

Electric Vehicles can be an Asset to the Grid

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HONDA



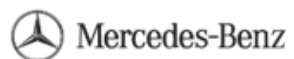
ISUZU



local motors
by



McLaren



NISSAN



Panasonic

PORSCHE



TOYOTA



VOLKSWAGEN
GROUP OF AMERICA

Electric Vehicles Available in the U.S. in MY2020

BEV (18)

Audi e-tron
BMW i3
BYD e6
Chevrolet Bolt
Fiat 500e
Hyundai Ioniq
Hyundai Kona
Jaguar I-Pace
Kia Niro
Kia Soul
MINI SE Electric
Nissan Leaf
Porsche Taycan
Tesla Model 3
Tesla Model S
Tesla Model X
Tesla Model Y
Volkswagen Golf

PHEV (34)

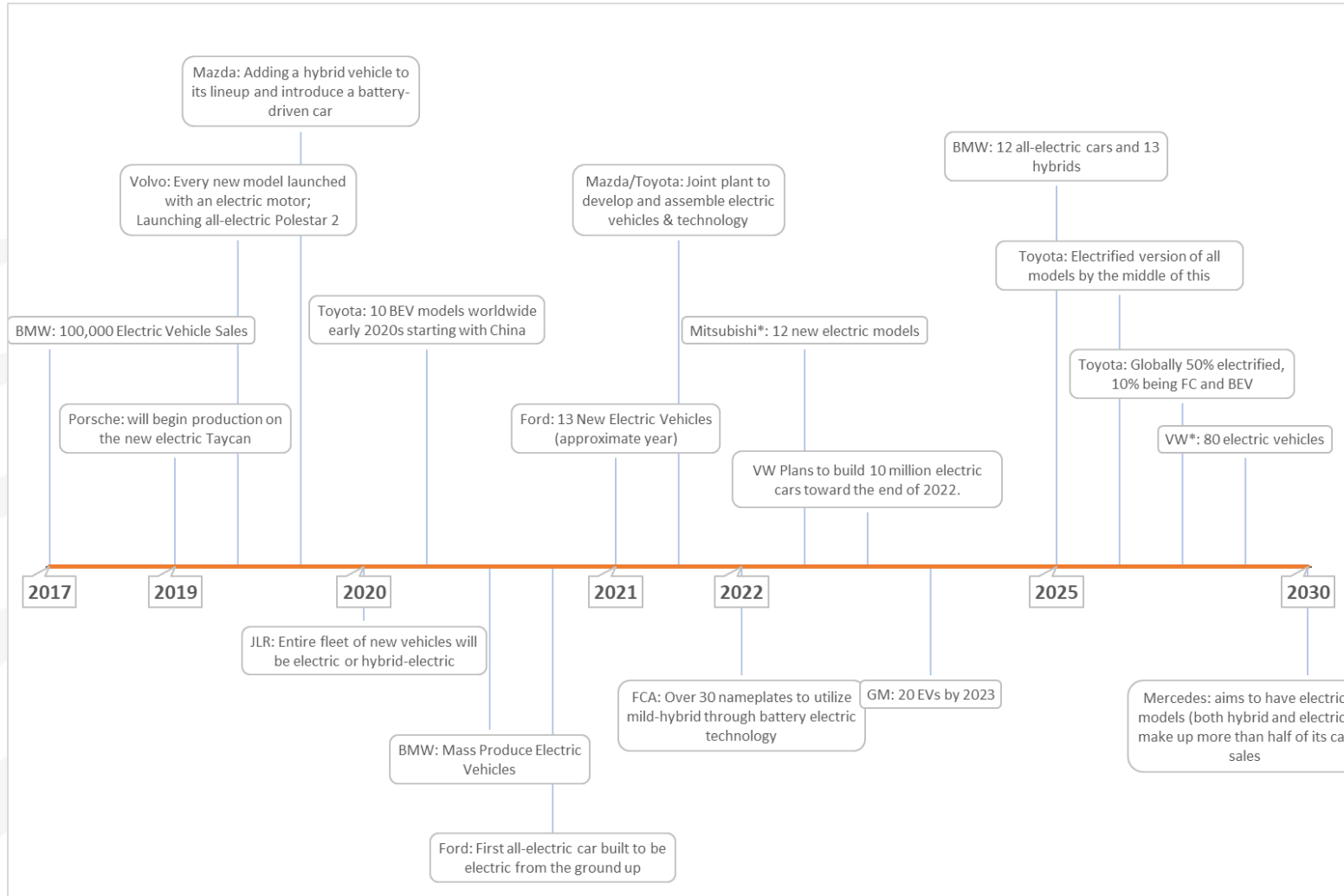
Audi A8	Kia Optima
Audi Q5	Land Rover Range Rover
Bentley	Land Rover Range Rover Sport
Bentayga	Sport
BMW 3 Series	Lincoln Aviator
BMW 5 Series	Mercedes-Benz S-Class
BMW 7 Series	MINI Countryman
BMW i8	Mitsubishi Outlander
BMW X3	Porsche Cayenne
Chrysler Pacifica	Porsche Panamera
Ford Fusion	Subaru Crosstrek
Honda Clarity	Toyota RAV4 Prime
Hyundai Ioniq	Toyota Prius Prime
Karma Revero	Volvo S60
Jeep Wrangler	Volvo S90
Jeep Compass	Volvo V60
Jeep Renegade	Volvo XC60
Kia Niro	Volvo XC90

FCEV (3)

Honda Clarity
Hyundai Nexa
Toyota Mirai

Sources: IHS Markit Vehicle Technical Intelligence Platform (VTIP)
<https://www.caranddriver.com/features/g15377500/plug-in-hybrid-car-suv-vehicles/>
<https://www.caranddriver.com/shopping-advice/g32463239/new-ev-models-us/>

More than 100 EV models expected by 2025



“Before the pandemic, auto makers and suppliers had committed a total of \$234 billion to electrification projects for the five-year period starting in 2020, according to Alix’s research, equivalent to roughly an entire year’s capital spending for the industry.”

Wilmot, Stephen. “The Car Industry’s \$1.1 Trillion Debt Problem.” The Wall Street Journal (June 17, 2020) (available at: <https://www.wsj.com/articles/the-car-industrys-1-1-trillion-debt-problem-11592384319>)

Increased EV charging equals increased electricity load?

Electric Vehicles & Impact to the Grid

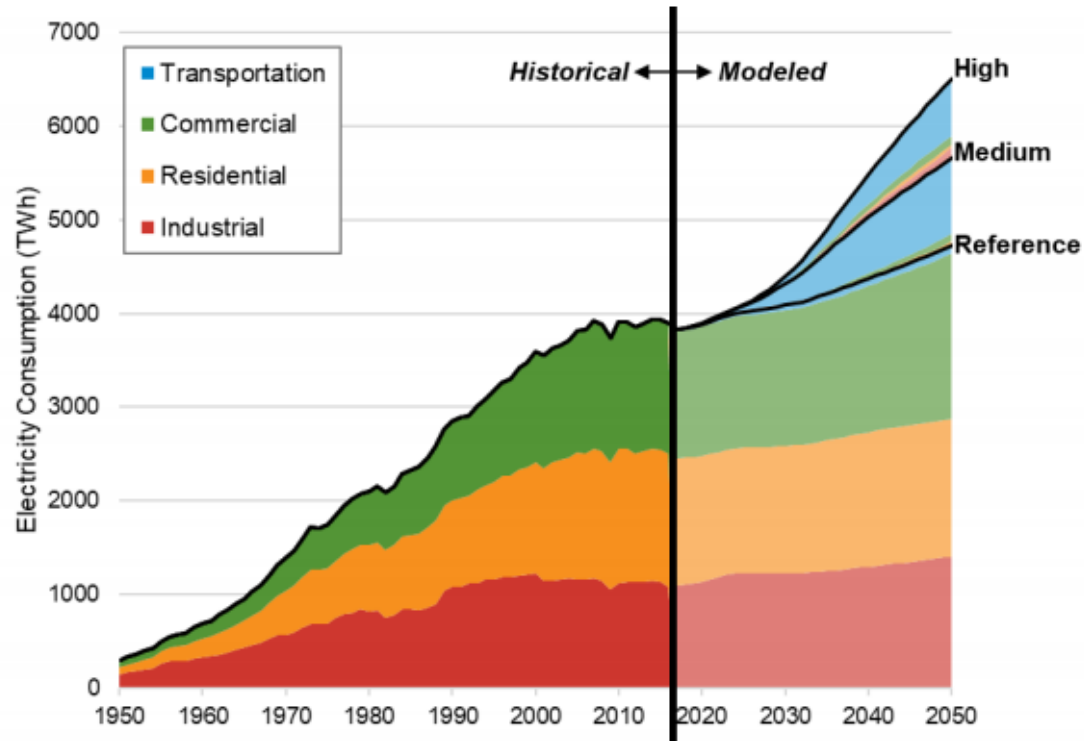


Figure ES-3. Historical and projected annual electricity consumption

Moderate technology advancements are shown. Slight adjustments were made to the modeled industry consumption estimates (for 2017–2020) to align them with available historical data.

Electricity Consumption from Transportation:

- 1,782 TWh (high scenario)
- 932 TWh (medium scenario)

<https://www.nrel.gov/docs/fy18osti/71500.pdf>

EVs can be an asset to the grid, not a liability

Electric vehicles can be an asset to the grid

Benefits of V1G (modulation) & V2G (bi-directional control):

- Reduce energy service costs
- Reduce customer electricity bills
- Reduce TCO for EV owners
- Enable higher penetration of renewable capacity
- Improved grid flexibility and resiliency
 - Reduce the need for conventional generation
 - Augment grid-scale energy storage
- Increase utilization of existing assets

These benefits
can be realized
through V1G
today!

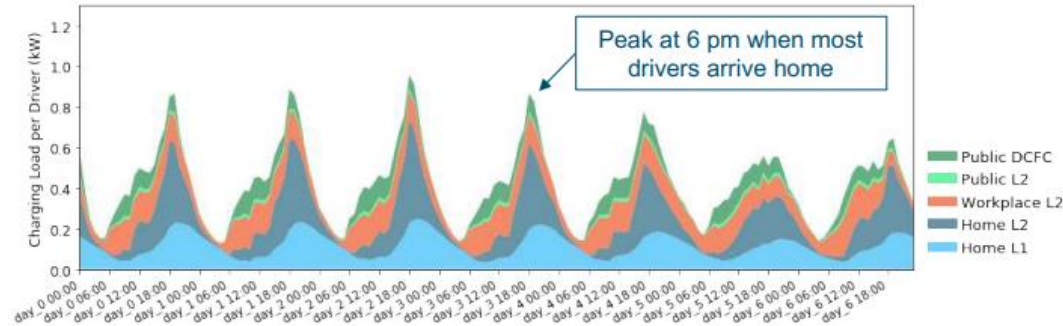
Reduce energy customer electricity bills



Residential and workplace bill management (VGI use cases #1 and #2)

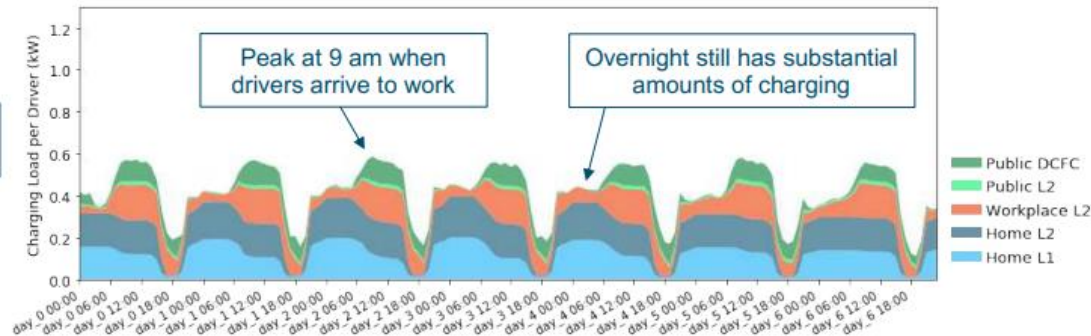
Unmanaged charging (2025, summer, one week)

Peak load = 0.957 kW

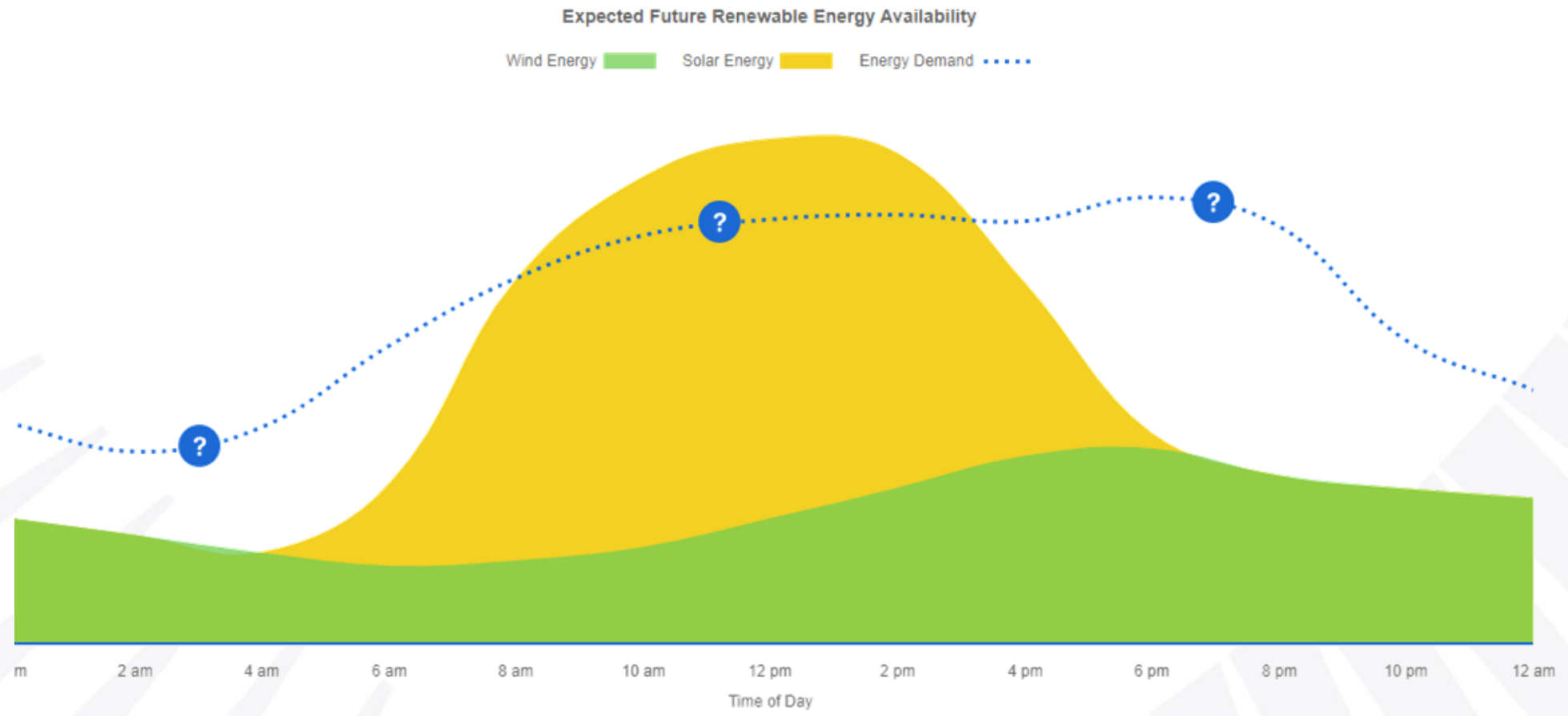


Managed charging w/ VGI (2025, summer, one week)

Peak load = 0.587 kW



Enable higher penetration of renewable capacity



2020 SAE Government & Industry Meeting. Jeff Samalot (BMW)

Open Questions for VGI (V1G & V2G)

- Who Pays? Who benefits?
 - Customer
 - Utility
 - 3rd Party Network
- Policy drivers & certainty
- Use cases
- Communication standards & protocols
- Utility regulatory access
- Economic value
- Customer awareness & enrollment
- Data privacy & access
- How to minimize impact on battery life
- EVSE & vehicle hardware requirements

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