Improving Preparedness of Communities for Evacuations using ZEVs

Workshop #2 With Community Partners

Date: December 5th

Location: UC Merced

Summary: UC Merced, UC Davis, UC Santa Cruz and UC Berkeley have been developing decision-aid tools that can help communities prepare evacuations with electric vehicle (EVs). The research team would like to like to share with community partners the latest the latest version of these tools. We are seeking feedback in order to make sure that our research can address the needs of the community partners. During the workshop we will have technical presentations, live demos of the prototype of our tools and group discussions.

Agenda

Time	Description	Presenter
11:00-11:20	*1. Welcome + round of Introductions*	deCastro (UCM) + all
11:20-11:35	*2. Scoring method to evaluate readiness of EV evacuations (v2.0)*	Osman Saleem (UCSC)
11:35-11:50	*3. Planning of energy, infrastructure and storage needs for EV evacuations (Part 1 – Analysis)*	Farzan ZareAfifi (UCM)
11:50-12:05	*4. Planning of energy, infrastructure and storage needs for EV evacuations (Part 2 – Optimization tools)*	Saheed Lakeh (UCSC)
12:05-12:30	*Live demo* *Note: Tools available here in link [A] (see URL below)*	Farzan + Osman
12:30-13:25	**Lunch**	-
13:25-13:30	*Group Photo*	-
13:30-13:50	*5. Modeling of a real-world evacuation in Mariposa, CA*	Qijian Gan(UCB)
13:50-14:10	*6. Optimal routing/ scheduling of vehicles and dispatch of mobile chargers during EV evacuations*	Xuchang Tang (UCD) Shuang Feng (UCM)
14:10:14:20	*7.Public policy implications for effective EV-based evacuations*	Markolf (UCM)
14:20-15:00	*8 Group discussion*	Moderator: Markolf
15:00-15:30	***9 Final discussion*** - *Are we missing any critical functionality in our planning and decision making tools for EV-based evacuation ?* - *Next steps of the project* - *Next workshop (May 2025)*	deCastro + ALL

[A] https://ucmerced.box.com/s/h9c1c6noehp0vqejbza81v0z6eix2afe

List of Participants

#	Organization	Name	Mode	Present
1	UC Merced	Ricardo de Castro	In-person	X
2	UC Merced	Sam Markolf	In-person	X
3	UC Merced	Shuang Feng	In-person	X
4	UC Merced	Dilawer Ali	In-person	X
5	UC Merced	Sarah Kurtz	In-person	X
6	UC Merced	Farzan ZareAfifi	In-person	X
7	UC Merced	Joseph Moyalan	In-person	X
8	UC Davis	Xinfan Lin	Remote	X
9	UC Davis	Xuchang Tang	In-person	X
10	UC Santa Cruz	Keith Corzine	In-person	X
11	UC Santa Cruz	Osman Saleem	In-person	X
12	UC Santa Cruz	Saeed Lakeh	In-person	X
13	UC Santa Cruz	Leila Parsa	Remote	X
14	UC Berkeley	Scott Moura	In-person	X
15	UC Berkeley	Qijian Gan	Remote	X
16	UC Berkeley	Michael Henderson	Remote	X
#	**Organization**	**Name**	**Mode**	
1	Merced Office of Emergency Services	Adam Amaral	In-person	
2	Pioneer Emobility	Michelle Browne	In-person	
3	Turlock Irrigation District (TID)	Monique Hampton	Remote	
4	Turlock Irrigation District (TID)	Jason Hicks	In-person	X
5	LLNL	Minerva Uribe-Robles	In-person	X
6	SJ EV Partnership	Ollie Danner	In-person	
7	Kern Council of Governments	Rob Ball	Remote	X
8	Mariposa Office of Emergency Services	Wes Smith	In-person	X
9	Mariposa Office of Emergency Services	Tim Rumfelt	In-person	X
10	Mariposa Office of Emergency Services	Raquel Sandoval	In-person	X
11	Calstart	Valerie Thorsen	In-person	X
12	City of Clovis	Bethany Berube	Remote	
13	City of Porterville	Teresa	Remote	
14	City of Clovis	Susanna Herrera	Remote	
15	City of Clovis	Nick Chin	Remote	
16	CARB	Stephanie Palmer	Remote	X
17	CARB	Natalie Reavey	Remote	X

Meeting Notes

1. Welcome + round of Introductions

- Mariposa OES shared their experience with Oak Fire evacuation in 2022
  - It was caused by arson;
  - More than 650 people had to be evacuated during a period of 3 to 4h
  - Public utilities turned off power
  - Highly uncertain; roads closed due to wildfire
- Mariposa OES shared that they are concerned about evacuation with ZEV and lack of infrastructure

2. Scoring method to evaluate readiness of EV evacuations (v2.0)

- Number of EVs in the community: CEC website has information about number of new EVs that were sold. **How about used vehicles?**
- How about number of school buses? They can shuttle lots of people to a shelter
- **Hydrogen vehicles will need a different type of refueling infrastructure** (especially medium- and heavy- duty). How to incorporate them in the evacuation score?

3. Planning of energy, infrastructure and storage needs for EV evacuations (Part 1 – Analysis)

- LLNL: Energy for evacuation has a non-linear behavior (it appears to increase quadratically with evacuation distance). Why is that?
- Mariposa OES
  - **Battery-based backup power has risks** (e.g. Lithium-based storage had many fires and incidents in stationary applications in recent years).Do you want to put this type of system in a community with high risk of wildfire? There are also zoning constraints about where we can place this stationary energy storage. It may not be practical
  - **Mariposa has 17k full-time residents. But also many "pass by tourists" to Yosemite**. How to account for non-residents? We do not know exactly how many people evacuate.
  - **How about evacuation of medium- and heavy-duty electric vehicles?**
- It may be dangerous to keep many EVs "left behind" during a wildfire, since they have lithium-ion batteries that pose fire hazards as well.
- **Carpooling?** Not common. Mariposa OES mentioned that most people do not want to leave cars behind (it is one of their most value assets; evacuees also bring their possessions with them in their cars).
- Calstart: Should communities invest in mobile charging or fixed charging?

4. Planning of energy, infrastructure and storage needs for EV evacuations (Part 2 – Optimization tools)

- TID
    - How to access data from power grid? Private companies are more protective of data. Public utilities (e,g, TID) are more willing to share data. TID shows the power generation capability of their gas units in their website
    - Another alternative to access data is through the CPUC
    - TID is the "balancing authority" for Stanislaus and Merced county

Live Demos

Assessment of energy and charging needs

- Do you consider energy to get back home?
- **Response vehicles (e.g. fire fighters) may be electric. How do plan to re-charge these vehicles during an emergency event**?
    - Currently, there are "fueling trucks" that bring fuel to fire fighters trucks that are deployed in the field. Should we have something similar if vehicles are electric?
- Two evacuation layers:
    - 1st layer is to bring people "out of danger" (not necessarily to a shelter)
    - 2nd layer is to bring people to a "shelter" (where they can at least spend the night)

5. Modeling of a real-world evacuation in Mariposa, CA

- What additional metrics should we consider in the evacuation?
    - Location of stranded vehicles? Are they away from danger?
- Where to place the mobile chargers?
    - **Public property is usually a good spot.** However
        - Schools require the interaction with a different jurisdiction (and they are also used as shelter)
        - We may need pre-arrangements with public entities (e.g. in case of an emergency, public entity X agrees to host a mobile charger). Could this be a public policy question?
        - For example, in Mariposa, the fair grounds are usually allocated to Calfire (it may not be a good place to put the mobile charger…)

6. Optimal routing/ scheduling of vehicles and dispatch of mobile chargers during EV evacuations

- In your optimal routing, you need to make sure you are not sending people to charge into danger
    - Can we account for that in our problem?
- Most people do not follow the instructions that are given. How to take that into account?

- We are able to improve the evacuation time in 10% (e.g 5.5h to 4.8h). Does this make a difference?
    - Mariposa OES says yes (especially if you give 30min extra time to leave danger; every minute counts)

7.Public policy implications for effective EV-based evacuations

- **Sam Markolf shared a list of 10 possible public policy contributions.**
    - **What is the cost of each approach? And their effectiveness? Doing a cost-benefit analysis for each measure would be very useful.**
- Many of the measures will require funding. **Where does the money come from?** If the state mandates (e.g. backup power or mobile chargers) who will pay for them?
- Improve electrical infrastructure is critical.
    - For example, TID is installing a 30MW charging station on I5 highway. It needs a complete new power station. Who will pay for it? **Utilities may not be able to support the extra investments in infrastructure**
- **Assessment of existing emergency equipment**? For example, Mariposa has 3 mobile generators. Could we use them/repurpose them to charge EVs during emergencies?
- Do we need chargers at shelters?

8. Final Discussion

- What is the "pain point" of evacuating with EVs?
    - **Mariposa OES mentioned that creating policies and procedures to deal with EV-based evacuation is the main challenge.**
    - Is the routing and scheduling of evacuation a key problem**? Mariposa OES mentions that only 10% of the local people follow their instructions** (however, Mariposa has many out-of-town visitors who will gladly follow the instructions provided by google maps; sometimes educating the local people may be the challenging part).
    - Is the sizing & placement of mobile chargers relevant?
- Considering human factors is critical.
    - Not everybody follows the instructions. What to do if they want to fully charge the battery (taking 1h to re-charge), while having people queuing to access the charging station? How to avoid people hoarding energy?
    - Humans have tendency to behave like herd (e.g. just follow the vehicle in front)
- Evacuations are often highly unpredictable; need to "plan on the fly"
- Mariposa has limited cell coverage (especially AT&T)**; lack of communication networks is also critical** (inability to communicate with people may affect the evacuation).
- Many of the Mariposa evacuations only have a few possible routes

- TID: improving resilience of charging infrastructure is critical (there has been lots of investments in increasing resilience of power systems)
- Mariposa OES:
    - A simple and low-cost strategy to improve readiness is to have policies in place to tell residents to keep SOC>75% during periods where hazard may be likely.

Action Items

- Ricardo de Castro: Slides should be presented with community partners after the meeting (uploaded them to the *https://ucmerced.box.com/s/h9c1c6noehp0vqejbza81v0z6eix2afe*?)

- Community partners:
    - upload answers to "Q-activity" prepared by prepared by Dr. Sam
    - review excel tools and website for readiness score (submit a google form!)
    - Mariposa OES: send list of backup shelters (outside Mariposa), which can handle the "spill over" of shelters in Mariposa

Photos


EPSON
Ricardo Pinto de Castro
Berkeley