



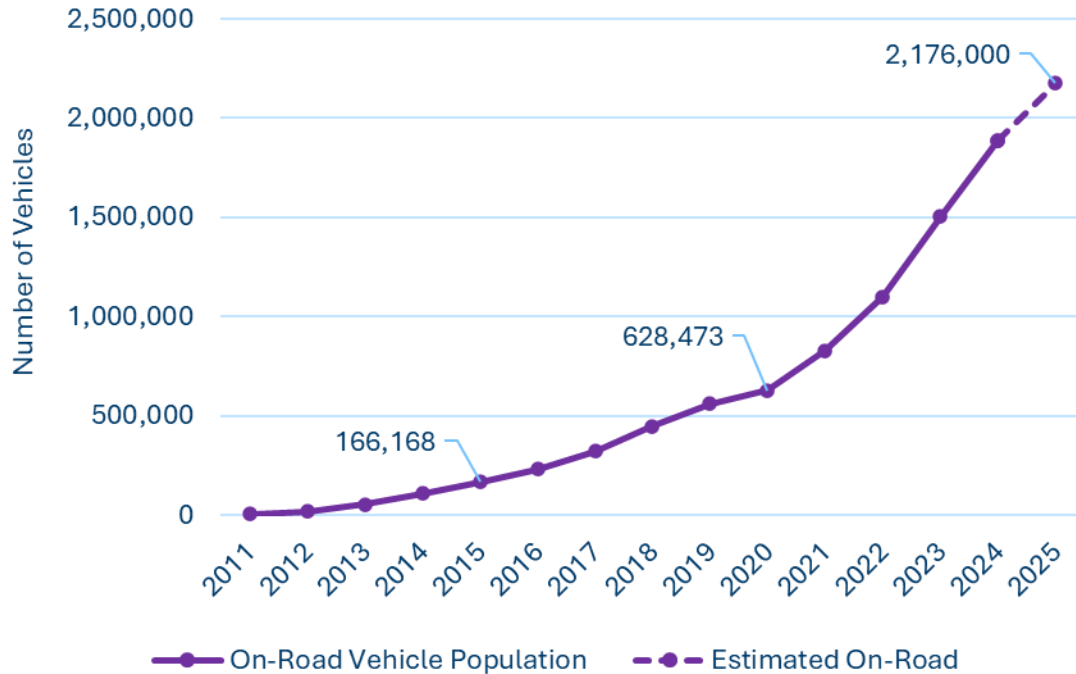
Unlocking the Benefits of Vehicle-Grid Integration and Bidirectional Charging

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Role of Vehicle Grid Integration (VGI) in California

Fast-growing population of EVs



Source: CEC



Constrained grid

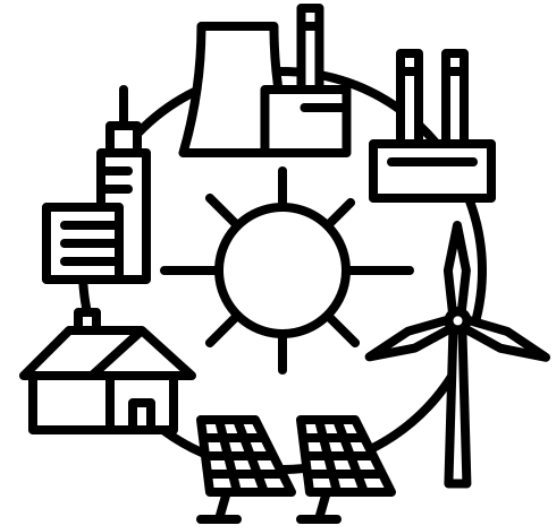
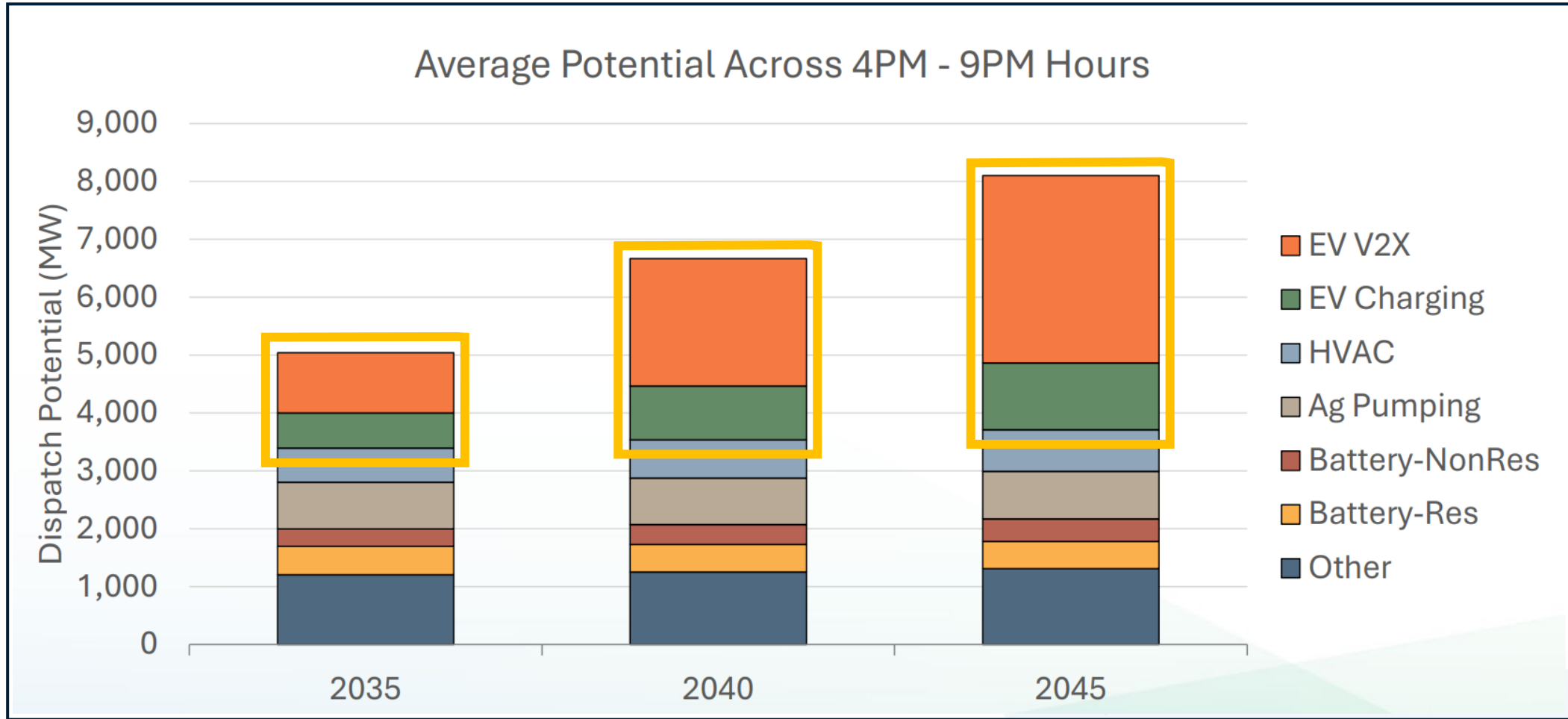


Image from Flaticon.com

VGI: Any method of altering the **time, charging level, or location** at which grid-connected electric vehicles **charge or discharge** in a manner that optimizes interaction with the electric grid and provides net benefits to ratepayers.



Bidirectional charging (or V2X) exceeds load flexibility potential of other resources



Source: 2024 SB 100 demand flexibility resource potential modeling



Bidirectional charging benefits EV drivers

A mobile, reliable, and cost-effective clean energy resource

Vehicle to home



Photo: Ford



Resilience – Price arbitrage

Power backup during outage, lower electric bills

Vehicle to load



Photo: Kia America



Mobility – Freedom and convenience

Power any appliance, anywhere

Vehicle to grid



Photo: Zum



Monetization – Contribution to a better grid

Compensation and rewards for providing grid services



Quantifying Vehicle-to-Home Potential

Recently published [Bidirectional Charging White Paper](#)

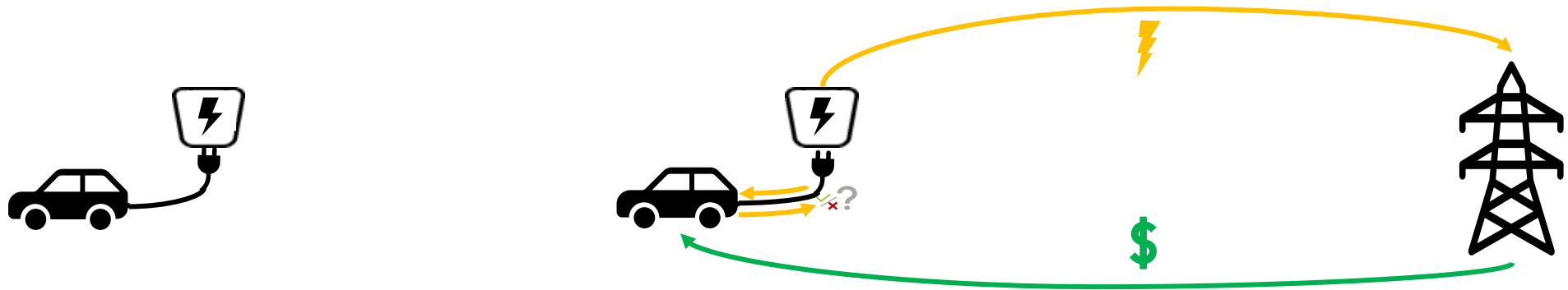
Vehicle-to-Home Potential in 2030		
Discharging during peak hours of 4 to 9 p.m.	Grid Disconnected	Grid Connected
EVs able to discharge at least once per week	2.3M (51.7% of EVs*)	2.36M (53% of EVs*)
Average total bill savings per EV (June to September – TOU rates)	\$262**	\$321**
Max grid load reduction (% residential load)	4.1 GW (9.4%)	5 GW (11.6%)

*based on 4.5M EVs in 2030
 **based on existing TOU rates

Source: CEC and NLR



Critical barriers to bidirectional charging remain



Emerging Product Offering

How do vehicle owners unlock the capability?

DRIVER EXPERIENCE

Interconnection

Do utilities approve installation of bidirectional products?

SAFETY

Revenue Opportunities

Do vehicle owners and rate payers have a value case?

COSTS & BENEFITS

Source: CEC



CEC actions are supporting bidirectional charging

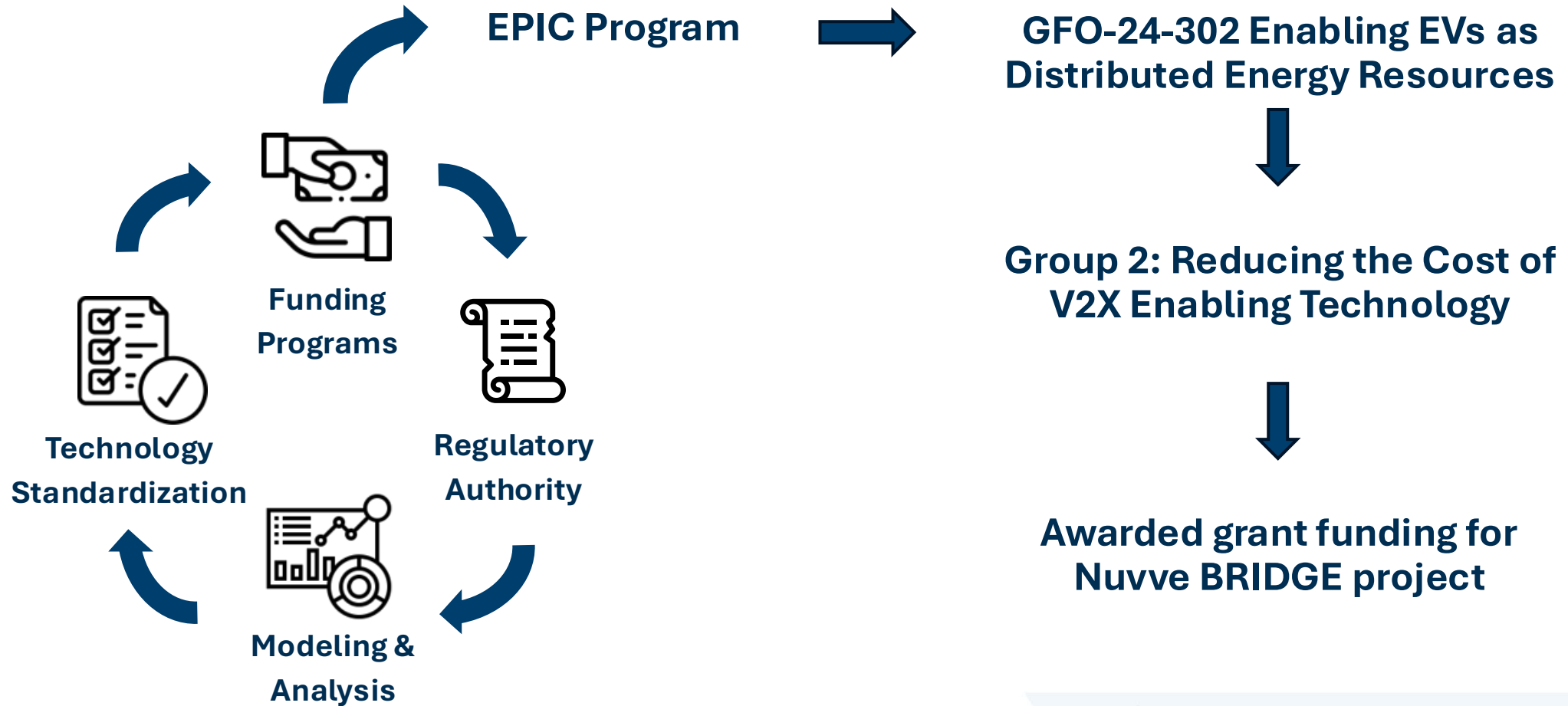


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