

# Autonomous Charging Management System



## The Invention

The invention is an autonomous charging management system for Electric Vehicles (EV). The invention utilizes a voltage feedback control structure at each charging station that compares system voltage at point of charging against a reference while also taking into account EV battery state of charge (SOC). This control structure reduces the EV charging as the system voltage approaches the reference. Moreover, the control structure does not require any communication between the EV and the utility.

## EV Infrastructure Market

- Most existing technologies for electric-grid-aware charging control of electric vehicles require two-way communication between the electric utility company and the end-user.
- In the United States, approximately, \$1.5 Billion is likely to be invested in the development of EV charging infrastructure by 2020.
- In Europe, more than 9 countries' governments will collectively invest above €200 Million (annually) to install public and private EV charging infrastructure by 2020.
- In China, an estimate suggests 12,000 public charging and 4.5 Million charge points totalling in investments of \$19 Billion is expected to be spent.

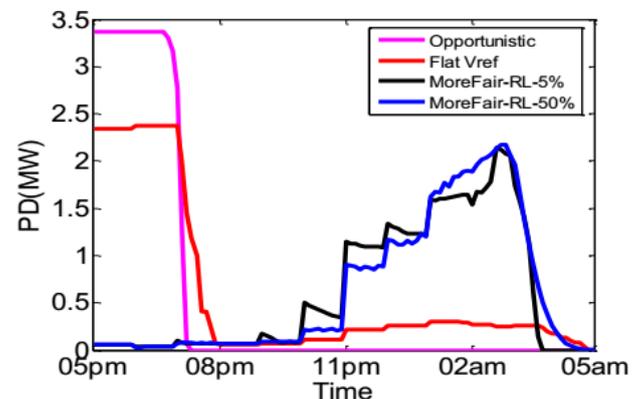
## Competitive Advantage

- Require no real-time communication between the utility and the charging station
- Offers a communication-free charge control strategy at which each EV autonomously adjusts its charging rate in a way that does not adversely impact the distribution grid.
- Avoids building the communication infrastructure resulting in significant savings for the utility company.
- Offer a fair control strategy to end users and flexibility.

## Project Status

This technology is at TRL 3. A distribution feeder test system was designed in a real time digital simulator with balanced and unbalanced nodes Analog controller action at each phase for nodes with balanced and unbalanced nodes of an autonomous charging management system for electric vehicles was verified.

Figure below show a comparison in terms of the aggregate EV load of the distribution system to demonstrate the effectiveness of the proposed control schemes in flattening the distribution system load profile.



## Looking for a Development Partner

Industrial partner collaboration is step forward for technology development and next step is to focus on hardware implementation and field test.

## Patent Protection

A patent US9616763 covers this technology and system.

## About KFUPM

King Fahd University of Petroleum & Minerals is a leading educational organization for science and technology. KFUPM Innovation & Industrial Relations is the IP management and technology licensing office tasked with taking innovation from lab to market.

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