**Topic/Description:** Workplace Charging of Electric Vehicles using Agent-based Modelling factoring employee access to residential PV ~~and energy storage~~. The aim is to determine what price employers can theoretically charge employees with access to varying charging capabilities.

**Abstract**

# Introduction

## Motivation

* Explain rationale for electrifying transport sector
  + 1) Environmental
  + 2) Possible benefits (lower running costs) 🡪 transition to barriers for uptake
* Factors affecting uptake rate of EVs
  + Charging infrastructure (one of them)
* Establish context for workplace charging and reliance on home charging
  + **\*\*\***Need to establish problem: not much work on workplace charging *economics*?
  + Introduce parameters with associated uncertainties (energy required, commute distance, efficiency)
  + Limited charging infrastructure
    - Look at the majority of time where cars/vehicles are parked (home/work)
* Introduce pricing structures and problem definition of solving for highest possible price employers can charge
  + Justify use of ABM; required to represent the various charging capabilities of individual consumers
    - How the employer is subjected to risk through the employee’s ability to charge using solar + storage

**General Topics** (Problem/Solution - area of interest to expand on)

🡪Environmental Concerns / Electrification of transportation

🡪Workplace charging economics / Consumer willingness  
(why is workplace important – find study on travel nodes/patterns Gonzalez)  
(where is risk involved – the inclusion of alternative sources of charging [home-grid/pv,workplace,public] on the consumer side – competing with other sources)

🡪Consumer preferences regarding home and work charging / lacking info on interaction on a large scale  
(cite survey / small sample sizes) – need for greater information on a larger scale  
(distance linked to importance of fast chargers)  
(costs-pv,grid)

🡪Grid utilization?

## Literature Review / Related Work

* Economics of workplace charging + residential charging
* Self-consumption of PV?
* ABM of EV charging
* Consumer willingness

## Main Contributions

* Agent-based modelling on the impact of low-density residential charging including PV ~~and ESS~~ on workplace charging pricing
* Varying risk exposure depending on workplace charging price, use of ABM to represent the conditional value at risk that EV users are exposed to
* List assumptions regarding lack of installation costs: sunk costs

## Layout of Paper

# Proposed Methodology

* Brief overview of modelling approach

## Data

* Sources of data used

## Model Overview

* Agents
* Environment
* How is charging implemented

### Micro Level Parameters

* + Parameters of the individual agents: TBD
    - Initial/final state of charge (SOC)
    - Battery capacity
    - Efficiency/Power consumed (\*rolling resistance, frontal area, road gradients)

### Macro Level Parameters

* Charger availability/accessibility (type of parking)
* Charging level (type)
* Number of agents/EVs
* Purpose of travel
* Temporal information
  + Weekday vs Weekend
  + Peak/off-peak
  + Associated charging costs

## Mathematical Problem Formulation

* Parameters associated with risk
  + Range / energy requirements
  + Cost of charging
  + Range anxiety\*

# Simulation Setup

* Initialisation values for parameters
* Price structures
* Definition of metrics or indicators used to measure performance

# Results

* Charging scenarios (subject to change-original)
  + No access to residential charging
  + Access to residential charging
  + Access to residential charging and PV
  + Access to residential charging, PV and ESS
* Charging scenarios (updated)
  + Home + Public Charging (Baseline)
  + Home + Work Charging
  + Home + PV + Work Charging
* For each scenario, include sensitivity analysis
  + Price changes
  + Seasonal variations
  + Other factors that affect significant change in agent behaviour

# Discussion

* Implications of various strategies
* Policies that would facilitate or limit such strategies
* How does the distribution of PV, access to home charging affect results
* General limitations of model
  + Lack of additional travel patterns
  + Comments on realistic non rational behaviour of agents: range anxiety
  + (Herding effect? - tbd)

# Conclusion

* Main findings to summarise:
  + Determined price point/curve between home and work charging
  + Impact that including residential PV has on the results
  + Distribution of home/work charging (heat map)
* Future works

**Notes & Nonsense:**

* How does workplace pricing compare to public charging?
* Results will vary depending on the scale of businesses / employer
* Financial model required to incorporate long term viability
  + What happens if EV range increases due to advancements in battery technology

Theory of planned behaviour and rational choice theory

New paragraph – current charging preferences re: home / workplace charging  
 🡪 Introduce charging levels  
 🡪 Differentiate between public chargers vs fast DC  
 🡪 Importance of relationship between home/workplace charging  
pricing schemes – long term viability  
 🡪 in relation to charging levels  
workplace charging economics  
consumer willingness – other side of equation to be considered

Environment 🡪 Charging (Home/Workplace) 🡪 Economics 🡪 Consumer preferences

* Economics of workplace charging + residential charging
* Consumer willingness
* Self-consumption of PV? – consumer preferences: environmental concern
* ABM of EV charging – methodology review

However, slow uptake rate – list challenges

Despite these challenges, there has been a growth in EV sales in recent years

EV charging infrastructure is still developing – something about free charging models

Questionable long term financial viability – gap in knowledge on consumer willingness regarding EV charging