LEBANON ELECTRIC VEHICLES (EV) REGULATIONS TASK FORCE
WEDNESDAY, OCTOBER 29, 2025 - 5:00 PM
COUNCIL CHAMBERS, CITY HALL OR REMOTE VIA VIRTUAL PLATFORM
LEBANONNH.GOV/LIVE

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1. Call to Order

A. To participate in this meeting, please join live via Microsoft Teams or call 929-229-5356 (access code: 149 923 620#). If you have trouble accessing this meeting, please email Nate Reichert.

2. Meeting Schedule

A. Set next meeting date: Monday, November 10th from 5:00 PM - 6:15 PM or Monday, November 17th from 5:00 - whenever (room is open)

3. New Business

A. Discuss Fire, Building and Electrical Code requirements:

- Chief Wheatley, Chief Building Offical Hays, Fire Plans Reviewer Duane Egner

4. Old Business

A. Discussion: Electric Vehicles Site Plan and Zoning Ordinance Regulations with possible action

5. Approval of Minutes

A. None

6. Adjournment

The order of agenda items is subject to change.

Meetings are open for in-person and remote attendance. Members of the public who wish to attend remotely may do so by going to LebanonNH.gov/Live where you will find instructions on how to enter the meeting. Members of the public will be able to participate and ask questions through the City's virtual platform or by phone. Please note: Should technical difficulties occur during the meeting that disrupt virtual or phone connection(s), the meeting will continue without remote access capabilities.
Any person with a disability who wishes to attend this public meeting and needs additional accommodation, please contact the ADA coordinator at City Hall by calling 603-448-4220 at least 72 hours in advance so that the City can make any necessary arrangements.

LEAC proposed Zoning amendments 2025

A presentation to the EV Subcommittee on Zoning Ordinance amendments

Sherry Boschert
Lebanon Energy Advisory Committee (LEAC) member
Chair, LEAC EV Subcommittee
sherry.boschert@gmail.com
October 22, 2025

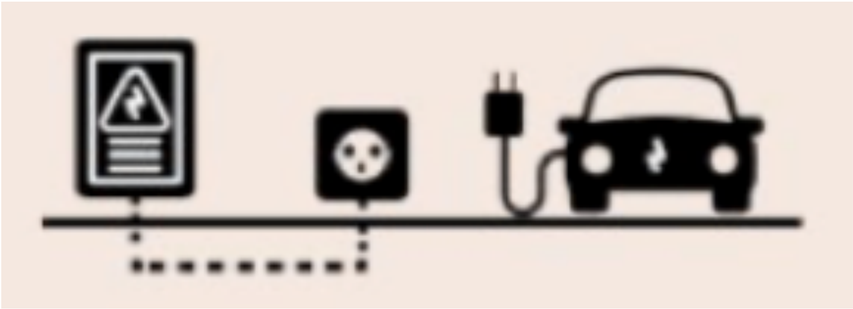
Lebanon Energy Advisory Committee's EV Subcommittee

Membership includes:

- *Five members with a collective 28 years of experience driving EVs*
- Clifton Below, former city councilman, mayor, state representative, prime author of the NH Community Power Law, co-author of the nation's first Electric Utility Restructuring Act
- Sherry Boschert, former journalist and author of *Plug-in Hybrids: The Cars That Will Recharge America* (2006), co-founder of the national non-profit group Plug In America
- Bill Stearns, Tom Benzel, and LEAC Chair Henry Bromberg

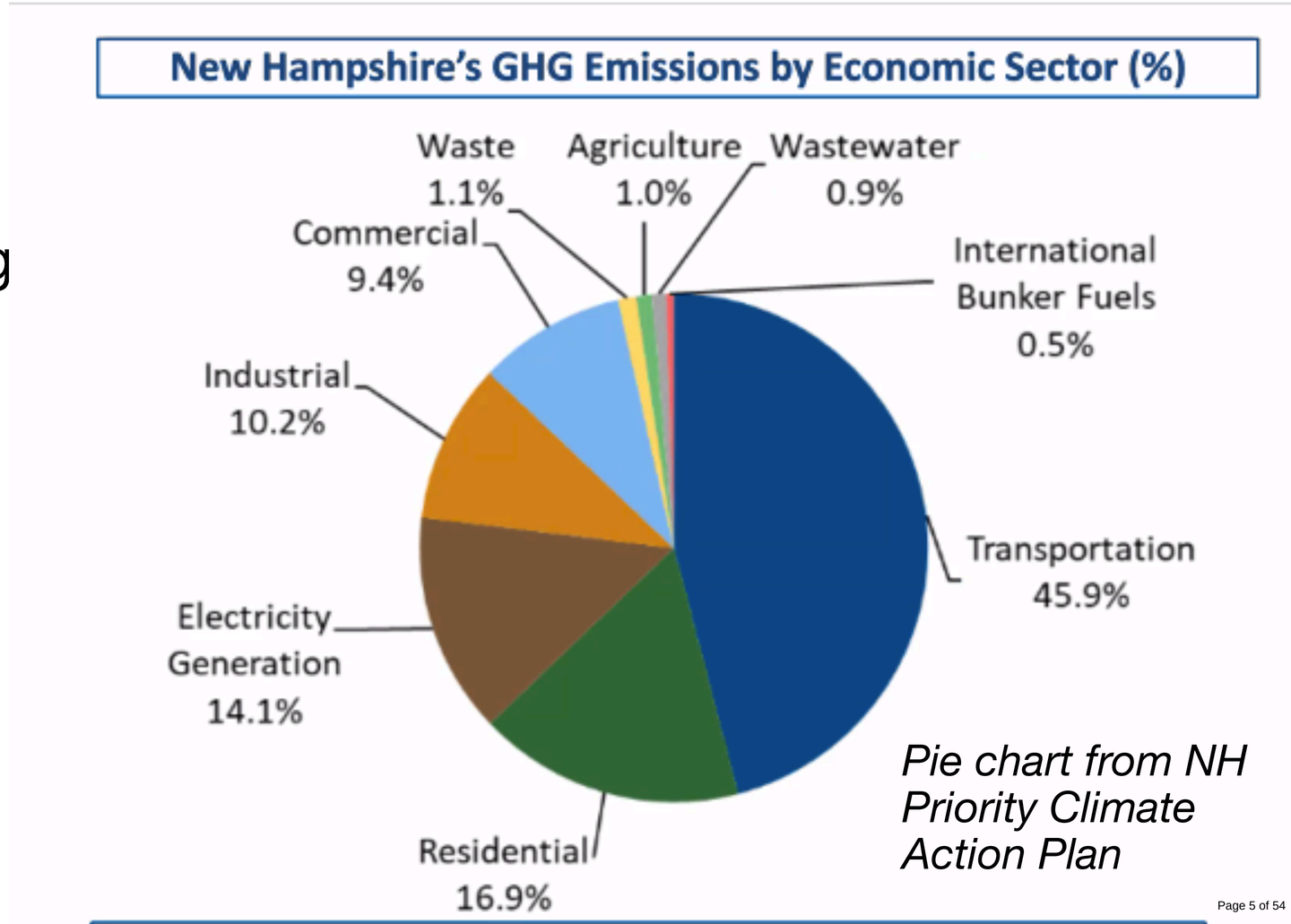
Topics to be covered (in 20 minutes or less!)

- **The Why** - Rationale for Lebanon's EV charging regulations & history
- **Issue #1** - Should these regulations be in the Zoning Ordinance or the Site Plan Review process?
- **Issue #2** - The regulations themselves & proposed amendments
- **Summary & Resources**



Background: Why did the City adopt the *2023* Zoning Ordinance regulations for EVSE?

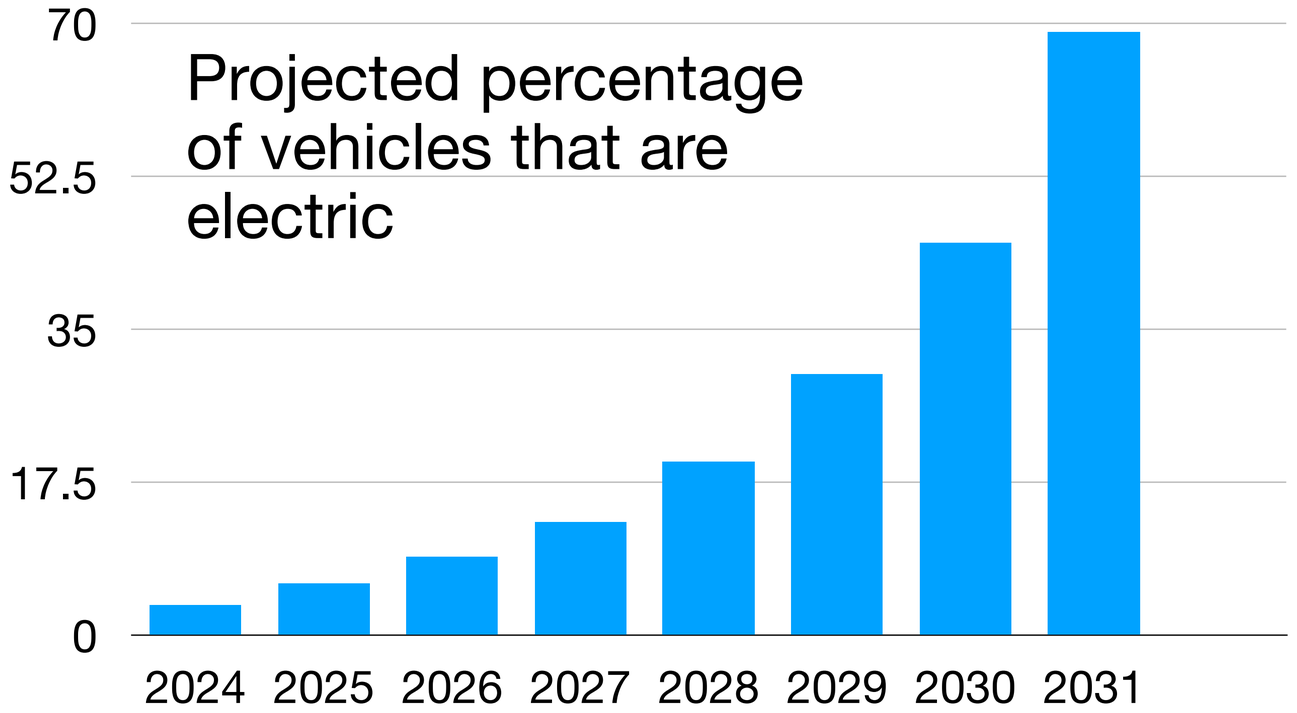
- Lebanon's goal to reduce greenhouse gas emissions
- Installing EV infrastructure during construction is 3-18 times less expensive than retrofits later
- New-car sales that are EVs: US >10%, CA >25%, China > 50%, Norway > 90%



Pie chart from NH Priority Climate Action Plan

EV growth in Lebanon: Data from City Clerk's office

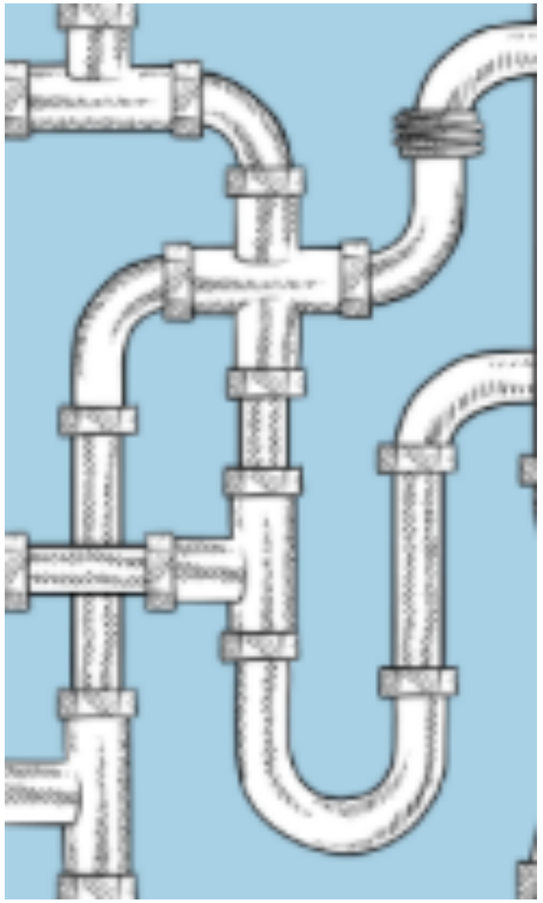
- 2023, 58 (2.3%) of 2,513 vehicle registrations were plug-ins (EVs + PHEVs)
- 2024, 95 (3.5%) of 2,692 vehicle registrations were plug-ins = 58% growth
- October 22, 2025, 159 full EVs = at least 50% growth
- If total vehicles number stayed same and EV adoption rate remained 50%, we could expect:
  - 2025: 159 (6%)
  - 2026: 238 (9%)
  - 2027: 357 (13%)
  - 2028: 536 (20%)
  - 2029: 804 (30%)
  - 2030: 1,206 (45%)
  - 2031: 1,809 (69%)



EV charging at home is like plumbing!

Now a necessity, not a luxury

- In 1920, only 2% of U.S. households had indoor plumbing and electricity.
- Then studies showed that indoor plumbing is important for public health.
- Regulations were adopted, and before long all new housing had indoor plumbing.
- Studies show we need to get off of fossil fuels a.s.a.p. to slow climate change; regulations providing EV charging at home are essential to that



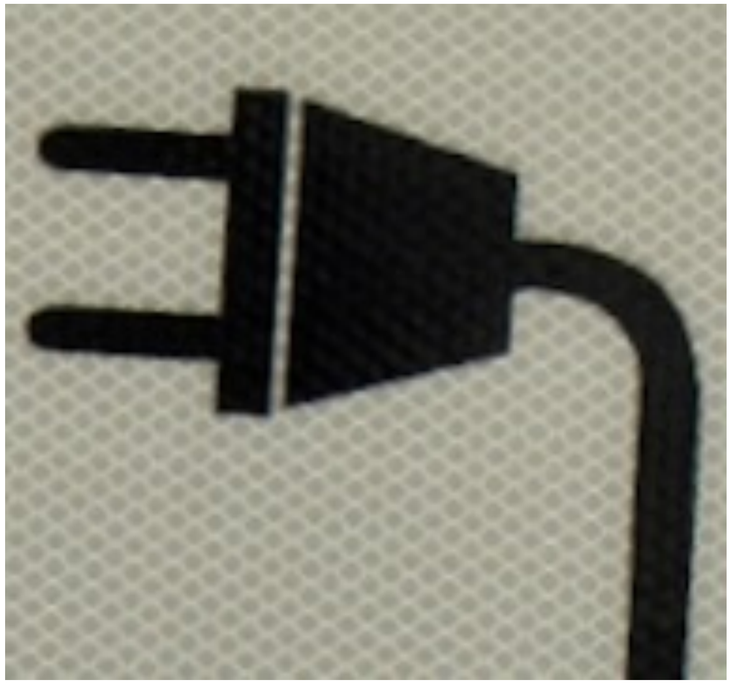
Issue #1: Leave the EV charging regulations in Zoning Ordinance or move to Site Plan Review process?

- Developer Jon Livadas submitted a petition to delete the EV charging requirements from the Zoning Ordinance and add an unspecified “simpler requirement” to Site Plan Regulations, which would be open to exceptions by Planning Board
- History: When the existing regulations were drafted, the Planning Board was hostile to EVs, so the regulations went into Zoning Ordinance instead of Site Plan Review
- Current Planning Board members seem more open to EVs, but what about when its composition changes again?
- Elsewhere in the U.S., EV provisions are housed predominantly in Building Codes or Zoning Ordinances, less so in Site Plan Regulations
- LEAC recommends keeping the regulations in Zoning Ordinance; see attachment in your Agenda Packet

Issue #2: LEAC's proposed amendments to Zoning Ordinance's EV charging regulations

LEAC's proposal will:

- Lower costs for housing developers
- Reduce demand on the grid
- Give more drivers EV charging access at home
- Reduce greenhouse gas emissions
- Simplify the Zoning Ordinance for EV charging

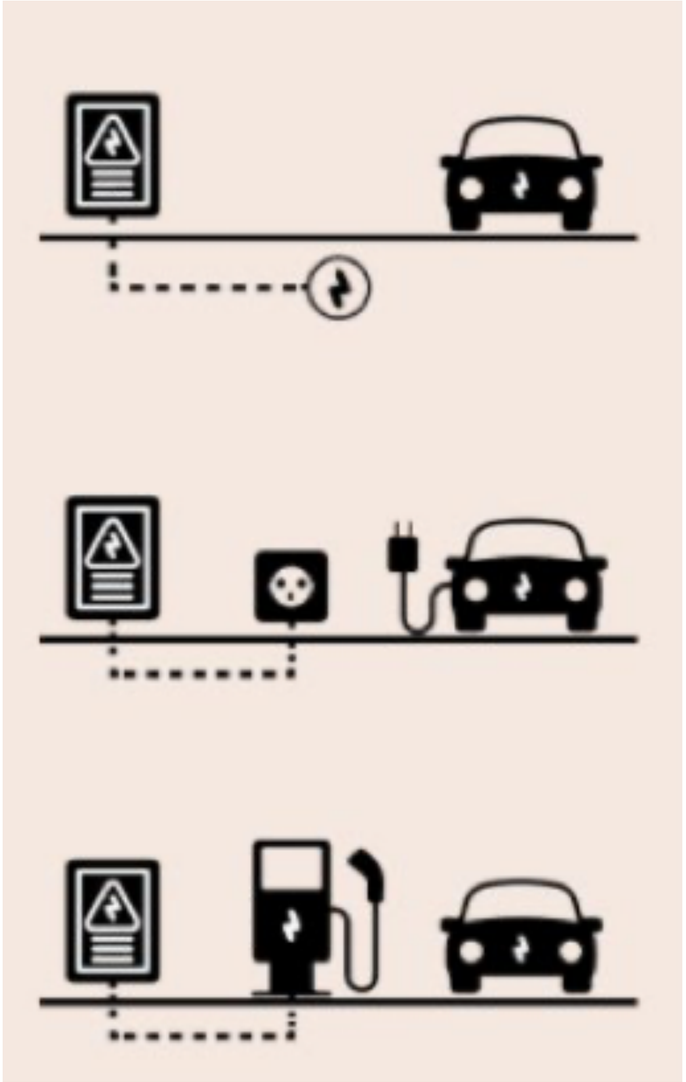


Background: EV Charging Station (EVCS) power levels

- **Level 1**: 20-amp breaker, 120-volt AC circuit; draws 1.9-3.2 kW for 2-5 miles of range/hour
- **Low-power Level 2:** 20-amp breaker, 240-volt AC circuit; draws 3.3-6.1 kW for 10-15 miles of range/hour
- **Level 2:** 40-amp breaker, 240-volt AC circuit; draws 6.2+ kW for 19+ miles of range/hour
- **Level 3:** Also called “fast charging,” primarily at public charging stations

Background: EVCS infrastructure levels

- **EV Capable:** Electrical panel capacity, space for a branch circuit, raceways for future EV Ready or EVCS. (Beware attempts to change this definition!)
- **EV Ready:** Panel capacity, dedicated branch circuit with conduit, wiring, etc. that terminates in an outlet
- **EV Installed**: Panel capacity, dedicated branch circuit, conduit, wiring, etc. terminating in an EVCS port

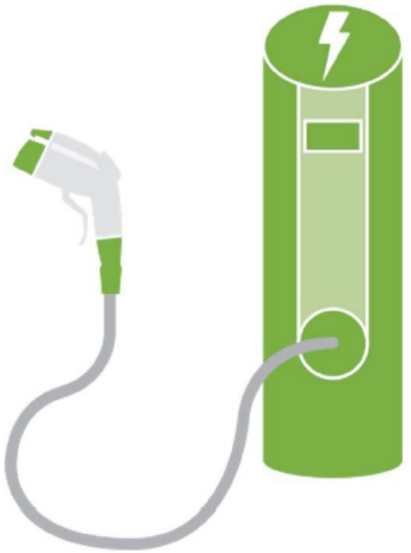


Summary: Power Levels + Infrastructure Levels

Pick the Power (left column) and Infrastructure (right column)

- Level 1
- Low-power Level 2
- Level 2
- Level 3

- EV Capable
- EV Ready
- EV Installed



Proposed changes to Lebanon Zoning Ordinance

Section 607.8 Electric Vehicles, and Appendix A - Definitions

- *Existing regulations adopted January 2023 for new multi-unit housing (MUH):*
  - 5% of off-street parking must be **L2** EV Installed
  - 20% **L2** EV Ready
  - 60% **L2** EV Capable
- *Key amendments proposed by the Lebanon Energy Advisory Committee (LEAC):*
  - For each new residential unit with parking, one **LPL2** EV Ready space per unit for 50% of the units with parking
  - **LPL2** EV Capable spaces for each of the other 50% of units with parking and 25% of remaining off-street parking spaces

Why Low-power Level 2 (LPL2)? *Energy*

Example: Woolen Mill — 155 units, 239 parking spaces

- Current Lebanon Zoning regulations
  - 5% Installed L2 = 12 parking spaces @ 40 amps each = 480 amps
  - Of the remaining spaces, 20% L2 Ready = 45 spaces = 1,800 amps
  - Of the remaining, 50% L2 Capable = 91 spaces = 3,640 amps
  - **TOTAL** 5,920 amps for 148 spaces; *5% of units with no EV charging*
- LEAC's proposed amendments
  - 50% of units LPL2 Ready = 78 spaces + LPL2 Capable for 50% of units + 25% of remaining 84 spaces = 90 spaces. **TOTAL** 3,360 amps for 168 spaces @ 20 amps each; **potentially less using load management (see blue edits in agenda packet)**. 100% of units have EV charging capability

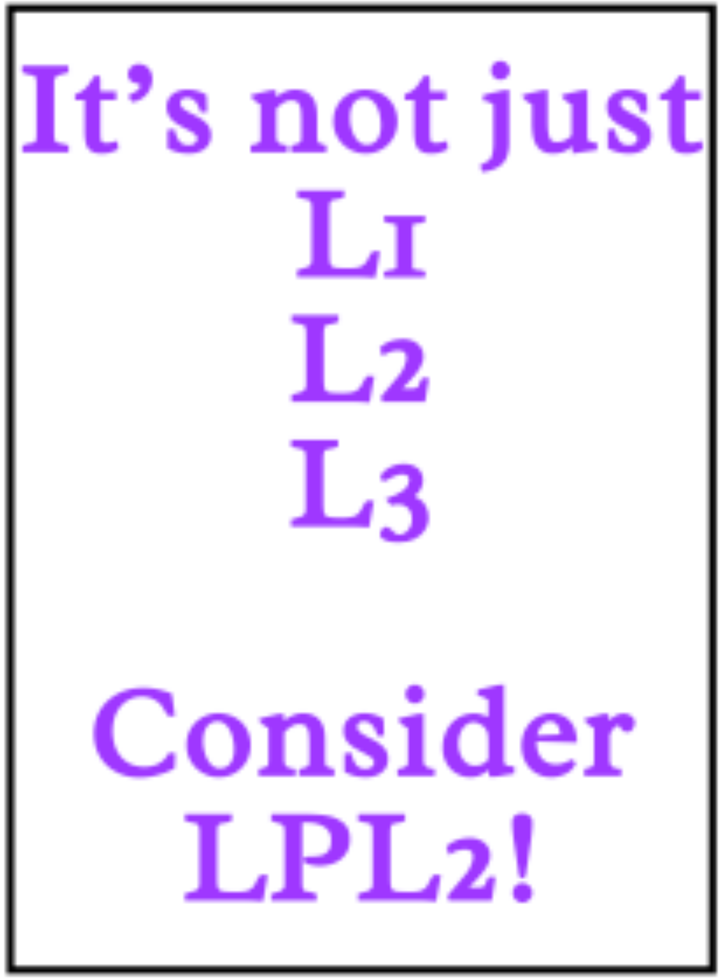
Why Low-power Level 2 (LPL2)? *Costs* ↓

- Adding LPL2 EV Ready to new multifamily housing adds only 0.3%-0.5% to construction costs
- Besides the lower costs for reduced electrical supply, EV Ready avoids the more expensive EV Installed
- Example: 10-year up-front + ongoing costs for 26 chargers at San Mateo, Calif. multi-unit housing:
    - Networked L2 EV Installed = $244,000-$260,000
    - LPL2 EV Ready smart outlets = $47,320
    - Years to break even through charging revenue = 18-20 years vs. 3 years (as modeled by orangecharger.com)

Goal: Sufficient charging at lowest cost

- LPL2 would meet the charging needs of 100% of Upper Valley commuters, according to data from 2021 survey of 532 residents by Vital Communities

- LPL2 would meet the charging needs of 94% of commuters in the Lebanon Micro New England City and Town Area
  (covering Lebanon, Piermont, Orford, Lyme, Dorchester, Hanover, Canaan, Orange, Enfield, Grafton, Plainfield, Grantham, Cornish, Croydon)
  Based on 2010 data in study by Meghan Butts, “EV Implementation in Rural New Hampshire”



Outside assessment of “The Case for LPL2”

This is a great initiative… I will say that the main takeaways of your document are correct: It’s low cost to make parking spaces capable of LPL2 charging when done at the outset, and can adequately serve many more drivers than would be served by the same electrical service size at full L2 charging rates.

—Jack Greene (former Project Engineer, Norwich EV)

- See Boschert’s report: “The Case for Low-power Level 2,” https://docs.google.com/document/d/1Kfth10VRxVSZ1ZlhFABwvUNJjDly-29t/edit?usp=share_link&ouid=114368692623349234926&rtpof=true&sd=true

Precedent for LPL2 regulations

- The California Green Building Standards Code (CALGreen) as of January 1, 2026 will require at least a LPL2 EV-Ready or EV-Installed parking space for any new unit with a parking space at multi-unit housing
- The LPL2 spaces are allowed to share power between them as long as the system can provide a minimum of 3.3 kW simultaneously for each unit
- New hotels or commercial, office, or retail developments must have at least LPL2 EV Ready or Installed for 65% of parking at hotels/motels or 20% of spaces at commercial, office, or retail lots
- San Jose, Calif. changed from requiring L2 EV charging at 30% of multi-unit housing parking to require LPL2 EV Ready for 100% of units with parking

Implementing the Zoning requirements

Configurations - developers decide

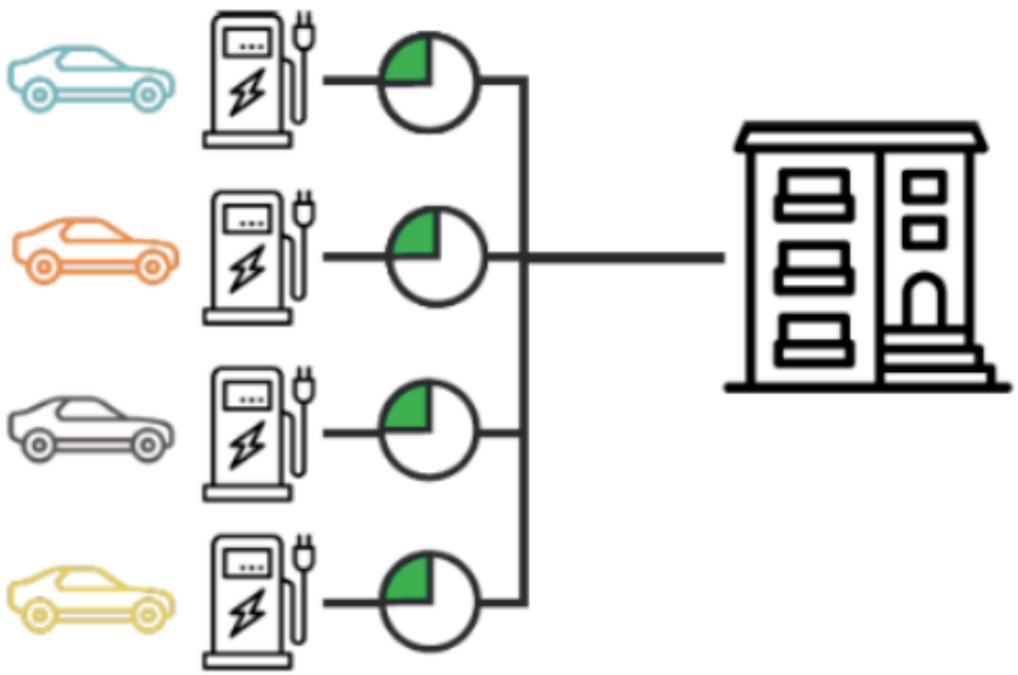
- LPL2 or full L2
- EV Ready or EV Installed
- Regular or smart outlets
- Assigned or unassigned parking
- Load management or not
- Can offer >1 power level
- Options for covering user costs

Low-Current L2

Smart Outlets

Optional: Load Management

- Load management = A system that balances power so total energy draw doesn't exceed capacity. May avoid electrical capacity upgrades.
- Unmanaged: Two LPL2s need 40 amps capacity, each deliver 3.3-6.1 kW
- Managed: Two L2s with total 40-amp capacity: One EV gets 7.7 kW or two EVs charging at same time get 3.8 kW each (meets LPL2 threshold)



See blue edits in your Agenda Packet.

Options for assigning electrical costs

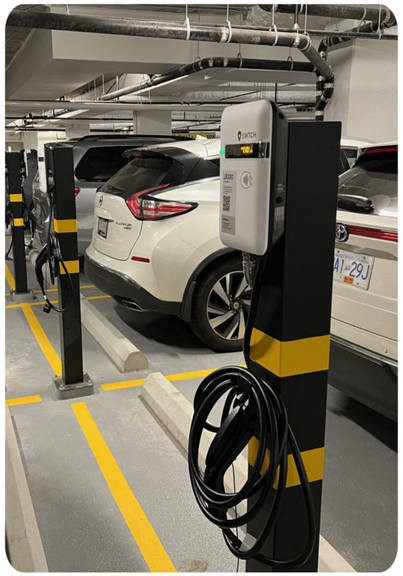
In ascending order of expense & complexity

- Plain LPL2 outlets. Roll average costs into rent/fees
- Assigned parking spaces with EVSE connected to each unit’s electrical panel
- Smart outlets at parking spaces, billed to user by app (2022: $1,000 installation, $200/year management fee, allows revenue stream)
- Networked chargers, billed to users (2022: $7,000 installation, $390-$450/year management fee, allows revenue stream)

Thoughts on competing proposals

Questions to ask:

- Have they changed the definitions of EV Installed, EV Ready, EV Capable?
- Are they comparing theirs to LEAC's proposal, or to existing regulations?
- Do they recognize the "chicken-and-egg" problem (people don't get EVs if they can't charge at home), which skews claims of "no demand?"
- Put claims of costs for EV charging infrastructure in context: What is the total cost of the development? Data suggest adding LPL2 = 0.3%-0.5% of total.
- Recognize that EV Capable is not EV charging. Add triggers for converting EV Capable to EV Ready? (See blue edits in your Agenda Packet.)



Debunking some distractions

- Safety from vehicle fires is not a limiting factor. See https://pluginamerica.org/the-facts-about-ev-fire-safety/

- “Technology is changing rapidly:” The prime fueling paradigm remains the same — charging stations. At-home, low-and-slow charging is safest, cheapest, and most convenient. Battery swapping stations or competition from hydrogen fuel-cell vehicles are hype.

LEAC requests your support

Recommend LEAC's proposed amendments to the EV Charging requirements in the Zoning Ordinance, and keep them in the Zoning Ordinance

Now is the time: EV charging for ALL

Reduce developers' costs and lower demand on the electrical grid while maintaining access to EV charging and reducing the risks of climate change

Sources & Resources

- Webinar for developers on “Low-power Level 2 EV Charging,” June 28, 2025 by Sherry Boschert: https://youtu.be/6yW06za-ui8
- Report: “The Case for Low-power Level 2,” https://docs.google.com/document/d/1Kfth10VRxVSZ1ZlhFABwvUNJjDly-29t/edit?usp=share_link&ouid=114368692623349234926&rtpof=true&sd=true
- Plug In America / Affordable and Convenient Access to EV Charging report - https://pluginamerica.org/policy/charging-solutions-for-multifamily-housing/
- Safety: https://pluginamerica.org/the-facts-about-ev-fire-safety/

Additional information requested by the EV Task Force at its Oct. 22, 2025 meeting
Compiled by Sherry Boschert, Lebanon Energy Advisory Committee

Please note: See the full eight-page white paper, "The Case for Low-power Level 2" for more details and examples. The paper is attached after the following comments.

More details and examples of reducing costs by using Low-power Level 2 vs. full Level 2 and/or installing EV charging during initial construction vs. later retrofits

1) I am still seeking examples of Low-power Level 2 (LPL2) use on the East Coast. On the West Coast it is becoming almost the standard for multi-unit housing. The company Orange Charger, Inc. (Orangecharger.com) said it contracted to install its LPL2 smart outlets during construction of 20- to 50-unit multi-unit housing developments in Denver, Colo, Florida, and Texas, but I have not received data on those.
2) The experience and estimates of Orange Charger (one of the companies specializing in LPL2 smart outlets) suggest that adding LPL2 EV-Ready for every unit with parking at new multi-unit developments adds 0.3%-0.5% to construction costs. Orange estimates that the costs of installing and operating two LPL2 EV-Ready outlets would be 69% less than the costs for a two-port L2 EV Installed charger -- $2,750 vs. $8,750:

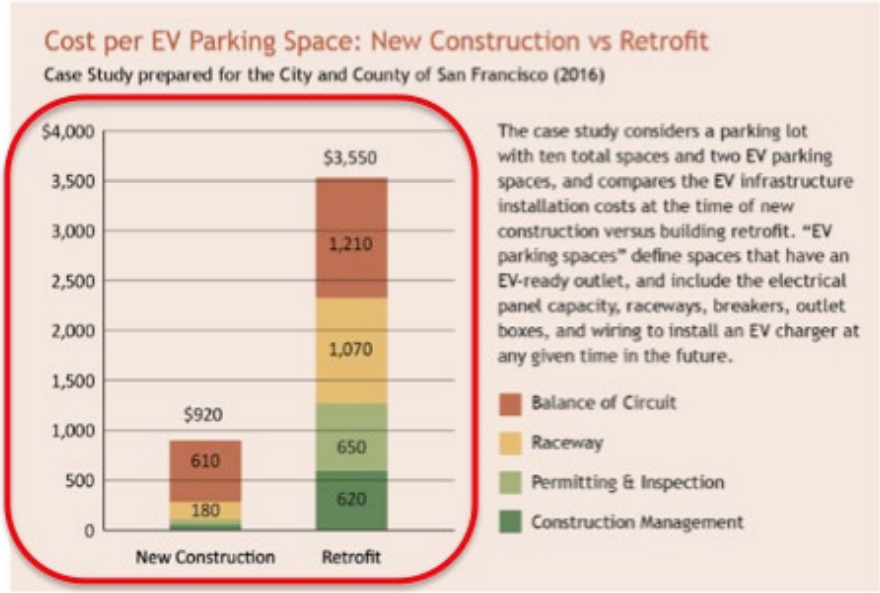
	Traditional networked charger	Orange Outlets
Hardware Cost per unit	$2,000+	$750
Wifi and Added Network Gear	$2000+	None
Setup fees	$500	None
Electrical permits & licenses	$500+	$500+
Installation	$3,000+	$1,500+
Annual Services Fees	$300	None
Ongoing service fee	10% of revenue share	kWh based usage fee
Approx. yearly OPEX	$450	None
Total installed cost	$8,750	$2,750 Over 69% of savings

3) In 2023 a group of California State legislators compared two scenarios using low- and high-cost estimates for two different charging strategies. ***Strategy A:*** Provide one LPL2 EV-Ready space for all units with parking at multi-unit housing plus L2 EV Installed at 10% of open/guest/shared parking spaces. ***Strategy B:*** Provide L2

Installed charging stations at 10% of total parking spaces and LPL2 EV Ready charging at 40% of total spaces.

The associated costs ranged from $789-$1,485 for each LPL2 EV Ready space and $2,596-$3,883 each for L2 Installed. *Result:* Strategy A was 9%-36% less expensive depending on the number of parking spaces and units. Source: Letter from 11 California State legislators to California Building Standards Commission Community Development Staff, May 15, 2023 regarding "Electric Vehicle Charging Clarification in the CALGreen Intervening Code Cycle. Sherry can share the letter upon request.

4) The director of Energy Programs for Peninsula Clean Energy reported that installing LPL2 or L1 charging can be seven-fold less expensive than installing L2 charging. The marginal cost during construction for new buildings to install LPL2 charging (compared with no charging) is approximately 0.3% of total costs. "Scaling EV Charging Program Impacts," presentation by Phillip Kobernick, Peninsula Clean Energy, at the 2024 National Community Choice Aggregation Conference. Slides available upon request.
5) In 2021 consultant Sven Thesen & Associates compared two proposed EV infrastructure codes for multi-unit housing: one requiring LPL2 for each unit with parking and the other requiring L2 charging at 40%-73% of unit spaces (5% L2 EV Installed, 25% LPL2 EV Ready, and 10% L2 EV Capable). For 150,000 new multi-unit housing dwellings, the LPL2-only strategy would provide greater societal benefits in seven of eight measures. Initial costs would be $28 million higher but would reduce other costs by $1.4 billion and avoid 2.9 million extra tons of carbon dioxide emissions. Source: "A Comparison of Two Multi-Family Dwelling EV Charging Codes https://tinyurl.com/mu3zvk9n," Sven Thesen & Associates, 2021.
6) Installing LPL2 smart outlets to serve 128 parking spaces at 112 condos on two sites at Stanford (Calif.) University cost $1,776 per EV-enabled spot, according to a case study.
7) A 2022 case study by Orange Charger, Inc. at 14 apartments with 26 parking stations found that installing six Orange smart outlets reduced costs by $18,506 compared with expected expenses from installing two L2 chargers (projects costs of $9,894 vs. $28,400). Sherry can share document upon request.
8) Installing full Level 2 in a parking garage is 3.8 times more expensive as a retrofit compared with new construction, a 2018 case study suggests (source: DriveElectric.gov slide taken from Southwest Energy Efficiency Project, 2018, "Cracking the Code on EV Ready Building Codes" – see slide, next page)



Data on EV adoption rates from various communities

Local communities:

Lebanon, NH: 159 EVs on Oct. 22, 2025 (67% annual growth); 95 in 2024 (64% annual growth and 3.5% of all registered vehicles); 58 in 2023 (2.3% of all registered vehicles, increased from 0.5% of vehicles in 2020), per City Clerk's office

Hanover, NH: 232 in 2022, up from 120 in 2020 (93% growth in 2 years), per Sustainable Hanover

Hartford, VT: 278 in 2024, up from 194 in 2023 (43% annual growth) and 139 in 2022 (40% growth 2022-2023), per Two Rivers-Ottauquechee Regional Planning Commission

Norwich, VT: 353 in 2024, up from 285 in 2023 (24% annual growth) and 204 in 2022 (40% growth 2022-2023), per Two Rivers-Ottauquechee Regional Commission

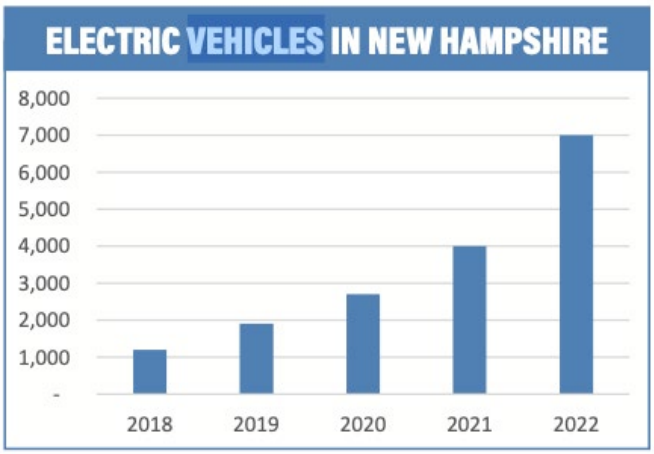
Other communities:

Portland, OR: Unavailable, but for Multnomah County as a whole, 33,077 ZEVs

Portsmouth, NH: Unavailable

States:

New Hampshire State: 9,861 EVs alone in December 2024 (not including PHEVs); up from 4,835 in 2020 (a 104% growth rate 2020-2024), per U.S. Dept. of Energy and NH Department of Environmental Services. August 2023: more than 8,000 EVs and 2,600 PHEVs, per WMUR-TV.



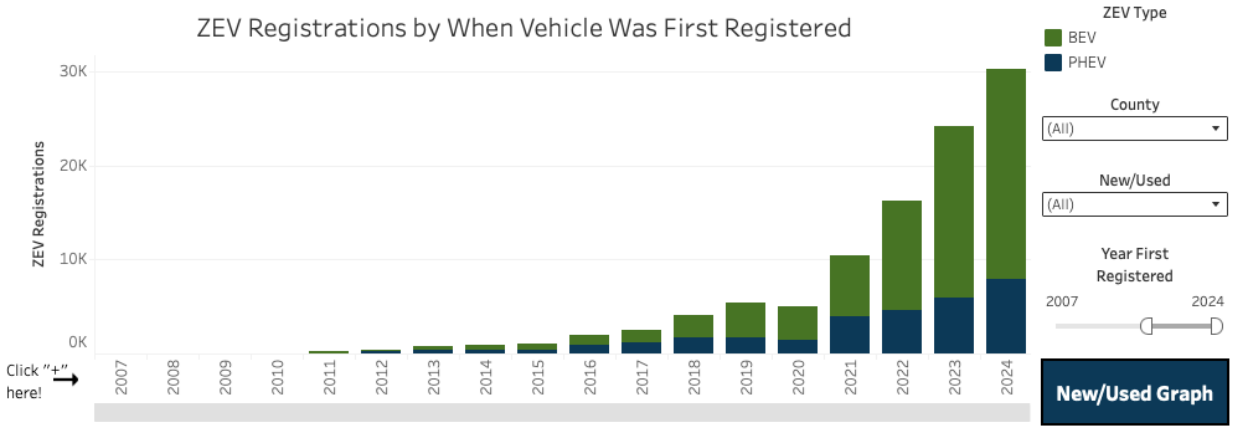
Source: US Department of Energy, Alternative Fuels Data Center

Colorado State: 90,083 EVs in Sept. 2024 per U.S. Dept. of Energy; 27% of new car sales as of Oct. 22, 2025, and from July 1 to Sept. 30, EVs were 32% of new car sales in Colorado, according to the Colorado Energy Office.

State of Maine: 7,377 EVs in Sept. 2024 per U.S. Dept. of Energy

Vermont State: 1,810 ZEVs in 2024; up from 1,313 in 2023 (38% annual growth) and 937 in 2022 (40% growth 2022-2023), per Two Rivers-Ottauquechee Regional Commission

State of Oregon: 123,664 registered, including 87,698 EVs and 35,966 PHEVs, per Oregon Electric Vehicle Dashboard:



Additional comments from Sherry in response to discussion at the Oct. 22 meeting

1) *I corrected a math error in my previous presentation in the following slide:*

2) *In response to Don Collins' question about whether the electrical grid can accommodate EV charging in general:* All EVs have timers that drivers can set to charge when it's cheapest or most convenient. When drivers are able to charge their EVs at home, where it is plugged in all night, nearly all charging happens in the late-night and early morning hours when there is excess capacity in the grid and rates are lowest. If the utility changes the rate structure to incentivize charging at a different time for any reason, drivers will follow the price signals and adjust charge times.

   In addition, utilities are adding power sources, and innovative ideas are being considered to help the grid handle our increasingly electrified society. One example is this report by the nonprofit organization Rewiring America, which suggests that having energy-hungry data centers contribute funds for energy efficiency work on homes and businesses can meet 100% of data center demand growth.
3) *In response to comments by Jon Livadas' friend in San Francisco:*
   a. He said he charges his EV almost exclusively at public chargers instead of at home, by choice. Lucky him – he must be affluent enough to afford it. The public Electrify America fast chargers in West Lebanon charge $0.48/kWh. The public Rivian fast chargers in West Lebanon charge $0.60/kWh. In comparison, charging at home on residential rates costs as little as $0.13/kWh with Lebanon Community Power.
   b. The image that he showed of public charging stations in Lebanon makes it look (to the untrained eye) as if there are lots of public chargers here. The only truly fast chargers here are a multi-port charging station exclusively for Teslas and two multi-port stations for non-Teslas, all in West Lebanon. These are expensive for users and would require many residents to drive 8-12 miles round trip to use them. There are a few, much slower Level 3 chargers in central Lebanon but they are at car dealerships with no other amenities nearby. The time needed to charge at those slower stations dissuades EV drivers from using them. The rest of the few public EV charging stations in

Lebanon are Level 2, which can take hours to fully charge an EV, or Level 1, which can take days. Most of these are located at workplaces, condos, or a hotel, where it makes sense for their residents or workers but not so much for others.

Lebanon's Zoning Regulations on EV Charging:
The Case for Low-power Level 2 (LPL2)
January 2, 2025; updated October 26, 2025
By Sherry Boschert, chair, EV Subcommittee, Lebanon Energy Advisory Committee

The Lebanon Energy Advisory Committee's Electric Vehicle (EV) subcommittee has proposed modifying Lebanon's Zoning regulations regarding EV charging in order to "right-size" the requirements by including the option of Low-power Level 2 (LPL2) charging. This should save money for developers, drivers, and our community as a whole while reducing stress on the electrical grid and lowering greenhouse gas emissions compared with the current Zoning regulations.

In response to the Planning Department's request for examples of LPL2 use and associated costs, below is an examination of experiences with LPL2 charging, in sections:

1. Summary
2. Driver habits
3. Energy
4. Costs and emissions
5. Existing and proposed regulations
6. Sources

Key terms and acronyms:

L2 = Level 2 EV charging (on a dedicated 40- to 100-amp breaker and 208/240-volt circuit drawing 6.2+ kW to supply 19+ miles of range per hour of charging).
LPL2 = Low-power Level 2 EV charging (on a 20-amp breaker and 208/240-volt circuit drawing 3.3-6.1 kW to supply approximately 10-15+ miles of range per hour of charging).
EV Installed = Everything needed for EV charging is installed for the parking space including an EV charging station (EVCS) and port that plugs into the car.
EV Ready = Everything needed for EV charging is installed for the parking space minus the charging station/port, but with an electrical outlet that drivers can plug into using their own charge cords.

EVCS Capable = Most components needed for EV charging at the parking space are installed (electrical panel capacity, space for a dedicated branch circuit, and mounted raceways) to enable easy future conversion to EV Ready or EV Installed.

1. Summary

I am still seeking examples of LPL2 use on the East Coast. On the West Coast, it is becoming almost the standard for multi-unit housing. For example, in the State of California (the nation's largest vehicle market), changes to the California Green Building Standards Code (CALGreen) go into effect at the start of 2026 that require at least one LPL2 EV-Ready charging space for every unit with parking at new multi-unit housing. If there are more parking spaces than units, 25% of the additional spaces also must have LPL2 EV-Ready charging.

Reports and experiences from West Coast sources show that making LPL2 charging available to all units with parking at new multi-unit housing developments would result in greater economic and environmental benefits for residents and communities as a whole at a cost to developers that is less than or comparable installing a smaller proportion of L2 EV charging stations. Residential LPL2 also reduces stress on the electrical grid and fewer greenhouse gas emissions compared with installing smaller numbers of L2 stations.

2. Driver habits

EVs in the United States grew to approximately 4.09 million in 2024, up from 3.3 million in 2023, 2 million in 2022, and 1.3 million in 2021. Projections suggest that half or more of new vehicles sold by 2035 will be EVs.

In Lebanon, there were 159 registered EVs by October 22, 2025 compared with 95 EVs and plug-in hybrid vehicles (PHEVs) in December 2024 – an increase of 50% or more year over year. The previous year, there was a 64% increase from 2023 (58 EVs and PHEVs) to 2024 (95), according to the City Clerk's office. Plug-in vehicles made up 3.5% of vehicles in Lebanon in 2024, up from 0.5% in 2020.

A recent J.D. Power report showed that 83% of EV owners prefer to charge at home. Most of the 31% of Americans who live in multi-unit housing lack residential charging options. In the past two years the percentage of renters interested in or relying on EV charging jumped from 27% to 34%, according to the National Multifamily Housing Council and Grace Hill 2024 Renter Preferences Survey.

Except on long-distance road trips, EV drivers "top off" when charging rather than "filling up" like gas-car drivers do when refueling. The most logical, safe, and convenient place to charge an EV is at home, where vehicles tend to sit for 8-12 hours of each day. Residential EV charging allows drivers to plug into lower-power electrical sockets that still meet most commuters' needs while utilizing least-cost residential electrical rates.

LPL2 EV charging could meet the daily charging needs of 94% of commuters residing in the Lebanon Micro New England City and Town Area, according to my analysis of a study by Meghan Butts of the Upper Valley Lake Sunapee Regional Planning Commission. The remaining 6% of commuters might seek additional charging on the other end of their commute or would occasionally utilize public L2 or fast EV chargers.

LPL2 charging for each unit at multi-unit housing provides the same convenience enjoyed by residents of single family homes – the ability to leave a vehicle overnight without having to move it from a shared charger, and knowing they'll wake up to a charged car.

3. Energy

Orange, Inc. (one of the companies specializing in LPL2 and L1 charging) reported in a 2023 paper that usage data from its charging outlets showed that drivers needed an average of 16.8 kWh of electricity per day. That need may be slightly higher in New Hampshire conditions than in California but is easily met overnight with 4-6 hours of LPL2 charging, which delivers 3.3-6.1 kW. Requiring L2 stations that deliver 6.2+ kW for each unit at multi-unit housing is overkill; residential LPL2 is right-sizing charging at less cost and greater convenience.

Using those numbers and California grid data from 2022, Orange also forecast potential impacts on the U.S. electrical grid. If 25% of an expected 10 million EV drivers in 2035 live in apartments with LPL2 charging and charge between 9 p.m. and 9 a.m. daily, those 2.5 million cars would need 9.5 GWh of energy per hour. Without LPL2 charging at home, though, if those drivers use public fast-charging stations two or three times per week before or after work, they would require 312,500 GW of peak load (if all plugged in at once), which is many multiples of current grid capacity.

Several scenarios below estimate what the energy capacity would need to be under Lebanon's current or proposed Zoning regulations for EV charging at multi-unit housing.

A. If current Zoning requires one off-street parking space per studio apartment and 5% of those spaces must be L2 Installed, that's 20 EVSE Installed spaces for a development with **100 studio apartments**. Two adjacent spaces are allowed to share one charger circuit, so at least (10) 40-amp circuits would be needed, or 400 amps. And 20% of the remaining 80 spaces must be EV-Ready; that's 16 more spaces requiring at least 8 shared 40-amp circuits, or 320 amps. And 50% of the remaining 64 spaces must be L2 EV-Capable; that's 32 more spaces needing at least (16) 40-amp circuits, or 1,280 amps. The total comes to **2,000 amps for those 70 spaces with EV charging access now or in the future, and 30 parking spaces (30%) would get no EV charging at all.**

B. Currently, apartments with **one or more bedrooms** may require up to 1.5 parking spaces per unit, which is 50% more than for studios. The electrical capacity needed for L2 EV charging for 70 of **100 units** either now or in the future would be **3,000 amps and, still, 30% of spaces would get no EV charging** now or in the future.

C. **Under the proposed Zoning amendments**, LPL2 could meet residents' daily charging needs using much less energy. For **100 studio apartments** with 100 EV-Ready LPL2 parking spaces, two adjacent spaces are allowed to share one charger circuit, so at least (50) 20-amp circuits would be needed, or **1,000 amps**, **and all 100 units would have EV charging.**

D. Under the proposed Zoning amendments, for **100 units with one or more bedrooms**, **each unit gets an EV-Ready LPL2** charging space and two adjacent spaces can share one charge circuit, requiring 1,000 amps. **And 25% of the remaining 50 spaces would be EV-Capable LPL2** -- so, 13 spaces, with two adjacent spaces allowed to share one charger circuit, requiring at least (7) 20-amp circuits or 140 amps. That totals **1,140 amps and all 100 units would have EV charging.**

Note: Other EV charging infrastructure options may reduce the energy load further. For example, the addition of "load management" or a "load balancer" to LPL2 stations at multi-unit housing might serve four to six times more charge ports compared with unmanaged L2 stations and use half the electrical capacity.

4. Costs

Although the cost of installing EV charging necessarily is site-specific, LPL2 EV Ready requires less electrical infrastructure compared with L2 Installed. LPL2 also lowers costs for installation and maintenance of EV charging stations by using less expensive charging outlets instead of full charging stations. The money saved by not requiring L2 Installed EV

charging stations for multi-unit housing provides builders with sufficient funds to include LPL2 outlets for every unit at equivalent or less cost, studies suggest.

Charging at home on residential rates typically costs drivers half as much as using public, third-party chargers. Presumably, building managers will prefer LPL2 outlets because there are fewer shared EV chargers to manage, and residents will prefer LPL2 outlets because of EV charging access for all at less cost to drivers than using public chargers.

California cost comparisons:
A group of California State legislators compared two scenarios using low- and high-cost estimates for two different charging strategies. ***Strategy A:*** Provide one LPL2 EV-Ready space for all units with parking at multi-unit housing plus L2 EV Installed at 10% of open/guest/shared parking spaces. ***Strategy B:*** Provide L2 Installed charging stations at 10% of total parking spaces and LPL2 EV Ready charging at 40% of total spaces.
The associated costs ranged from $789-$1,485 for each LPL2 EV Ready space and $2,596-$3,883 each for L2 Installed.

1. For a hypothetical new 100-unit residential building with 300 parking spaces where each unit has 2 dedicated parking spaces and there are 100 common/guest parking spaces, Strategy A would require 576 kW total (at the breaker) and cost $104,893-$187,319. Strategy B would require 864 kW and cost $172,596-$294,675. **Strategy A was 36%-39% less expensive and provided universal access to EV charging.**
2. For a hypothetical 100-unit apartment complex with 180 parking spaces where 50 units have 1 dedicated space, 50 units have 2 dedicated spaces, and there are 30 common/guest spaces, Strategy A would require 509 kW and cost $86,722-$160,139. Strategy B would require 518 kW and cost $103,558-$176,805. **Strategy A was 16%-9% less expensive and provided universal access to EV charging.**

Peninsula Clean Energy, at the 2025 National Community Choice Aggregation Conference:
The director of Energy Programs for Peninsula Clean Energy reported that installing LPL2 or L1 charging can be seven-fold less expensive than installing L2 charging. The marginal cost during construction for new buildings to install LPL2 charging (compared with no charging) is 0.3% of total costs.

Orange Charger, Inc. comparisons:
The experience and estimates of Orange (one of the companies specializing in LPL2 charging) suggest that adding LPL2 EV Ready for every unit with parking at new multi-unit developments adds 0.3%-0.5% to construction costs.

On its website, Orange estimates that the costs of installing and operating two LPL2 EV-Ready outlets would be 69% less than the costs for a two-port L2 EV Installed charger -- $2,750 vs. $8,750.

In a 2023 paper on case studies at multi-unit properties, Orange reported that installation of a LPL2 EV-Ready outlet may cost as low as $3,600 compared with $8,000-$12,000 for L2 EV Installed.

In a 2022 presentation, Orange estimated that for a multi-unit apartment complex in San Mateo, Calif. with 26 EV chargers, the 10-year up-front and ongoing costs for LPL2 outlets would be approximately $47,320 compared with $244,000+ for networked L2 chargers. Factoring in potential charging revenues and service fees/commissions, the LPL2 installations could break even in 3 years compared with 18-20 years for the L2 stations.

Sven Thesen & Associates:
This consultant compared two proposed EV infrastructure codes for multi-unit housing: one requiring LPL2 for each unit with parking and the other requiring L2 charging at 40%-73% of unit spaces (5% L2 EV Installed, 25% LPL2 EV Ready, and 10% L2 EV Capable).

For 150,000 new multi-unit housing dwellings expected to be built over a 20-year period, the LPL2 strategy would result in greater benefits in seven of eight measures:

- Shorter society payback time (years for cumulative savings to exceed initial costs)
- Faster societal internal rate of return
- EV charging available to more housing units
- Greater net residents' and societal savings
- More carbon dioxide emissions avoided
- Reduced cost for emission reductions
- Utility retrofit costs avoided

Initial construction costs would be $28 million higher for LPL2 at all 150,000 units compared with installing L2/LPL2 for a subset of units ($205 million vs. $178 million). That initial investment in LPL2 would produce a $1.4 billion greater reduction in other costs and avoid 2.9 million more tons of carbon dioxide emissions compared with the L2/LPL2 strategy, the report stated. The analyses did not factor in an estimated $0.7 billion to $1.6 billion that would be needed later to add EV charging to spaces that don't get them initially under the L2 strategy.

5. Existing and proposed regulations

LPL2 Examples:

- In 2025 the City of Lebanon, N.H. is considering changing its Zoning regulations that require EV charging at new developments to allow or require LPL2 in certain circumstances. To see the latest version of this proposal, contact sherry.boschert@gmailcom.

- The San Jose (Calif.) City Council unanimously adopted a strong EV charging code for new multi-family housing on January 30, 2024. Instead of L2 EV charging access at 30% of residential parking spaces, every residential parking space will be equipped with a **LPL2** receptacle, and each residential unit with assigned parking will have their receptacle directly wired to their panel or meter. The Council approved an exemption from the direct-wiring requirements for "unbundled" parking (i.e., parking that is paid for on a separate lease).

- On December 17, 2024 California regulators unanimously adopted amendments to the California Green Building Standards Code (CALGreen) to go into effect at the start of 2026 that require at least a **LPL2** outlet or charger (i.e., EV Ready or EV Installed) for any new unit with a parking space at multi-unit housing. (These could be standardized outlets – NEMA 6-20, 14-30, or 14-50 -- or J1772 or J3400 chargers.) The LPL2 spaces are allowed to share power between them as long as the system can provide a minimum of 3.3 kW simultaneously to each unit. If parking spaces are assigned, the EV charging for each space will be on a separate circuit wired to that unit's electrical panel "when feasible." If parking spaces are shared, there must be at least one EV-Ready space per unit. If there are more parking spaces than there are units, at least 25% of the excess needs to be EV Ready or Installed. These codes apply not just to new developments but any time a parking space is added or altered at an existing development in a way that requires a building permit.

  The new California codes also include mandates for hotels or commercial, office, or retail developments. At least LPL2 EV Ready or EV Installed is required at 65% of parking at new hotels or motels and 20% of spaces at new commercial, office, or retail parking lots. In some cases, property owners can install DC fast charging to reduce the required number of LPL2 spaces.

- Bay Area Air Quality Management District Draft Charge! Program Guidance for Fiscal Year Ending 2025: BAAQMD grants for EV charging infrastructure may be awarded to LPL2 or L1 chargers but only at multi-unit housing facilities.

Full L2 examples:

- Lebanon's current Zoning regulations, 2023: See Lebanon's Zoning Ordinance, especially pages 131-132 and definitions on pages 183-184 and 187. These require at least one EV-Ready L2 space at new one- or two-family homes. At off-street parking for new multi-unit housing, they require 5% of parking spaces to have installed L2 EVSE, 20% to be L2 EV-Ready, and 60% to be L2 EV-Capable. At

new non-residential developments with at least 30 off-street parking spaces, 2% of spaces must have L2 EVSE, 10% must be L2 EV-Ready, and 50% must be L2 EV-Capable.

- Dover, N.H. 2021: At https://ecode360.com/33400371 see Chapter 153 (Site Review Regulations), Part 14 (Site development design criteria), Section D (Parking), specifically items § 153-14(D3) and § 153-14(D5.a.5). Section D3 requires EV-Ready L2 spaces at 5% of parking for new multi-family residential projects and 2% of parking at non-residential projects. In Section D5.a.5., a conditional use permit for an increase in the number of parking spaces requires one L2 Installed charging station for every 10 requested parking spaces over the parking maximum where use of the parking space typically results in at least two hours of parking, and two L2 Capable charging spaces for every 20 spaces requested where use of the space typically doesn't last two hours or longer.

- City of Boston Electric Vehicle Readiness Policy for New Developments: L2 EV Installed at 25% of parking spaces and L2 EV Ready at 75% of spaces, or the equivalent charging capacity through slower or faster charging stations as determined by a point system that weights various charger types to ensure that the same number of EVs are served per unit of time (with extra points for EV Car Sharing or Electric Bike Parking).

Unspecified power levels:

- Vermont Upper Valley: The 2023 Climate Action Plan by the Two Rivers Ottauquechee Regional Commission, page 3, calls for implementing an "EV Ready" building ordinance requiring new developments to have panel capacity and conduit in place (i.e., "EV Capable") to charge EVs and establishing minimum parking requirements for exclusive EV use. It also calls for parking garages to have at least 20% of spaces served by charging outlets at construction and an additional 20% every 5 years thereafter.

6. Sources

"Why EV Charging is the Ultimate High-Tech Amenity for Modern Multifamily Residences," *Buildings*, November 11, 2024: https://www.buildings.com/resiliency-sustainability/electrification/article/55241601/why-ev-charging-is-the-ultimate-high-tech-amenity-for-modern-multifamily-residences

Email communications from town officials in Dover, N.H.

Climate Action Plan, Two Rivers Ottauquechee Regional Commission's Intermunicipal Regional Energy Coordinator Program: https://www.trorc.org/wp-content/uploads/2023/04/TRORC-IREC-CAP-V4-1.pdf

Email communications with Wendy Chou and Dennis Murphy, Acterra.

"California will require EV charging for all new residential units in 2026," *Electrek,* December 18, 2024: https://electrek.co/2024/12/18/california-will-require-ev-charging-for-all-new-residential-units-in-2026/#:~:text=California will require EV charging for all new residential units in 2026,-Jameson Dow | Dec&text=California's new building codes will,only actual problem with EVs.

Letter from 11 California State legislators to California Building Standards Commission Community Development Staff , May 15, 2023 regarding "Electric Vehicle Charging Clarification in the CALGreen Intervening Code Cycle.

"Scaling EV Charging Program Impacts," presentation by Phillip Kobernick, Peninsula Clean Energy, at the 2024 National Community Choice Aggregation Conference.

Papers, communications, and slide decks from Orange including "Building Affordable Equitable Charging to Multi-Unit Properties with Lower Power Charging," July 11, 2023 and others.

Electric Vehicle Readiness Policy for New Developments, City of Boston: https://www.boston.gov/sites/default/files/file/2020/03/EV%20Readiness%20Policy%20For%20New%20Developments%20%287%29.pdf

Charge! Program Draft Guidance for Fiscal Year Ending 2025, Bay Area Air Quality Management District: www.baaqmd.gov/charge

A Comparison of Two Multi-Family Dwelling EV Charging Codes," Sven Thesen & Associates, 2021: https://tinyurl.com/mu3zvk9n

Why should we adapt the zoning?

- Reason One: Local and regional Data does not match EV Charging requirements
- Reason Two: Rapidly changing technology will leave current regs and tech outdated
- Reason 3: High installment costs will become sunk costs burdened by renters / homeowners in perpetuity
- Proposal: Shift EV Charging Requirements to Site Plan Review

Local & Regional Data does not support the current or future regulations

EV Adoption & Charging Demand

Current Lebanon EVs:

- 95 EVs (2024) or 3.5% of total Vehicles
- 58 EVs (2023)
- We will have 170 spaces that will be EV capable charge EVs

Actual Multi-Family Use:

- Marek: 315 spaces / 245 Occupied Units / 225 Cars / 7 EV cars / 6 EV chargers
- 2.9% of occupied units
- No additional demand requests from tenants,

Boston:

- 12.6% of new Car Sales were EVs (2024)
- 8% of all cars are EV (estimated but lines up with National average estimated by Edmunds)

California

- 21.6% of new Car Sales were EVs (Q2 2025)
- 25.3% in 2024 / 25% in 2023
- 3.4-4.9% of total Cars

Colorado:

- Leader in EV adoption in 2024
- 15% EV Ready, 5% EV ready, 40% EV Capable

National AVG:

- 9.1% of new vehicles / 1.7% overall

Do you think Lebanon, NH is going to outpace the national adoption rate or even that of Boston, Colorado or California?

Rapidly Changing EV Charging Technology

How we got here:

2023 Adoption

EV requirements are adopted into the zoning regulations after LEAC presentation to the planning board failed to vote to include them in the site plan regulations

2024 LEAC EV subcommittee Adapts

One year later, new technology that allowed faster charging and a different approach resulted in the same committee who proposed the inclusion ONE YEAR prior submitting an updated proposal on their own

2025: Planning board suggests moving Regs back to site plan

One year later technology has continued to change resulting in the current regs being even more outdated and property owners incurring significant costs while this decision is being made

Why is there no discussion of future technology from the LEAC EV Subcommittee?

The only discussion we have heard about technology is the comparison of plumbing in the 1920s to EV infrastructure today. I think a more applicable comparison is when developers were wiring entire buildings for direct ethernet connection. Around 5 years later, wifi was introduced and billions of dollars, millions of pounds of plastic sent to landfills, and other waste that would eventually be ripped out to be sent to landfills

What Is Battery-Buffered Fast Charging?

A battery energy storage system can store up electricity by drawing energy from the power grid at a continuous, moderate rate. When an EV requests power from a battery-buffered direct current fast charging (DCFC) station, the battery energy storage system can discharge stored energy rapidly, providing EV charging at a rate far greater than the rate at which it draws energy from the power grid.

4 versions in 12-14 years

Nearly one-third of EV charging attempts fail, report finds

High uptime masks real issues as only 71% of tries succeed, per ChargerHelp!'s 2025 EV reliability study

Thomas Wasson · Friday, October 03, 2025

A new fully charged EV battery in five minutes: Are China's swap stations the future of electric cars?

6 May 2025

Share Save

Chinese electric vehicle company Nio **has now built over 3,300 battery swap stations in China**, while Catl, China's (and the world's) largest EV battery producer, **recently announced plans** with oil giant Sinopec to build a "battery-swapping ecosystem across the whole nation".

> In fact, experts say that it may be in the countries which, unlike China, remain in the early stage of a switch to EVs that battery swaps prove most useful for supporting electric car uptake – especially when it comes to addressing range anxiety among drivers.

Rising star Vammo rides past 1 million battery swaps for electric motorcycles

Micah Toll | Feb 5 2025 - 4:30 am PT | 2 Comments

Upfront Costs will hinder development and add to the affordable housing crisis

Debunking Design Cost Myths

Challenging Cost Assumptions

Many believe EV retrofitting is expensive, but site planning can significantly lower these costs.

Role of Soft Landscaping

Integrating soft landscaping reduces trenching costs and enhances the site's overall accessibility for EV infrastructure.

Utility corridors allow for easier future upgrades as EV demand grows, making investments more adaptable.

Future Costs

As tech improves EV costs go down

In 5-10 years buildings will have built up Capital Reserves that could pay for additional EV infrastructure

Costs of EVs

Six Figure Equipment Costs & Man Hours

Switchgears, panel boards, transformers, thousands of feet of conduit/copper wire.

Crew of 4 will take 7 months of electrical work

Cost of Time

Ordering transformers/switchgears and other utility gear has 40-70 weeks with no guarantee on arrival

Cost of Charging

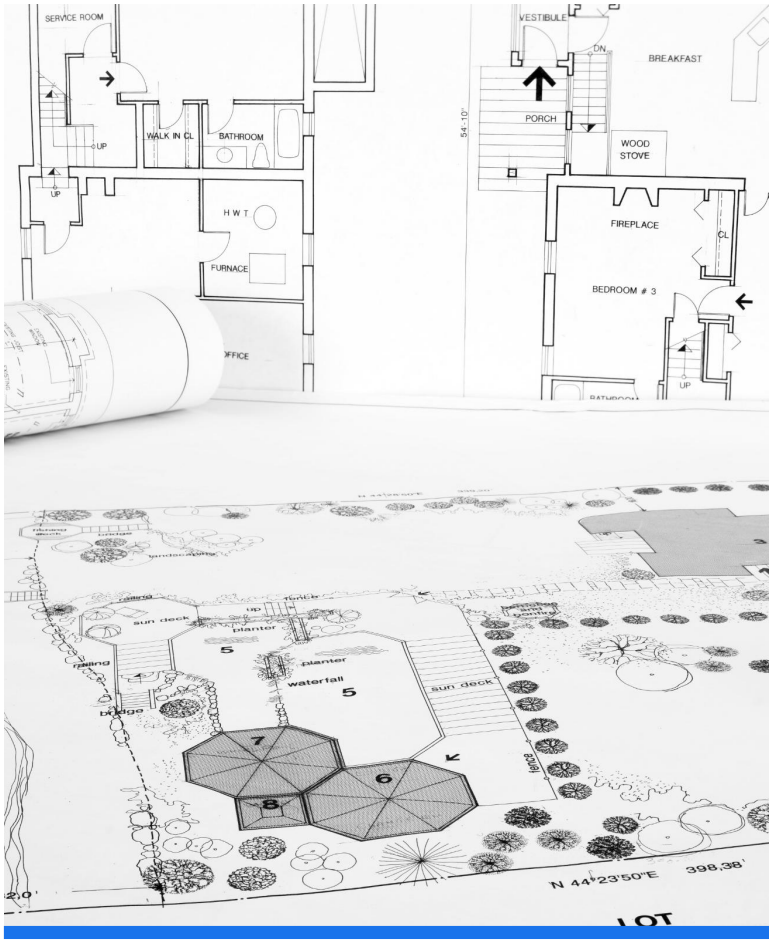
Owners will pass the cost onto tenants / fees for chargers and charger subscription software are in the 10s of thousands of dollars and would never be recoupable given the amount required. Tenants will bear those costs

Cost of Electricity

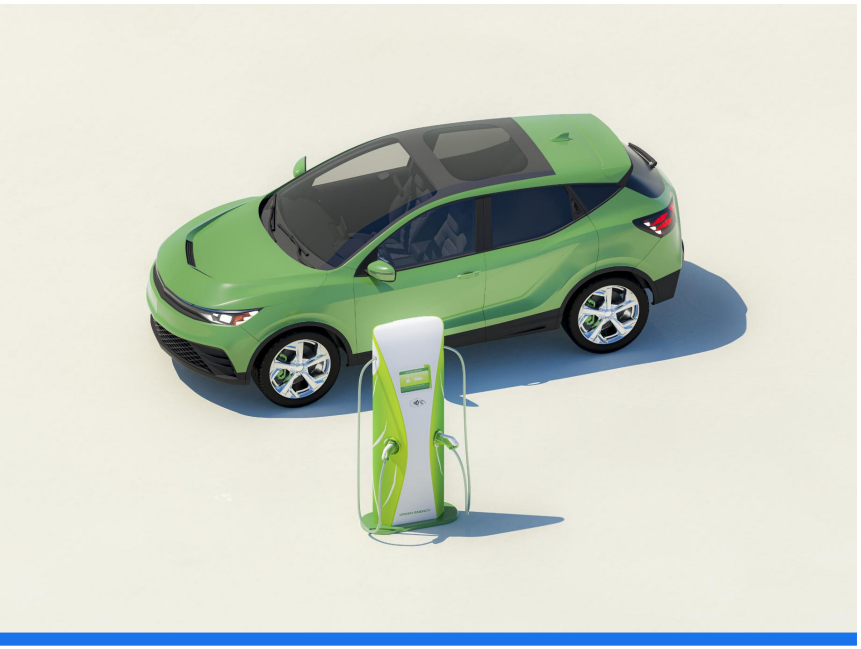
40% increase in electric bills in August – how do you think the increased load will affect those costs? How will it affect the aging grid and what dangers will that cause during dry summer months and cold winters when loads are at their highest?

Insurance Costs

Insurance brokers are already predicting significant cost increases due to EVs, especially inside buildings



Housing Crisis & Affordable Housing



Increased development costs = increased rent

The cost to build is directly correlated to what landlords pass through to the tenants

Higher Costs = Less apartments/homes being built

Developers only build if there is a profit, they only make a profit if there is enough spread between the cost and the return on that cost. Building will stop

More Units of any kind = more affordable housing

We have a macro issue in terms of affordable housing. A basement apartment with one window should not cost $2,000 a month to rent. We need more units of any kind.

Affordable Housing Development

If left in the zoning regs, affordable housing developments will have to follow the same rules which makes the likelihood of those projects not penciling very high.

Proposal: Shifting EV Charging Requirements to Site Plan Review

Challenges of Updating Zoning Codes to Keep Pace

Slow Revision Process

Revising zoning codes involves lengthy bureaucratic procedures that delay timely updates.

Technology Adaptation Delay

Slow zoning updates hinder rapid incorporation of new technologies in urban infrastructure.

Market Condition Challenges

Evolving market conditions in EV infrastructure require swift zoning changes, often unmet.

What will happen

Developers will have to build cheap product to offset the high site costs

Façades, finishes, parking structures, and amenities will be removed while rents will go up. (LWM would not have a public park, a river walk, and two garages)

Future developers will have to remove outdated infrastructure to meet the new technology requirements

Failing EV companies and new technology will require new hardware/software updates frequently, and the cost to maintain will eventually be not economical

OR Provide Flexibility in site-plan & developers will adapt to what tenant's demand

If demand for EVs increase developers will install chargers so they can maximize rent *(the Marek installed chargers even though they weren't required. match the current and future demand projected)*

EVSE Proposal for Lebanon

Installation Plan

Proposal includes installing 5% EVSE ready low power level 2 and 10% EV capable low power level 2

Flexible Infrastructure Design

Soft scape designs are incorporated to show the future path needed for increased load capacity if EV demand grows.

Annual Demand Assessment

Planning board will review demand each year using registered car data to guide future changes to site plan as demand and technology evolve. The planning board can amend the requirement annually