

# Transactive Control of Smart Railway Grid

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## Motivation

This project investigates a method to reduce the cost of electric energy for the high-speed electric train network using data-driven decision-making process and bi-directional real-time communication between electric trains and the electric grid

## Challenges

- Real time data collection and storage mechanism
- Formulation of transactive control problem
- Selection of the energy source with minimum cost
- Velocity adjustment of the train network
- Sharing energy between the trains

## Scientific Impact

- Formulation of online negotiation process
- Solving constrained optimization problem
- Implementation of the transactive control system
- Mechanism for collecting data for verification of the proposed method

## Solution

- Establishing reliable and secure communication link between the train network and the electric grid
- Developing algorithm for selecting the minimum cost energy based on the train schedule and location
- Proposing a two-Step optimization problem
- Introducing the railway dynamic market mechanism
- Performing computer simulation and comparing the results with measured field data

## Broader Impact on Society

- High-speed electric train is a sustainable and reliable way of transportation
- Reducing the cost of energy for this system makes it more cost-effective for the costumers

## Broader Impact on education

- The mathematical formulation of transactive control is educational for engineering students and researchers
- The optimization techniques used to solve the railway dynamic market mechanism involves novel methods

## Broader future impacts

- Data-driven decision-making is adopted in many industries including cyber physical systems
- Electric train network could be used as a dynamic energy storage system for more resilient electric grid system