life cycle.[4] [7] Traditionally, power systems have been supplied by large fossil-fuel generation plants, with most people participating as passive consumers of electricity. Now, power systems are undergoing a fundamental transition, due to the rapid adoption of electric vehicles, roof-top solar, home batteries and other distributed energy resources. Distributed energy resources allow previously passive consumers to become 'prosumers' – proactive consumers that actively manage their consumption, production and storage of energy. However, under existing electricity market arrangements, small-scale prosumers are stuck on retail supply contracts that individually meter their electricity usage, limiting the potential value of their energy resources.

For example, consider two cases:

1. A single prosumer has solar panels and an electric vehicle parked at home during the day.
2. There are two neighbours, one with solar panels, and the other with an electric vehicle.

From a power system perspective, the two situations are the same – local demand and supply are balanced, so there is no impact on upstream power generation or transmission.

However, this is not reflected by the retail market. In the first case, the prosumer can plug in their electric vehicle and charge it for free. In the second case, the electric vehicle owner will be charged at the same rate they would be if they were supplied by a power plant many miles away. The prosumer with solar panels will receive a feed-in tariff, but this won't take into account the reduction in transmission losses and congestion their generation helped create.

Now though, retail electricity markets look set for disruption. A race is on between start-ups and established firms to develop peer-to-peer (P2P) energy trading platforms that would allow prosumers to sell energy directly to one another, rather than having to go through their retail supplier.

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