JUMP e-bike use in Davis and Sacramento

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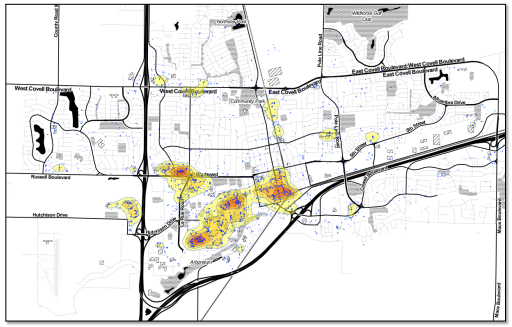
Research Question

- *How are JUMP e-bikes being ridden in Davis and Sacramento?*
- *What are the life cycle impacts associated with riding a JUMP e-bike 1 km in Davis?*

JUMP e-bike with swappable battery



Heat map of JUMP ride start locations in Davis, November 2018

Methods and Data

- Real-time e-bike location and state of charge (SOC) data aggregated for JUMP Davis and Sacramento every 2 minutes for 30 days (Nov. 1 – Nov. 30)[1]
- Raw data converted into "events" for each bike and analyzed

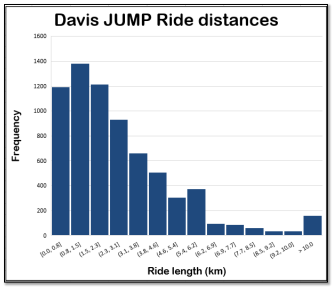

```
[{"bike_id":"bike_31152","name":"7085","lon":-122.33963,"lat":47.
610571666666665,"is_reserved":0,"is_disabled":0,"jump_ebike_batte
ry_level":"73%","jump_vehicle_type":"bike"},
```


bikeName	duration	battLast	battNow	dbatt	locLast	locNow	rideKM
6723	12	0.38	0.35	-0.03	[38.5435267, -121.7374783]	[38.536565, -121.7536783]	0.012
6723	12	0.35	0.33	-0.02	[38.536565, -121.7536783]	[38.53537, -121.7537383]	0.008
6723	31.017	0.88	0.85	-0.03	[38.5484583, -121.7620717]	[38.5412733, -121.7519867]	0.012
6723	11.017	0.85	0.84	-0.01	[38.5412733, -121.7519867]	[38.54133, -121.75206]	0.004
6723	15.983	0.84	0.82	-0.02	[38.54133, -121.75206]	[38.539705, -121.7699967]	0.008
6723	10	0.79	0.77	-0.02	[38.5375033, -121.7709233]	[38.5373367, -121.7551183]	0.008
6723	183	0.77	0.44	-0.33	[38.5373217, -121.7550117]	[38.539905, -121.75863]	0.132
6723	13.117	0.47	0.45	-0.02	[38.539905, -121.75863]	[38.5476267, -121.77203]	0.008

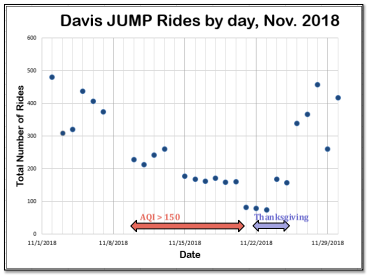
- Δ SOC converted to distance ridden for each ride event using range assumption of 42 miles (67.6 km)
- Life cycle assessment (LCA) performed for Davis JUMP use (functional unit: 1 person kilometer traveled (PKT)), including the impacts of bike and battery production, electricity use, JUMP van production and fuel use

[1]Data Source: General Bikeshare Feed Specification (GBFS), an open-source data feed supported by the North America Bikeshare Association

Results



Histogram of JUMP rides in Davis in November 2018, by distance.

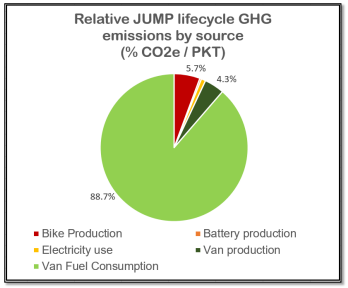


Daily jump rides in Davis, November 2018. Red arrow indicates days when wildfire smoke was prevalent.

	Davis	Sacramento
Average bikes in system	98	656
Total daily ride distance (km)	760	5752
Total daily rides	265	1580

General statistics of JUMP system in Davis and Sacramento

One result from Life Cycle Assessment of JUMP in Davis. Assumes 330 km of van driving per day per JUMP van



	Davis	Sac.	%diff
Daily distance ridden per bike (km)	7.8	8.8	13%
Average ride distance (km)	2.9	3.6	27%
Median ride duration (min)	16.2	18.0	11%
Daily rides per bike	2.7	2.4	-11%

Relevant comparisons between JUMP use in Davis and Sacramento, November 2018

About this study

- **Key findings:**
  - Daily JUMP rides decreased ~ 44% in Davis and ~ 20% in Sacramento during period with heavy forest fire smoke (excluding 11/21 – 11/23)
  - Greenhouse gas emissions associated with JUMP are highly dependent on fuel used by JUMP vans
  - In Davis in November, riding a JUMP bike 1 km is carbon-equivalent to a JUMP van driving 1/3 km
- **Relevance:**
  - Novel methodology for bikeshare analysis; expandable to any bikeshare system in GBFS database
  - Davis is especially interesting because JUMP is testing its battery-swapping models here
- **Limitations:**
  - Range assumption has high uncertainty
  - JUMP use depends greatly on season and air
  - Life cycle assessment model assumptions carry high uncertainty, especially van km driven.
- **Future research (looking for input):**
  - Validate and error-check data sifting methodology
  - Compare JUMP use across cities and compare JUMP with other bikeshare companies
  - Investigate time of use
  - Test battery range more systematically
  - Further research JUMP operations
  - Add google API capability to calculate shortest distances

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