

Informed Consent

Electric Vehicle Charging Preferences

UT Austin Internal Review Board # STUDY00003114

Dear Respondent,

The University of Texas at Austin invites you to take part in a research study to better understand Americans' preferences and opinions on electric vehicle (EV) charging. Results of this study will be used to guide policy decisions and to design future electrified transportation options. Your participation is voluntary, but very important. If you are unable to participate for any reason, any other adult with a driver's license in the household can complete the survey. We are interested in your answer to every question, including those dealing with topics that might be less familiar to you.

The survey will take about 15-20 minutes to complete, but we think you'll find it interesting and fun to do. **Your input and opinions are very important, since it is critical that a variety of perspectives be represented.**

Thank you in advance for your participation in this important study. If you have any questions or comments about the study, feel free to contact the study coordinator, Matthew Dean, at mattdean@utexas.edu, or the principal investigator, Kara Kockelman, at kkockelm@mail.utexas.edu or (512) 471-0210.

Thank you very much for your time and cooperation.



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By clicking on the arrow button below, you agree to participate in this study and verify that you are 18 years or older. This research is conducted by The University of Texas at Austin. This study has been reviewed and approved by the University of Texas at Austin Institutional Review Board for the protection of study participants. The online survey and the questions asked pose no more risks to you than you would come across in everyday life. All responses will be treated in strict confidence, and your identity and privacy will be protected. You may benefit from this survey by directly supporting an effort improve electric vehicle charging price schedules and policies, though, since it is an experimental procedure, no benefits can be guaranteed. If you have any questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you may contact the UT Institutional Review Board at (512) 471-8871 or at orsc@uts.cc.utexas.edu.

Screener Block

This survey might introduce you to **new concepts**, namely "**smart charging**" of **electric vehicles** (EVs). Smart charging often shifts EV charging based on prices or allowing the local power company to alter charging (like staggering timing so not all EVs start charging at once). **The goal is to lower power costs, lower emissions, and protect the power grid.**

What is smart charging?

Charging **whenever my EV requires it.**

Using an **app or timer to charge only during off-peak hours** to lower costs and emissions.

Section A: Household & Vehicle Information

Home & Vehicle Information

Do you rent or own your current residence?

I own my home/apartment

I rent my home/apartment

I live with parents (or friends/others) and am not paying rent

Other:

What *best* describes your current residence?

Single-family house (**detached house**)

Townhouse (attached house)

Apartment/condo

Mobile home/trailer

Dorm or retirement home/assisted care

Other:

How many apartments/condos **in total** are at this location?

Apartment building with only **2 to 3 units**

Apartment building with **4 to 10 units**

Apartment building with **more than 10 units**

Single apartment/condo (such as a garage apartment/ADU)

Does your home have any of the following **technologies**? (Please select all that apply)

My home has a ... **smart thermostat**, which adjusts the central air conditioning (AC) through a smartphone app

... **whole-house generator**, which provides backup power for blackouts (**fuel-powered**)

... **solar panels**, which generate electricity. The system can produce the following kW:

... **solar water heater**, which heats water.

... some **other** technology (examples include battery storage, geothermal heating/cooling, & heat pumps)

How many motorized cars & trucks does your household have?

Please include cars, trucks, SUVs and vans (**whether owned, leased, or a company vehicle**). Do NOT include electric bikes, scooters, or motorcycles. **Your household includes everyone** who lives in the same dwelling unit, **including relatives and roommates**.

My household has ...

- 0 vehicles
- 1 vehicle
- 2 vehicles
- 3 vehicles
- 4 vehicles
- 5 or more vehicles

Why does your household own/lease 0 vehicles? (Please select all that apply)

My household does not own/lease a vehicle because ...

it is not needed to get to places for everyday needs.

public transit/car share/bike/walk is suitable for everyday needs.

of the environmental impacts of vehicle ownership.

vehicles are too expensive to buy/lease outright.

vehicles are too expensive to maintain, refuel, and park.

vehicle insurance is too expensive.

of health reasons.

of age related reasons.

of no driver's license.

On average, how many miles do you drive annually? Do NOT include miles where you are a passenger or miles that other household members drive. You should include miles where you borrow a friend's vehicle or rent a vehicle.

On average, how many miles do you drive annually in your household vehicles? Do NOT include miles where you are a passenger or miles that other household members drive. Do NOT include rental vehicles in this response.

For example, if you drive 10 mi/day and have a 200-mi round-trip twice a year, you should select the option "4,000 to 4,999 miles." Or if you drive a little over 30 mi/day during the year, you should choose "11,000 to 11,999 miles."

At home, where do you normally park the vehicle you drive the most?

At home, I park my vehicle ...

In my **garage**

In my **driveway**

In a shared garage/parking lot with **controlled access** (i.e., keypad entry/fob to enter)

In a shared garage/parking lot **without controlled access**

On the **street**

Other:

Vehicle Types

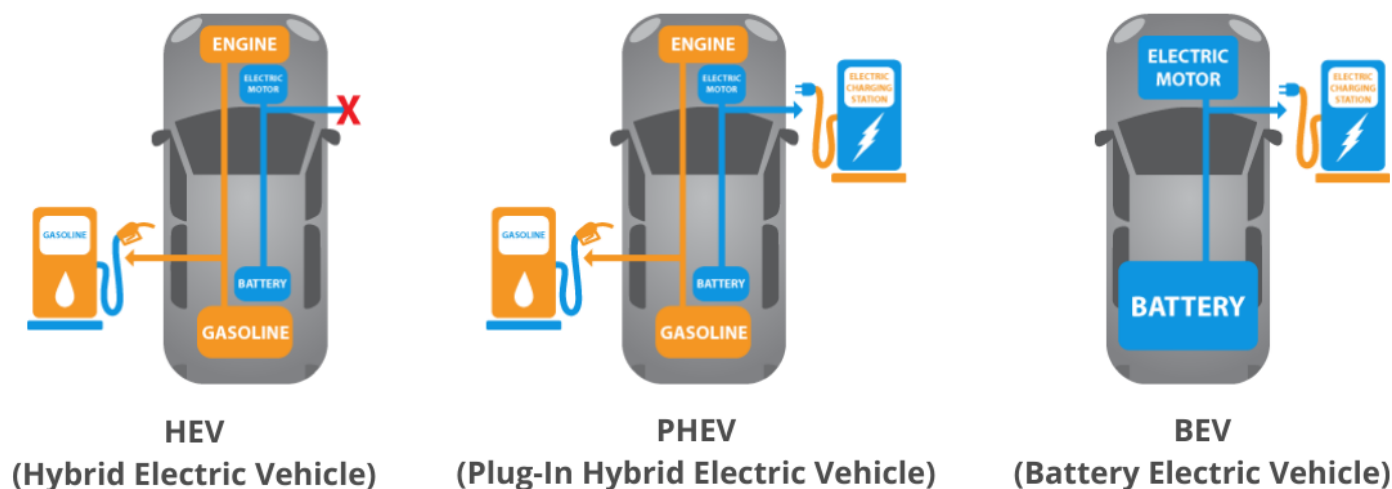
This survey **asks about vehicle types** and **may ask you to assume you have a battery electric vehicle (BEV)**. Please review the following information before continuing the survey.

Gasoline/Diesel Power. Powered entirely by an internal combustion engine.

Hybrid-Electric. Powered by a combination of an internal combustion engine and electric motor. The battery of the electric motor is charged by recovering braking energy.

Plug-In Hybrid-Electric. Powered by a combination of an internal combustion engine and electric motor. The battery of the electric motor is charged from the electricity grid. The electric-only range is typically 10-40 miles.

Battery Electric/Fully Electric. Powered only by an electric motor. The battery of the electric motor is charged from the electricity grid. The range on a single charge can be as low as 50 miles or as high as 520 miles, depending on the vehicle.



Does your **household** own/lease an **electric** vehicle?

Please include hybrid electric vehicles (**HEVs**), plug-in hybrid electric vehicles (**PHEVs**) or battery electric vehicles (**BEVs**). Please do NOT include fuel cell electric vehicles.

Yes, my household **owns/leases an EV (HEV, PHEV, and/or BEV).**

No

What type of EV(s) does your household own/lease? (Please select all that apply)

We also would like to know the **all-electric range of your household plug-in EVs**. For example, the Tesla Model Y 74 kWh battery can provide 326 miles of range on a single charge. The Nissan LEAF standard 40 kWh battery can provide 149 miles.

Hybrid electric vehicle (**HEV**)

Plug-in hybrid electric vehicle (**PHEV**), with an **all-electric range (in miles) of:**

Battery electric vehicle (BEV), with a range (in miles) of:

How often is the plug-in EV you drive the most charged at home?

The EV I drive the most is charged at home ...

every day ("top off" charging).

more than 3 times per week (but not every day).

twice a week.

once a week.

less than once a week.

Other:

My household doesn't charge my EV at home.

When is the EV you drive the most typically plugged in at home? (Please select all that apply)

The EV I drive the most is typically plugged in at home on ...

	weekdays	weekends
... during the morning hours (6 AM - 10 AM)	☐	☐
during midday hours (10 AM - 2 PM)	☐	☐
during afternoon hours (2 PM - 5 PM)	☐	☐
during evening hours (5 PM - 9 PM)	☐	☐
during night hours (9 PM - 6 AM)	☐	☐

How **convenient** would it be to **charge a plug-in EV** at **home**?

Extremely convenient

Somewhat convenient

Neither convenient nor inconvenient

Somewhat inconvenient

Extremely inconvenient

Please rank the **most significant barrier(s)** to charging your plug-in EV at **home**. Drag and drop the items into the two categories: a barrier or not a barrier.

Items	
Other (please write in): 	Ranked list of barrier(s)
Charging equipment too costly	
No dedicated/reserved parking space	
Physical space limitation	
Need landlord permission	NOT a barrier
New electrical wiring required/not configured to charge an EV	

If you had a **plug-in EV**, could you **charge** your vehicle at **home**?

Yes, there is already a charger at my home (could apply to multi-family units).

Yes, I could install a charger at my home.

No, I have no way to charge an EV at home.

How **convenient** would it be to **charge a plug-in EV** at **home**?

Extremely convenient

Somewhat convenient

Neither convenient nor inconvenient

Somewhat inconvenient

Extremely inconvenient

Please rank the **most significant barrier(s)** to charging a plug-in EV at **home**. Drag and drop the items into the two categories: a barrier or not a barrier.

Items

Physical space limitation

**Charging equipment too
costly**

**New electrical wiring
required/not configured
to charge an EV**

Need landlord permission

**No dedicated/reserved
parking space**

Other (please write in):

Ranked list of barrier(s)

NOT a barrier

When is your household likely to buy (or lease) a new (or used) vehicle **for your primary use?**

In less than 1 year

In 1 to 3 years

In 3 to 5 years

In 5 to 10 years

In more than 10 years

I am very unlikely to buy/lease a vehicle in the future

If your household had to buy a vehicle in the **next 5 years, would it be a **plug-in EV** (either a plug-in hybrid [PHEV] or battery electric vehicle [BEV])?**

My household would ...

definitely buy a plug-in EV

probably buy a plug-in EV

probably NOT buy a plug-in EV

definitely NOT buy a plug-in EV

I don't know if I my household would buy a plug-in EV

Please rank the **top 3 reasons** why your household would $\{q://QID318/ChoiceGroup/SelectedChoices\}$ in the next 5 years.

Insufficient number of charging stations

No at-home charging options

Long-distance trips

High purchase price

Need for travel planning

Fear of getting stranded (0% battery)

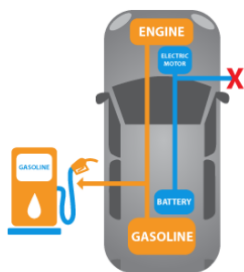
Risk of battery degradation & replacement costs

Long charging times

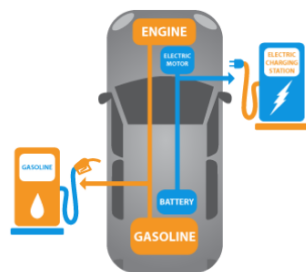
Concerned about battery waste & mining

Cost to add charging at home

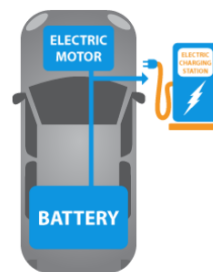
You said your household would $\{q://QID318/ChoiceGroup/SelectedChoices\}$ for your use in the next 5 years (if you had to). **Out of 100%, how likely would this new vehicle be a plug-in hybrid electric vehicle (PHEV) versus a battery electric vehicle (BEV)?**



HEV
(Hybrid Electric Vehicle)



PHEV
(Plug-In Hybrid Electric Vehicle)



BEV
(Battery Electric Vehicle)

For example, the new vehicle is 70% likely to be a PHEV and 30% likely to be a BEV.

_% likely to be a PHEV

_% likely to be a BEV

Total

Would this **new plug-in EV** be your **primary vehicle** or someone else's in the household?

It will be my primary vehicle (this new EV is driven most often by you)

It will be someone else's primary vehicle

It will be our household's backup vehicle (no one person uses it the most)

Assume now that you would definitely buy a new battery electric vehicle (BEV). What is the **range (in miles)** that you would like to have? Range is the maximum distance you can drive starting from a full battery.

Remember that a BEV is powered only by an electric motor.

Where would you charge this new battery electric vehicle?

For example, I would charge 95% of the time at home, 0% at work, and 5% at public chargers.

I would charge _% of the time at home.

I would charge _% of the time at work.

I would charge _% of the time at public chargers

Total

If you had to buy a new battery electric vehicle (BEV), you said you would like to have one with a range of \${q://QID358/ChoiceGroup/SelectedChoices}. Range on a single charge is just one aspect of driving an electric vehicle. Other important aspects include the number of public charging stations and the time to charge (from 0-100%).

If you had to only pick 2 out of the 3 options (long-range BEVs, sufficient number of public charging stations, and fast charging), **which 2 would you pick?** The option not selected remains the status quo.

Long-range BEVs (like current gas-powered vehicles)

Fast charging (like the time to pump gas)

A sufficient number of public charging stations (like gas stations)

Which **best** describes your **employment status**?

Employed, working 40 or more hours per week (including self-employed)

Employed, working 1-39 hours per week

Student, working part time

Student, not working

Not employed, looking for work

Not employed, not looking for work

Retired

Disabled, not able to work

In a typical week, **how often do you work from home (WFH)?**

I WFH every working day

I WFH 1-2 days a week

I WFH 3-4 days a week

I do not or rarely WFH

How do you typically get to work/school? For example, if you take your bike on public transit please select the two options.

I usually ...

drive to work/school by myself

carpool to work/school with others (includes dropping off kids at daycare or vanshare commuting programs)

walk or bike to work/school

take public transit to work/school

Can you (or could you) charge a plug-in EV at work/school?

Please answer based on the **most visited work location** if you have multiple job sites or your **in-office** work location if you work from home (WFH) some days of the week. If you typically park off-site, like at a third-party garage/lot, please answer whether you can charge at this off-site location or similar off-site locations.

I don't know

Yes, I can charge an EV at work/school in the same lot/garage as I normally park.

Yes, I could charge an EV at work/school but would have to park in a different lot/garage.

No, I do not (or would not) charge because there are not enough chargers (or I cannot reserve access).

No, I could not charge an EV at work/school (no chargers at my work or school).

If you drove to work, could you charge a plug-in EV at work/school?

Please answer based on the **most visited work location** if you have multiple job sites or your **in-office** work location if you work from home (WFH) some days of the week. If you typically park off-site, like at a third-party garage/lot, please answer whether you can charge at this off-site location or similar off-site locations.

I don't know

Yes, I can charge an EV at work/school in the same lot/garage as I would normally park.

Yes, I could charge an EV at work/school but would have to park in a different lot/garage.

No, I do not (or would not) charge because there are not enough chargers (or I cannot reserve access).

No, I could not charge an EV at work/school (no chargers at my work or school).

How often do you charge the plug-in EV you drive the most at work/school?

I charge the plug-in EV I drive the most at work/school ...

every workday

a few times per week

once a week

a few times per month

Other:

I don't charge my EV at work.

Is workplace charging a benefit provided to employees or do you pay for the cost of charging yourself?

My employer pays for the cost of EV charging at work.

I directly pay for the cost of EV charging at work.

Do you work an **overnight shift for your job at work/school?** An example of an overnight shift is 10 PM to 6 AM.

No, I never work an overnight shift at work/school.

Yes, I sometimes work an overnight shift at work/school.

Yes, I only work an overnight shift at work/school.

During **weekdays, when do you **typically leave in the morning and arrive back home**?**

For example, I usually leave home around 8:30 am and arrive home around 6:00 pm.

On a typical weekday, I leave home around ...

On a typical weekday, I arrive home around ...

During **overnight shifts, when do you **typically leave in the evening and arrive back home**?**

For example, I usually leave home around 8:00 pm and arrive home around 6:00 am.

On a typical weekday, I leave home around ...

On a typical weekday, I arrive home around ...

Section B: Electricity & Background Information

Electricity Prices

Currently, most EVs are charged at home. The cost of charging (or "refueling") depends on the price your electric power company sets.

On average, Americans pay 13 cents per unit of electricity (kWh) used. A full charge (i.e., 0-100% range) of a 250-mile battery-electric vehicle (BEV) for example, would cost approximately \$8.30. For a gas-powered vehicle with 30 mpg fuel efficiency

driving 250 miles to have lower fuel costs, gas prices would have to be less than \$1 per gallon.

We are interested in **how prices may influence charging habits**. The next page will ask you about your **household's electric bill**.

Residential electric bills usually contain at least two charges. The first is a customer charge (\$). The second is a **volume-based charge (\$/kWh)**.

How does your local power company set the price for the amount of electricity consumed in a month (\$/kWh)? Please ignore any additional fees that may be applied to consumption (like fuel add-ons and taxes).

Fixed prices: pay the same price per unit of electricity (\$/kWh)

Tiered prices: the cost per kWh changes as you use more electricity (for example, \$0.07/kWh for the first 1200 kWh and \$0.12/kWh after 1200 kWh)

Time-of-use (TOU) prices: costs are higher during "peak hours" (for example, \$0.20/kWh from 4 PM - 8 PM and \$0.10/kWh all other hours)

Wholesale prices: you pay for the actual cost of electricity in the wholesale energy market, which changes price every 15 min to an hour.

Unsure, I have no idea how my household's monthly electric bill is calculated.

Other (for example, TOU with tiered prices)

Do you pay a **different** price for **at-home EV charging**?

No, the energy is added to my household's energy consumption.

Yes, we pay a separate tiered price for our EV demand.

Yes, we pay a separate time-of-use (TOU) price for our EV demand.

Yes, we pay a separate wholesale price for our EV demand.

Yes, we pay a separate unlimited charging package for our EV demand.

Unsure

Other (please specify)

EV Smart Charging

Electric power companies can use prices to incentivize EV owners to charge their vehicles during low-cost hours to reduce the impacts of many EVs on the power grid. The power company can use time-of-use prices or pass down the real costs of producing electricity to the EV owner. Some EV owners use apps or timers to only charge during off-peak (or low-cost) periods.

Instead of using prices to shift EV charging, power companies can directly control EV charging. Called **utility-controlled smart charging**, the goal is to reduce charging costs for the EV owner, use more renewable energy, and improve power grid reliability.

Smart charging has benefits for the power grid and EV drivers.

How **important to you** is the listed benefit from smart charging?

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Smart charging can...					
reduce my electric bill costs	☐	☐	☐	☐	☐
... maximize zero-carbon renewables (solar, wind)	☐	☐	☐	☐	☐
... contribute to global climate goals	☐	☐	☐	☐	☐
... reduce air pollution from power plants	☐	☐	☐	☐	☐
... reduce the impact of more EVs on the grid	☐	☐	☐	☐	☐
... this is a data quality check, please select "slightly important"	☐	☐	☐	☐	☐
... reduce the need for expensive large-scale energy storage	☐	☐	☐	☐	☐
... make the electric grid more reliable	☐	☐	☐	☐	☐

Before today, were you knowledgeable on **utility-controlled smart charging**?

No, I had no knowledge on smart charging

Yes, and I am slightly knowledgeable on smart charging

Yes, and I am moderately knowledgeable on smart charging

Yes, and I am very knowledgeable on smart charging

Yes, and I am extremely knowledgeable on smart charging

Would you be **interested in a smart charging program** for your **plug-in EV(s)**?

I already participate in a smart charging program

Not at all interested in a smart charging program

Slightly interested in a smart charging program

Moderately interested in a smart charging program

Very interested in a smart charging program

Extremely interested in a smart charging program

Would you be **interested in a smart charging program** for a **future plug-in EV**, assuming you owned/leased one?

Not at all interested in a smart charging program

Slightly interested in a smart charging program

Moderately interested in a smart charging program

Very interested in a smart charging program

Extremely interested in a smart charging program

Section C: Smart Charging

EV Charging Preferences

Assume now that you drive a battery-electric vehicle (**BEV**) with a range of **250 miles** and **can charge at home**. You have a charger that provides 10 to 20 miles of range for every hour of charging.

Given your weekly driving and (expected) charging habits, **would you allow your local power company to directly control charging**? The power company would use this power to mostly stagger charging schedules to avoid peaks in energy demand from BEVs.

Yes, I do not care what happens as long as I wake up with a full charge, but do not interrupt my charging during the day.

Yes, I would allow them to control my charger daily to optimize grid demand throughout my community.

Yes, I would allow them to control my charger only when needed, like to prevent grid strain on days of high energy demand.

Maybe, I would need to more information to feel confident in giving up total control.

No, but I would be willing to stagger charging myself through an app/timer.

No, I want my vehicle to charge when plugged in and stop charging as soon as it reaches a full charge.

I am unsure

Other:

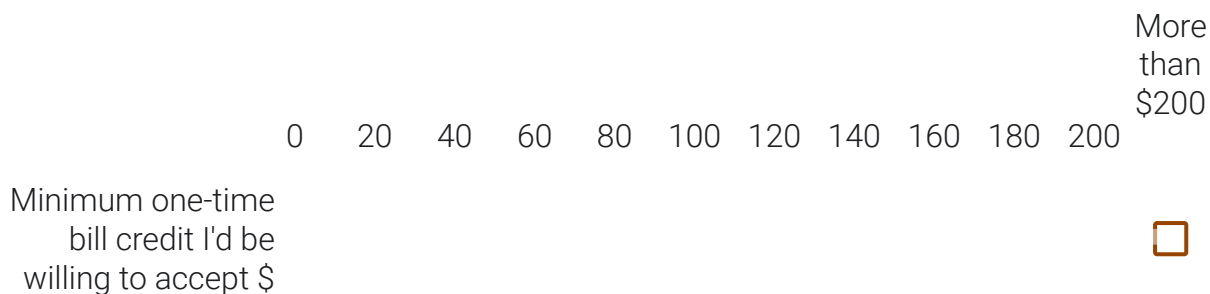
Assume now that you have a battery-electric vehicle (**BEV**) with a range of **250 miles** and **can charge at home**. You have a charger that provides 10 to 20 miles of range for every hour of charging.

Your local power company gives you a one-time bill credit (\$) if you participate in an EV smart charging program. The power company studies your EV charging patterns for one month and creates a **custom charging schedule** for you. This allows the power company to charge EVs at a lower cost without impacting your travel needs.

Details:

- For **overnight charging**, you allow the power company to charge your EV whenever, so long as you receive a **full charge** by the morning. Your vehicle is charged sometime between the hours of 10 PM and 6 AM.
- For **daytime charging**, the power company can interrupt charging during extreme events (**no more than 5 times a year**). Otherwise, your charging is not affected.
- Must stay enrolled in the program for **at least 1 year** to receive the one-time credit.

What is the smallest one-time bill credit (\$) you would accept to allow your local power company to modify your EV charging when plugged in?



In **addition** to a one-time incentive, **how much money per year** would the local power company have to pay you for each **year** of ongoing participation?

More
than
\$20

0 2 4 6 8 10 12 14 16 18 20

Minimum credit I'd
be willing to accept \$

☐

Please select the option that **best** describes your opinion on each topic:

	Strongly agree	Somewhat agree	Neither agree or disagree	Somewhat disagree	Strongly disagree
The power grid can support the government's EV adoption goals .	☐	☐	☐	☐	☐
Smart charging is a net good for society .	☐	☐	☐	☐	☐
After plugging in my EV, I don't want to think about how my EV charges.	☐	☐	☐	☐	☐
Utility-controlled charging has more risks than benefits for my lifestyle.	☐	☐	☐	☐	☐
EV owners should pay higher fees on their monthly electric bill to pay for power grid upgrades .	☐	☐	☐	☐	☐
I don't trust my utility to always guarantee my vehicle is fully charged before I need it.	☐	☐	☐	☐	☐
Privacy is more important than giving up some control to have a stable power grid .	☐	☐	☐	☐	☐

Section C2: Automatic Enrollment in EV Smart Charging Program

Instead of a one-time credit for voluntary participation, you can pay a **monthly fee to leave** the smart charging program.

What is the **highest fee you would pay to charge whenever you want**? If you would not pay to leave the program, select \$0.

I would pay an extra \$ per month to charge as I want

Assume now that your **power company automatically enrolls you** in its **EV smart charging program** (same terms as before). **Instead of a one-time credit for voluntary participation**, you can pay a **monthly fee to leave** the smart charging program.

How **much do you value the freedom to charge as you want?** If you would not pay to leave the program, select \$0.

I would pay an extra \$ per month to charge as I want

Section D: Additional Demographic Information

We have just a few questions left!

Given the choices and information presented in the survey, **we are interested to know if you have changed your mind on plug-in EVs.**

If your household had to buy a vehicle for you in the next 5 years, would it be a **plug-in EV** (either a plug-in hybrid [PHEV] or battery electric vehicle [BEV])?

My household would ...

definitely buy a plug-in EV

probably buy a plug-in EV

probably NOT buy a plug-in EV

definitely NOT buy a plug-in EV

I don't know if my household would buy a plug-in EV

You said your household would \${q://QID305/ChoiceGroup/SelectedChoices} for your use in the next 5 years (if you had to). **Out of 100%, how likely would this new vehicle be a plug-in hybrid electric vehicle (PHEV) versus a battery electric vehicle (BEV)?**

For example, the new vehicle is 70% likely to be a PHEV and 30% likely to be a BEV.

_% likely to be a PHEV

_% likely to be a BEV

Total

DEMOGRAPHICS

Including yourself, how many **people** live in your household? Your household includes everyone who lives in the same dwelling unit, including relatives and roommates.

1

2

3

4

5 or more (please specify):

Including yourself, how many **workers** usually live in your household? (Please include all the persons in your household who get paid for working full-time, part-time, or are self-employed.)

0

1

2

3

4

5 or more (please specify):

What is your **age**?

Less than 18 years

18 to 24 years

25 to 34 years

35 to 44 years

45 to 54 years

55 to 64 years

65 to 79 years

80 or more years

Prefer not to disclose

What **gender** do you *most* identify with?

Male

Female

Other

Are you Hispanic or Latino?

Yes

No

Prefer not to disclose

Which of the following *best* describes your **ethnicity**?

White/European White/Caucasian

Black/African American

Asian/Pacific Islander/Asian American

American Indian/Native American

Mixed/Multiracial

Other (please specify):

Prefer not to disclose

How many **children** (those **under the age of 16 years**) usually live in your home?

0

1

2

3

4 or more (please specify):

Which of the following *best* describes your household's **total annual income from all sources, before taxes**, for all members of your household? (Income data is **very important** for developing models on behavior and preferences).

- Less than \$30,000**
- \$30,000 to \$39,999**
- \$40,000 to \$49,999**
- \$50,000 to \$59,999**
- \$60,000 to \$74,999**
- \$75,000 to \$99,999**
- \$100,000 to \$124,999**
- \$125,000 to \$149,999**
- \$150,000 to \$199,999**
- \$200,000 to \$249,999**
- \$250,000 to \$299,999**
- \$300,000 or more**
- Prefer not to disclose**

Would you be willing to tell us **more generally** about your household's income?

- Under \$25,000**
- \$25,000 - \$49,999**
- \$50,000 - \$74,999**
- \$75,000 - \$99,999**
- \$100,000 or more**
- Prefer not to disclose**

What is the **highest level of education** you have completed?

Some grade/high school

Completed high school or GED

Some college

Completed technical school/associates degree

Completed Bachelor's degree

Completed Master's (or equivalent) degree

Completed PhD (or equivalent) degree

What is your **marital status**?

Single

Married

Divorced

Widowed

Domestic Partnership

What is the **zipcode** of your **primary residence**?

We ask that you use the [USPS ZIP Code Lookup tool](#) to provide your 9-digit zipcode, without any space or dash (like 787121476).

OPTIONAL: Do you have any **comments or suggestions** for us?

OPTIONAL: Would you be willing to look up your **most recent monthly electricity bill** and provide us with fee information (kWh, \$)?

Total Energy Consumption/ Usage ("Meter Read" in kWh)

Total Electric Bill Charges (\$)

Base Customer Charge/Fee (\$)

Electric Company

Rate Plan/Schedule (ex: "008 - Residential Service" or "Time-of-Use")

Optional Block Test

Thank you for your responses on this critical topic! We would like to ask you about **bidirectional charging** features, where a BEV can send power back to devices, homes, and the grid.

Are you able to spend more time answering questions?

No, I cannot give more time.

Yes, I can provide more time.

Section E: Optional Bidirectional Charging

EV Bidirectional Charging

Some new BEVs can both charge and discharge electricity (called bidirectional charging).

Some BEVs are designed to provide power through standard outlets (for worksite tools at construction sites, electric heaters or appliances at campsites, TVs, or sound equipment at tailgates/festivals), also called vehicle-to-load (V2L). Vehicles may even provide partial or full power for one's home if the home's circuit breaker is wired properly (vehicle-to-home, V2H). Power companies may even tap into BEV batteries

to provide short-term power to the local power grid in emergencies or when electricity is in high demand (vehicle-to-grid, V2G).

The Ford F-150 Lightning, shown below powering worksite tools, demonstrates V2L technology. There are at least 7 vehicles (Nissan Leaf ZE1, Mitsubishi Outlander plug-in, Ford F-150 Lightning, Hyundai Ioniq 5, Kia EV6, BYD Atto 3, MG ZS EV 2022) with some form of bidirectional charging capabilities, each with different battery sizes, plug connection types, and maximum power draw.



Bidirectional charging has benefits for the power grid and EV drivers.

How **important to you** is the listed benefit from bidirectional charging?

	Not at all important	Slightly important	Moderately important	Very important	Extremely important
Bidirectional charging can... reduce my electric bill costs	☐	☐	☐	☐	☐
... can provide emergency power to my own house	☐	☐	☐	☐	☐
... provide emergency support to the electric grid	☐	☐	☐	☐	☐
... maximize zero- carbon renewables (solar, wind)	☐	☐	☐	☐	☐
... contribute to global climate goals	☐	☐	☐	☐	☐
... reduce air pollution from power plants	☐	☐	☐	☐	☐
... reduce the impact of more EVs on the grid	☐	☐	☐	☐	☐
... this is a data quality check, please select "not at all important"	☐	☐	☐	☐	☐
... reduce the need for expensive large-scale energy storage	☐	☐	☐	☐	☐
... make the electric grid more reliable	☐	☐	☐	☐	☐

Before today, were you knowledgeable on **bidirectional** charging (including V2G, V2H, and V2L)?

No, I had no knowledge on bidirectional charging

Yes, and I am slightly knowledgeable on bidirectional charging

Yes, and I am moderately knowledgeable on bidirectional charging

Yes, and I am very knowledgeable on bidirectional charging

Yes, and I am extremely knowledgeable on bidirectional charging

Bidirectional Charging

Some battery-electric vehicles (BEVs) have outlets to power small power tools or appliances. This is called **vehicle-to-load (V2L)**, which could allow you to **power devices at worksites, campsites, tailgates, or other locations**.

If **V2L was an added feature** on your next vehicle, how **much more money** would you be willing to pay (on top of your car price)?

\$0 to add V2L technology to my next BEV purchase.

Less than \$250 to add V2L technology to my next BEV purchase.

Another \$250 to \$500 to add V2L technology to my next BEV purchase.

Another \$500 to \$750 to add V2L technology to my next BEV purchase.

Another \$750 to \$1,000 to add V2L technology to my next BEV purchase.

Another \$1,000 to \$1,250 to add V2L technology to my next BEV purchase.

More than \$1,250 to add V2L technology to my next BEV purchase.

Other (please specify)

Assume you **primarily drive a battery-electric vehicle (BEV)** with **V2L** technology. **How often do you expect to use this ability?**

I do not expect to rely on V2L

I expect to rely on V2L around 1-2 times a year

I expect to rely on V2L at least 3-4 times a year

I expect to rely on V2L at least once a month

I expect to rely on V2L at least once a week

I expect to rely on V2L more than once a week

Vehicle-to-home (V2H) technology could allow your BEV to **power your home partially or fully during grid blackouts**. If your house has solar panels (PV) and battery storage, your BEV could charge mostly on stored renewable energy.

This technology requires a vehicle with V2G capability, a charger-to-home integration system, and electrical upgrades to your home's circuit breaker to switch power from the grid to your charging equipment. The electrical upgrades can cost anywhere from \$1,000 to \$3,000.

If V2H equipment was available for your next vehicle, how much more money would you be willing to pay (on top of your car price)? This is the amount you would pay the dealership and does not include any electrical upgrade costs.

\$0 to add V2H equipment to my next BEV purchase.

Less than \$1,000 to add V2H equipment to my next BEV purchase.

Another \$1,000 to \$2,000 to add V2H equipment to my next BEV purchase.

Another \$2,000 to \$3,000 to add V2H equipment to my next BEV purchase.

Another \$3,000 to \$4,000 to add V2H equipment to my next BEV purchase.

Another \$4,000 to \$5,000 to add V2H equipment to my next BEV purchase.

More than \$5,000 to add V2H equipment to my next BEV purchase.

Other (please specify)

Assume you primarily drive a battery-electric vehicle (BEV) and have **V2H** charging equipment. **How often do you expect to rely on V2H technology** to manage your home's power or lower your charging bill?

I do not expect to rely on V2H

I expect to rely on V2H around 1-2 times a year

I expect to rely on V2H at least 3-4 times a year

I expect to rely on V2H at least once a month

I expect to rely on V2H at least once a week

I expect to rely on V2H more than once a week

Power companies could use smart charging to interrupt charging when demand for electricity is at or near capacity (to avoid grid blackouts). They could also use bidirectional charging to send power back into the grid (with **vehicle-to-grid, V2G**) during emergencies.

Assume you **primarily drive a battery-electric vehicle (BEV)** and have V2G charging capabilities at home. You allow your power company to **interrupt** or **stagger** your charging (smart charging) and **slightly discharge** your battery during emergencies for a quarterly reward. You are also paid \$0.70 per mile of range reduced to help the grid.

How often do you expect your power company would slightly discharge your BEV's battery to support the electrical grid?

I do not expect my power company would access my BEV's battery

I expect my power company would access my BEV's battery around once a year

I expect my power company would access my BEV's battery at least once every 3 months

I expect my power company would access my BEV's battery at least once a month

I expect my power company would access my BEV's battery at least once a week

I expect my power company would access my BEV's battery more than once a week

Assume that **bidirectional charging degrades your vehicle's battery 1% faster** over the lifespan of the vehicle.

Note: You are **compensated \$0.70 per mile** of range reduced and the power company ("utility") cannot reduce your range more than 50 miles per emergency.

Would you allow your power company to discharge power from your battery during grid emergencies?

I definitely would participate in utility-controlled bidirectional charging.

I probably would participate in utility-controlled bidirectional charging.

I probably would not participate in utility-controlled bidirectional charging.

I definitely would not participate in utility-controlled bidirectional charging.

I am unsure.

How **likely** are you to let your **power company discharge your BEV**, if the following statements are true?

Your power company would notify you via an app notification, text message, email, or phone call (your choice) of a discharge request. You have the **option to opt-out** if the timing is inconvenient for you. The power company advertises that they expect to rely on your BEV **at most 2 times a year**.

	Extremely unlikely	Moderately unlikely	Neither likely/unlikely	Moderately likely	Extremely likely
Your battery warranty covers battery loss from discharging	☐	☐	☐	☐	☐
You are compensated \$ for battery loss	☐	☐	☐	☐	☐
You take responsibility for any battery loss	☐	☐	☐	☐	☐
The power company can drain up to 10% of your battery and must leave you with at least 50% remaining	☐	☐	☐	☐	☐
The power company can drain up to 5% of your battery and must leave you with at least 75% remaining	☐	☐	☐	☐	☐

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