

## Advanced IoT-Based Metering Infrastructure to Support Transactive Energy Exchanges

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One of the important issues in Transactive Energy applications as well as use of Blockchain-based smart contracts in support of transactive exchanges is verification of the off-the-chain data that trigger Smart Contract code execution. Traditional metering techniques do not have the agility to stand up to the requirements of the emerging transactive energy paradigm. In this presentation we propose the use of Internet of Things (IoT) techniques that have been used effectively in the social media to augment transactive energy exchanges and the off-the-chain metering information needed to drive Smart Contracts supporting these transactions, including recording transactions at the point of interconnection with the grid

Internet of Things (IoT) is a concept where a wide variety of field assets communicate over a common network (e.g. the Internet). In the world of energy trading and power systems operations, IoT provides a cost effective means to provide visibility on the distribution network to the system operators and also offers new technology solutions for agile asset metering in support of transactive energy exchanges. This includes new communication options for Advanced Metering Infrastructure (AMI) to support electricity, gas and water meters, the proliferation of low cost sensors on the distribution network, and embedded devices at customer premises that interface with utility legacy applications and new Energy Management Systems (EMS), Advanced Distribution Management Systems (ADMS) and Distributed Energy Resource Management Systems (DERMS).

In order to connect these “things” to intelligent systems in the cloud, IoT sensors and AMI meters must be capable of communicating wirelessly and in certain use cases at long distances (>3 miles) or to devices in hard to reach locations (e.g. underground). Traditional proprietary mesh technologies used for AMI systems work well in high density, shorter range scenarios. However, due to hopping, higher latency, and energy consumption, they are unsuitable for combining IoT and AMI on the same network since the IoT assets are typically remote and battery powered.

In this presentation we articulate the existing gaps in AMI and telemetry to meet the visibility needs of system operators into a large number of active DER assets, as well as the metering and deliverability verification needs of a large number of prosumers engaged in transactive exchanges. This includes the need for recording transactions at the point of interconnection (the metered point) between the Behind-the-Meter (BTM) participating assets and the grid. We then demonstrate how the new Low Range (LoRa) end point meters can be deployed and LoRa networks can be configured to provide an IoT-based Advanced Metering Infrastructure (AMIoT™), and utilizing the same infrastructure, enable various edge devices and sensors to provide visibility to the grid and support transactive energy exchanges.

**Keywords:** Transactive Energy, Smart Contracts, off-the chain Blockchain feeds, AMIoT™, LoRa, AMI, LPWAN, IoT