

## Late Backup

# Stages of EV grid integration

## Where we are today

Plug in your vehicle and charge

Off-peak charging encouraged through Austin Energy programs

Vehicle and grid do not communicate

Modest EV adoption

## Basic demand response

Demand response capabilities (similar to smart thermostats)

Peak shaving (pause charging at peak rates/times)

## Managed charging

Charging varies to achieve peak shaving

Reduces cost /grid stress, mitigates ramp rates

Aligns with renewables

## Vehicle to grid (V2G)

Allows for varying power level and direction to maximize peak shave

Reduces cost/grid stress, mitigates ramp rates

Aligns with renewables

Most complex form of EV & grid interaction

**Stage 1 → 3: power flows only to the vehicle**

**Stage 4: power flows to and from vehicle**

*Credit to: Dr. David P. Tuttle*