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July 6, 2016

MEMORANDUM

TO: Council members

FROM: Massoud Jourabchi, Manager, Economic Analysis

SUBJECT: Panel on Electric Vehicles

BACKGROUND:

Presenters: A Panel of industry groups

Summary: Staff has invited a panel of experts who will discuss current barriers to EV implementation. Also discussed will be opportunities for Council to become involved in increasing electric efficiency of the transportation system in the Northwest.

Panel members are:

Jeff Allen, Executive Director, Drive Oregon

JJ McCoy, Senior Policy Associate, Northwest Energy Coalition

John Morris, CEO, Morris Energy Consulting

Steve Douglas, Senior Director, Environmental Affairs, The Auto Alliance

Relevance: Understanding this growing load helps Council's ability to forecast future demands for electricity.

Work plan: B.3.1 Enhance Modeling of Electrification of Transport System

Electric Vehicles

1

STEVE DOUGLAS
SENIOR DIRECTOR, ENERGY & ENVIRONMENT



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- Vehicles
 - Availability
 - Longer ranges
 - More body styles (SUV, mini-vans, large cars, AWD)
 - Charging incentives
 - Financial incentives to promote sales
 - Billions for R&D and future PHEVs, EVs, and FCVs.
- Infrastructure Development
- Advocacy
 - Financial incentives
 - Non-financial incentives
 - Non-proprietary infrastructure
- Not enough! Support needed from federal, state, local governments, utilities, NGOs, EVSE providers

Current Electric Vehicles

3

BEV (12)

BMW I3 (and I3 REX)
Chevy Spark
Fiat 500E
Ford Focus Electric
Kia Soul EV
Mercedes B-Class EV
Mitsubishi iMiEV
Nissan LEAF
Smart EV
Tesla Model S
Tesla Model X
Volkswagen eGolf

PHEV (15)

Audi A3 e-tron
BMW 330e
BMW i8
BMW X5 Plug In
Cadillac ELR
Chevy Volt
Ford C-Max Energi
Ford Fusion Energi
Hyundai Sonata PHEV
Mercedes GLE-550e
Mercedes S-Class Plug-In
Porsche Cayenne S
Porsche Panamera S
Toyota Prius Plug-In
Volvo XC90 T8

FCV (2)

Hyundai Tucson
Toyota Mirai

Additional Electric Vehicles 2016 and 2017

4

BEV (3)

Chevy Bolt (CY2016)

Hyundai IONIQ EV (CY2016)

Tesla Model 3 (CY2017)

PHEV (6)

Chrysler Pacifica (CY2016)

Hyundai IONIQ PHEV (CY2016)

Mercedes C350e (CY2016)

Mitsubishi Outlander (CY2016)

Toyota Prius Plug-In (CY2016)

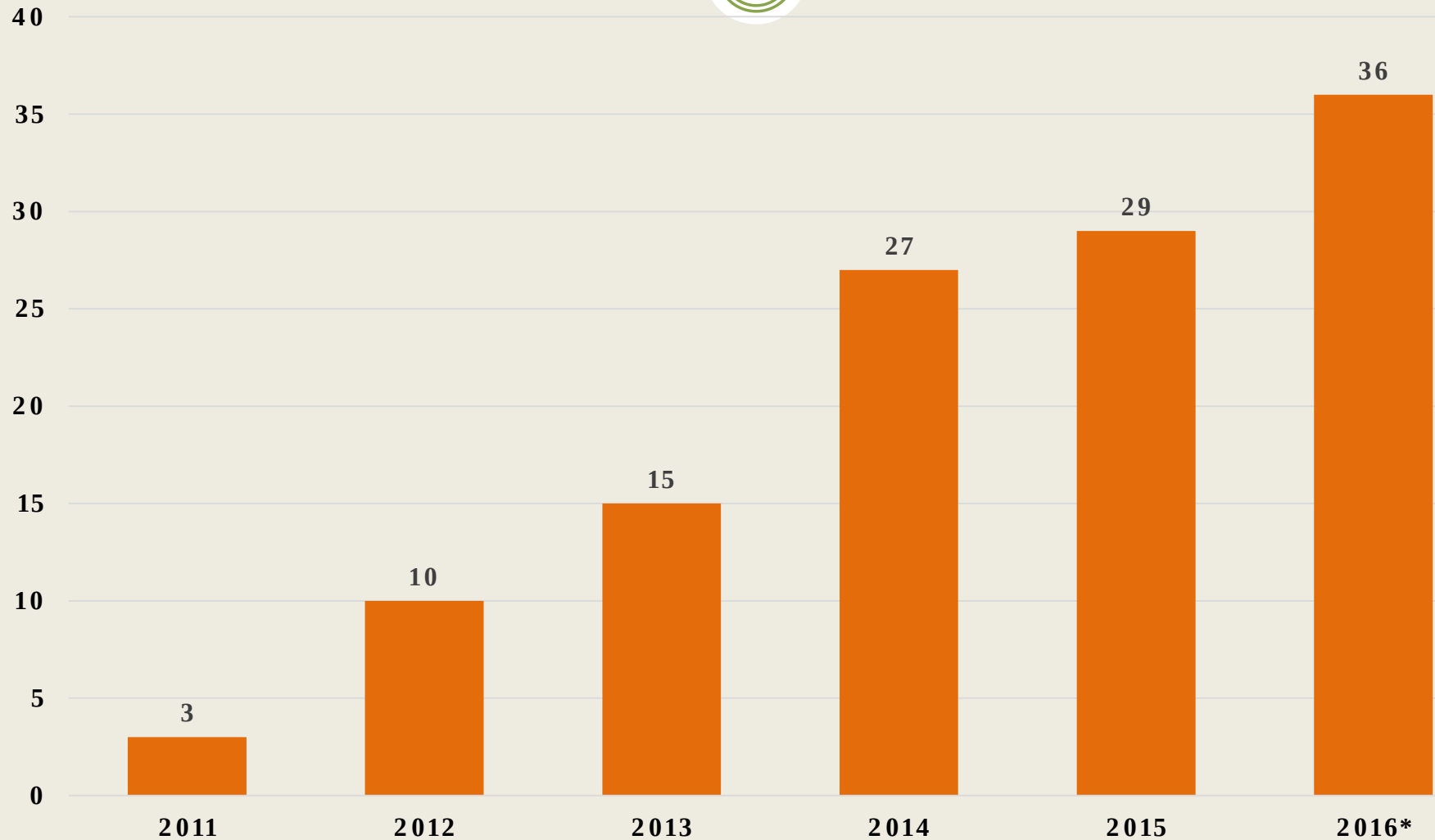
BMW 5-series (CY2017)

FCV (1)

Honda Clarity (CY2017)

Electric Vehicle Models

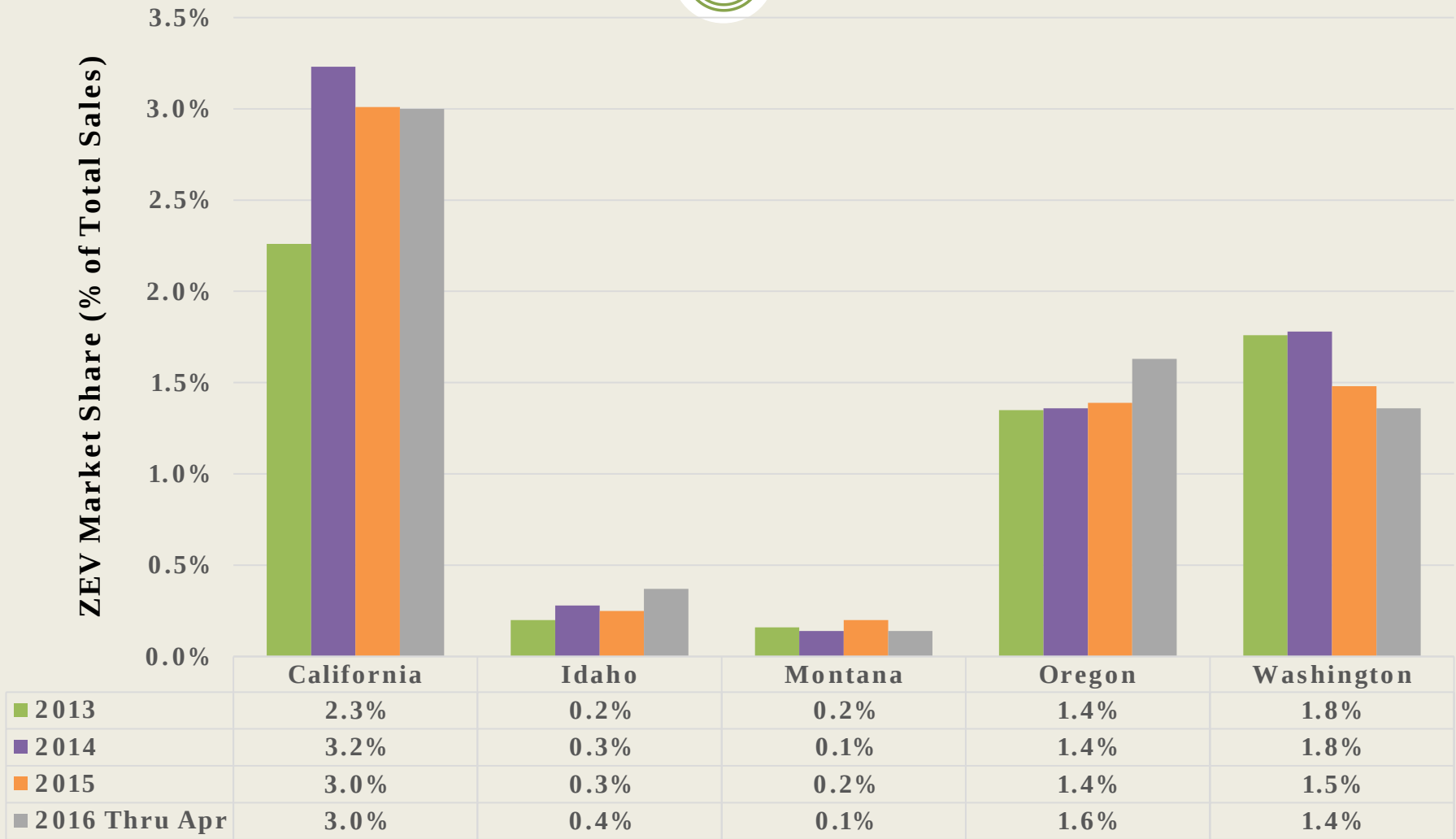
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* Expected models by the end of 2016

Electric Vehicle Market Share

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Challenges

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- Financial Incentives
 - Federal: \$7,500 tax credit exhausted for some OEMs in 2018
 - State: California rebate (\$5/2.5k/1.5k) exhausted 11-Jun funding unlikely before Sep
 - Local: Free and reduced price parking and other local incentives eliminated
- Non-Financial: CA HOV Lane Access for PHEVs unavailable since Dec-2015
- Infrastructure is not keeping pace with electric vehicle sales

Utilities

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- Infrastructure
- Rates for EV charging (in CA)
 - Overly complex – flat rate, TOU, tiered pricing
 - Many cases electric vehicles more expensive than gasoline
- Incentives for home charger
- Benefits to grid:
 - Managed charging (V1G)
 - Battery second life

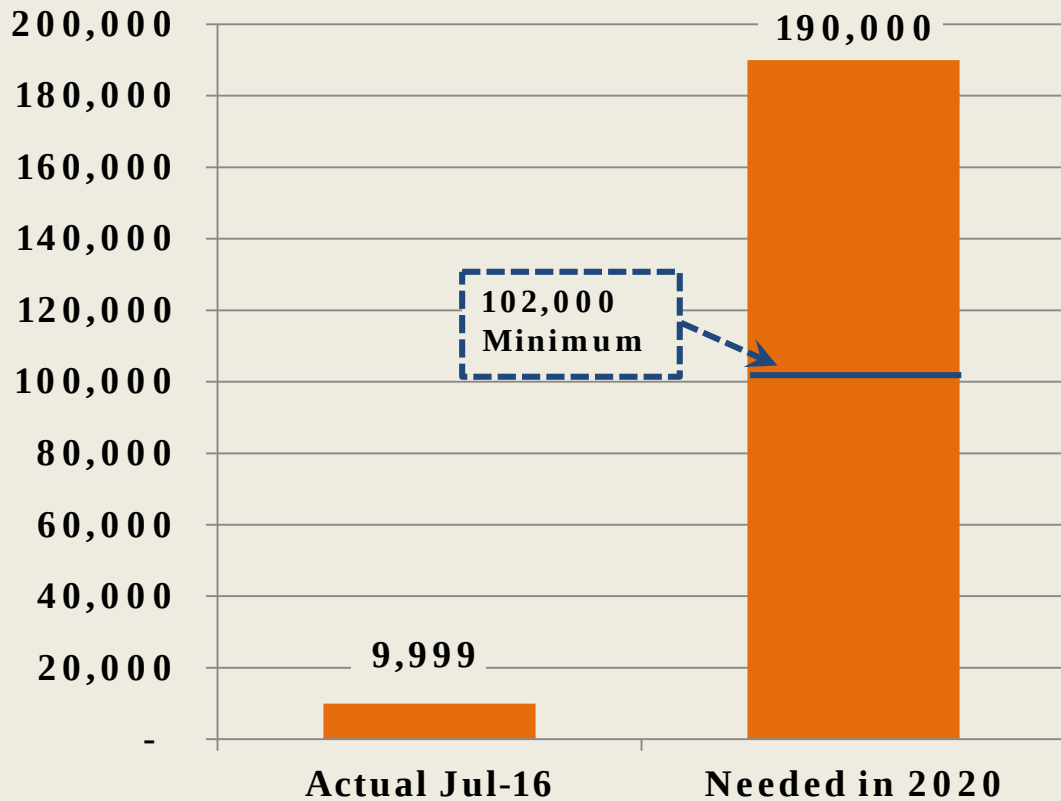
Backup Slides

9

CA Infrastructure

10

Number of Charge Points*



The New York Times | <http://nyti.ms/1NxWfNI>

SCIENCE

In California, Electric Cars Outpace Plugs, and Sparks Fly

By MATT RICHTER OCT. 10, 2015

May, 2014, NREL study* commissioned by CA Energy Commission found:

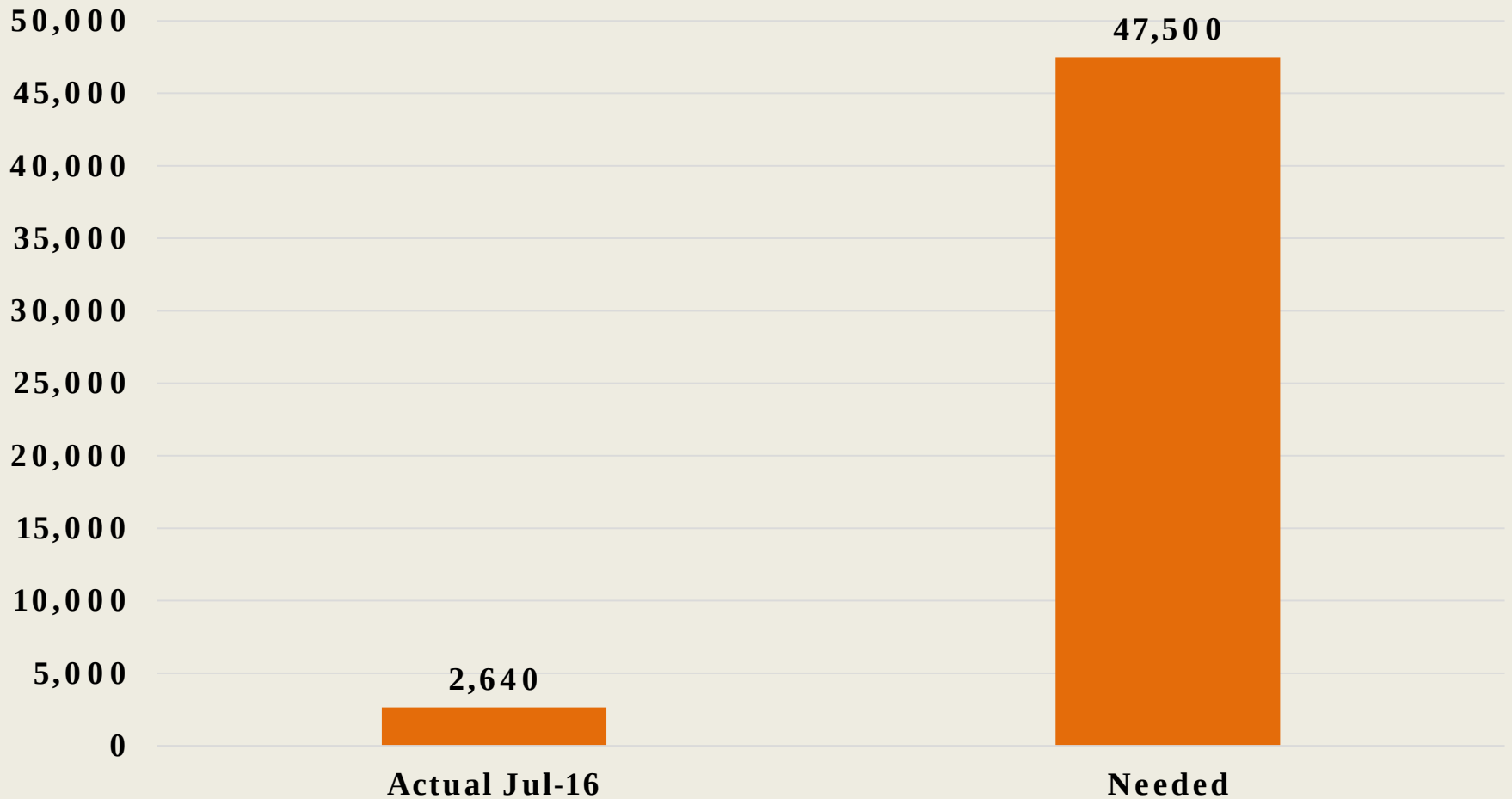
- 102,000 to 190,000 L2 charge points are needed to support the 2020 goal of 1 million plug-in electric vehicles in CA
- Today, less than 4 years from 2020, CA has only 9,999 charge points.

This is becoming a problem today with EV drivers unable to rely on vehicle charging beyond their home charging.

*<http://www.nrel.gov/docs/fy15osti/60729.pdf>

ID, MT, OR, and WA Combined Infrastructure*

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* Assuming ID, MT, OR, and WA combined have 25% of CA sales

Rate Cost & Complexity (CA)

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Nissan Leaf		
Utility/Rate plan	Ave rate (\$/kWh)	\$/gallon gas
PG&E: E-6	0.333	3.802
PG&E: E-TOU Option A	0.289	3.302
PG&E: E-TOU Option B	0.218	2.486
PG&E: EV-A	0.116	1.328
PG&E: EV-B	0.116	1.323
SCE: TOU-D	0.122	1.393
SCE: TOU-D-T	0.253	2.891
SCE: TOU-D-TEV	0.100	1.146
SCE: TOU-EV-1	0.126	1.439
SDG&E: DR-TOU	0.371	4.235
SDG&E: EV-TOU	0.182	2.078
SDG&E: EV-TOU-2	0.182	2.078
SDG&E: TOU-DR	0.372	4.247
SMUD: R-TOU	0.073	0.838
LADWP: R-1B	0.203	2.320
LADWP: R-1B (EV)	0.178	2.034
PG&E: E-1	0.364	4.159
SCE: D	0.302	3.456
SDG&E: DR	0.393	4.489
SMUD:R	0.190	2.171
LADWP: R-1A	0.243	2.779

Chevy Volt		
Utility/Rate plan	Ave rate (\$/kWh)	\$/gallon gas
PG&E: E-6	0.333	4.619
PG&E: E-TOU Option A	0.289	4.013
PG&E: E-TOU Option B	0.218	3.021
PG&E: EV-A	0.116	1.614
PG&E: EV-B	0.116	1.608
SCE: TOU-D	0.122	1.693
SCE: TOU-D-T	0.253	3.513
SCE: TOU-D-TEV	0.100	1.393
SCE: TOU-EV-1	0.126	1.749
SDG&E: DR-TOU	0.371	5.146
SDG&E: EV-TOU	0.182	2.525
SDG&E: EV-TOU-2	0.182	2.525
SDG&E: TOU-DR	0.372	5.160
SMUD: R-TOU	0.073	1.018
LADWP: R-1B	0.203	2.819
LADWP: R-1B (EV)	0.178	2.472
PG&E: E-1	0.364	5.053
SCE: D	0.302	4.199
SDG&E: DR	0.393	5.454
SMUD:R	0.190	2.638
LADWP: R-1A	0.243	3.377

Building “Good Load” to Reduce Carbon Emissions

Policy frameworks for utilities to drive Transportation Electrification (TE), with benefits to ratepayers, the environment, efficiency, and the grid

JJ McCoy
Senior Policy Associate



NW Energy Coalition
for a clean and affordable energy future

Scope of TE (more than just sedans)

- Passenger sedans



Battery Electric Vehicle (BEV)



Plug-in Hybrid Electric Vehicle (PHEV)



BEV +
PHEV
= PEV



- Light-duty trucks



- Shuttles / delivery vans
- Industrial equipment (e.g. forklifts)
- Transit buses
- Lawn & garden equipment
- Off-road service vehicles
- Shore power
- Light and heavy rail



Benefit #1 - Grid Utilization & Flexibility

- Greater utilization of existing assets. PNNL study found the NW region could electrify 2.8 million light-duty vehicles without adding any generation or transmission assets, if charging is managed off peak.
- Flexible load. Most vehicles are parked >20 hours a day. Potential alignment with variable renewable generation (e.g. noontime solar, overnight wind), load management (TOU), demand response programs.

Possible vehicle-to-grid integration, storage, grid services.

- Downward pressure on rates – Net new rate revenue from TE benefits all ratepayers:

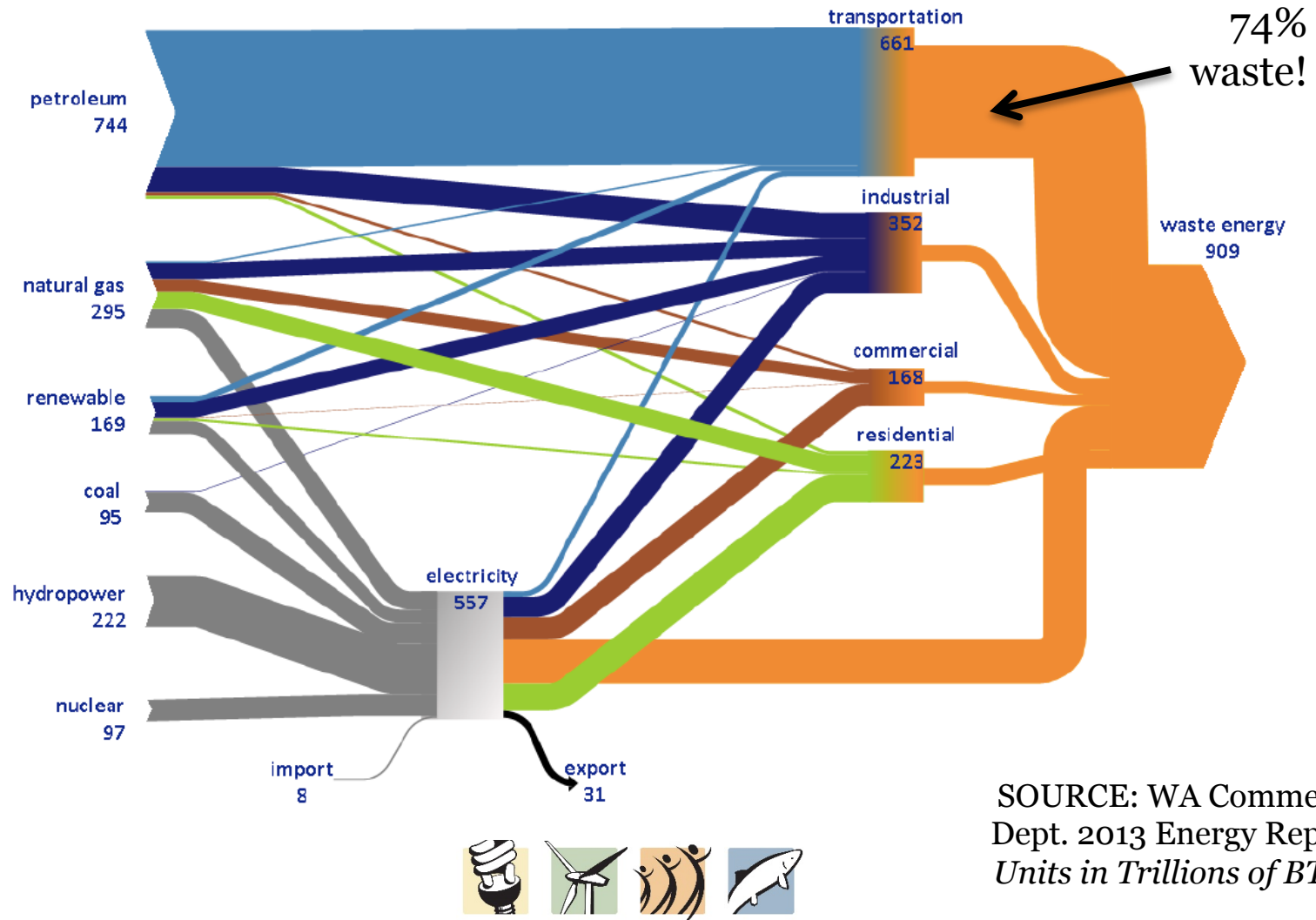
Vehicle Type	RIM Test NPV Benefits Per Vehicle (Lifetime)
Battery Electric Vehicle (BEV)	\$1,250
Transit Bus	\$120,505
Forklift	\$14,668



SOURCE: SCL/E3 "Transportation Electrification" Nov. 2015

Benefit #2 - Energy Efficiency

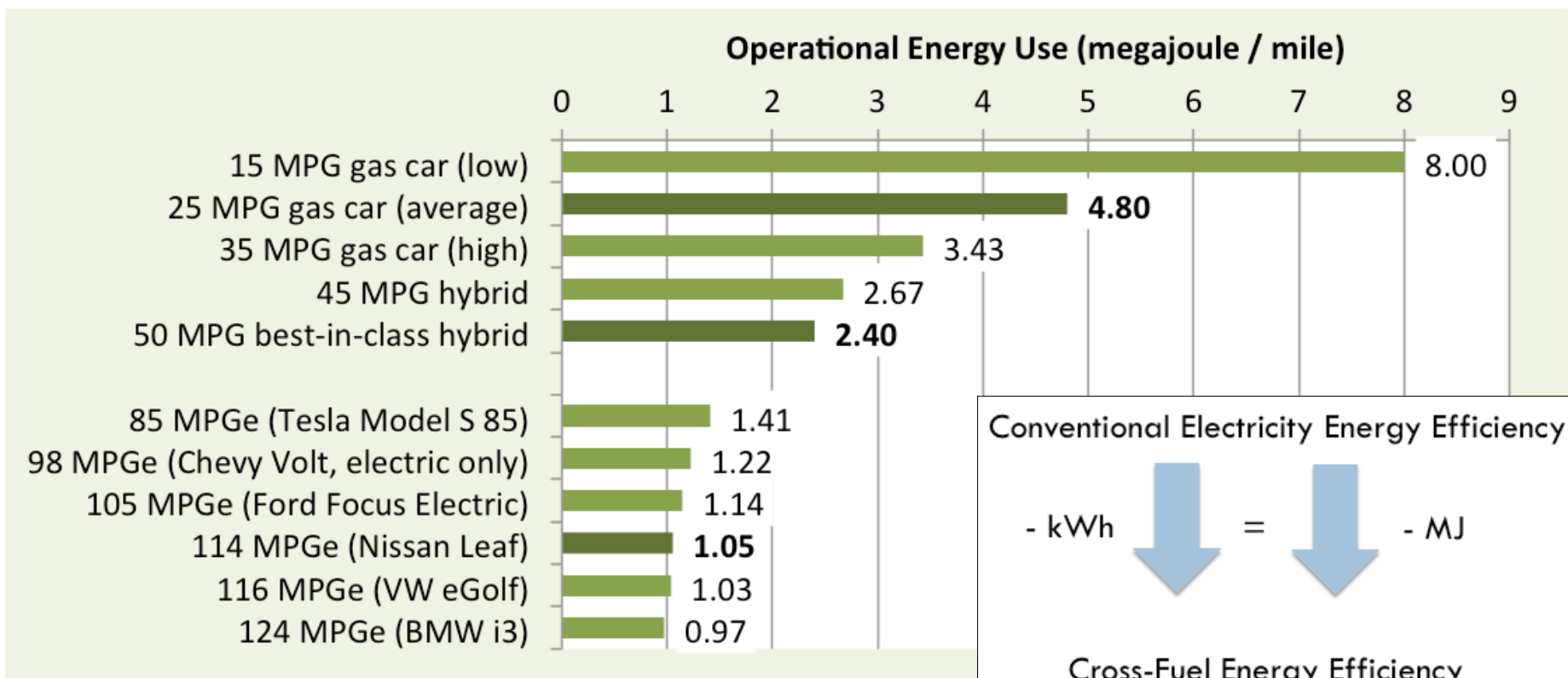
Transportation is the most wasteful sector of our economy



SOURCE: WA Commerce
Dept. 2013 Energy Report
Units in Trillions of BTUs

Cross-Fuel Efficiency

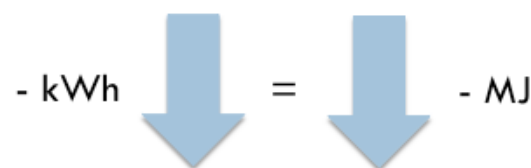
The electric motor lowers end-use energy consumption substantially



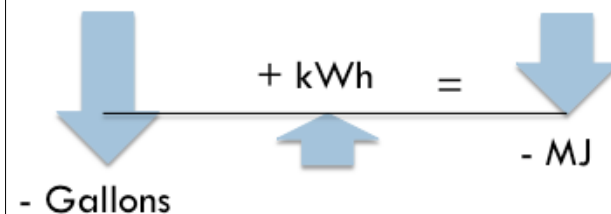
SOURCE: NWECC calculations using EPA fuel economy

1 gallon $\approx$ 120 megajoules $\approx$ 33.33 kilowatt-hours

Conventional Electricity Energy Efficiency



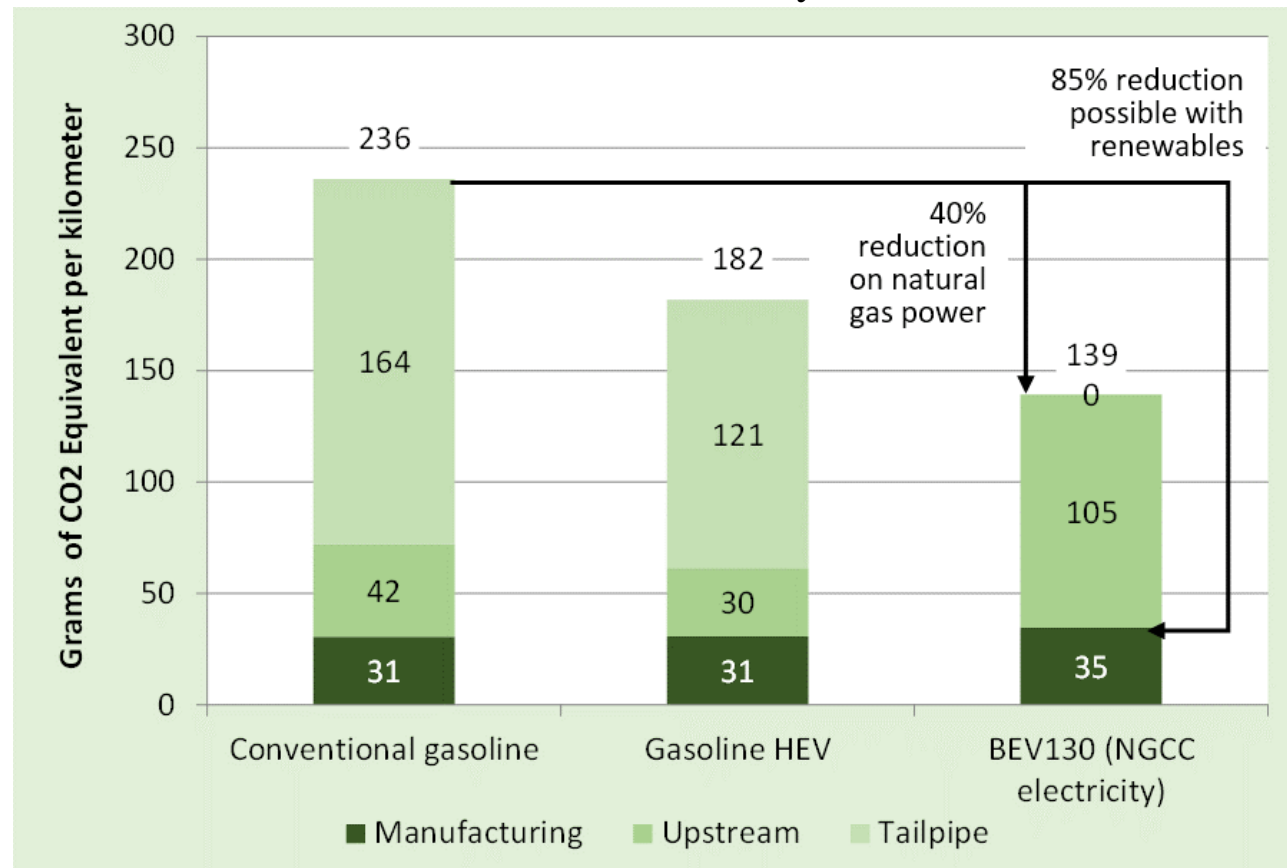
Cross-Fuel Energy Efficiency



Benefit #3 - Much Lower Carbon Emissions

- NW utilities have some of the best emissions performance for transportation with abundant hydropower, wind, etc.
- EPRI/NRDC estimate that it would take a gas car with 251 mpg performance to equal a BEV on Washington and Oregon's grid mix.

Full Lifecycle Emissions (g CO₂e / km)
Conventional Gas Car vs. Hybrid vs. EV



SOURCE: Adapted from Tong *et al*, 2015



Other Benefits

- **Air Quality** – Emission reductions of nitrogen oxides, ozone, fine particulates, all of which impact air quality and human health.
(EPRI/NRDC 2015)
- **Economic Boost** – Macroeconomic studies show that money saved on fueling and spent in pretty much any sector of the economy other than petroleum creates more jobs and economic activity in the local economy. Cost savings and economic gains are similar to gains from EE.
(Berkeley 2012 / Keybridge 2015)
- **Fun!** – EVs have great torque, awesome acceleration, and operate very quietly. Most drivers who try electric never want to go back to a gasser.



Ancillary Material



More resources:

- NW Energy Coalition website <http://nwenergy.org>
- Coalition's resolution in support of a greater utility involvement in transportation electrification. <http://bit.ly/1RD4YOU>
- Coalition research paper with additional figures and citations <http://bit.ly/1WaJUkN>
- CalETC utility consortium research on TE approaches, benefits, grid impacts, and ratepayer impacts. <http://www.caletc.com/caletc-research/>
- Avista EV charging proposal docket at WA Utilities & Transportation Commission <http://1.usa.gov/23eXMfW>

Contact:

JJ McCoy

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206-295-0196



Charging Rates

Charging Mode	Power Rating	Range added	Pros	Cons
Level 1 AC	1.4 kW	4 miles in an hour	Cheap. Works for long dwell times.	Slow. Takes >1 day to fully charge a BEV.
Level 2 AC	3.3, 6.6, 10, or 19.2 kW	12, 20, 35, or 75 miles in an hour	Faster. Standardized.	Expense of charging station and electrical supply. Larger demand.
DC Fast <i>3-phase</i>	24, 50, 100, 150 kW	35, 65, or >100 miles in <30 minutes	Fast. Enables intercity trips.	Very expensive. Standards war (CHAdemo, CCS, Tesla). Large demand.
Bus Transit on route overhead	Up to 500 kW	>20 mi in about 6 minutes	Enables quick re-fuel at start of route.	Expensive installation. Very large demand.

Key Term: Electric Vehicle Supply Equipment (EVSE)



Toward a policy framework for TE

Multiple states legislated TE policies for utilities in 2015 / 2016.

- **California SB 350**

- Tasks utilities with furthering TE. Writes environmental benefits and efficiency gains into ratepayer interest definition. Tasks utilities with planning for state carbon and air quality goals in their IRPs.

- **Vermont Act 56**

- Creates a rate-funded “energy transformation” program to reduce fossil fuel use by utility customers. Menu of approaches includes charging and vehicle incentives.

- **Washington HB 1853**

- Allows IOUs to install vehicle charging infrastructure behind the customer meter and earn an incentive rate of return, up to a 0.25% rate impact cap. Avista pilot proposal recently approved by UTC. Many open policy questions remain.

- **Oregon SB 1547**

- Directs utilities to achieve ratepayer and environmental benefits with TE programs. Oregon PUC currently in rulemaking. Utilities to file TE plans by 12/31/2016.



PANEL ON ELECTRIC VEHICLES

BRIEF OVERVIEW OF NW UTILITY ENGAGEMENT AND OREGON POLICY UPDATES

MORRIS
ENERGY CONSULTING

KEY TOPICS

- Overview of Utility Engagement with EV in the NW
- Oregon Policy that will impact EV Adoption
- Market Transformation Approach to EV in the NW

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UTILITY ENGAGEMENT WITH EV IN THE NW

CURRENT AND FUTURE OFFERINGS

- Puget Sound Energy
- Avista
- EWEB

EDUCATION AND OUTREACH

- Idaho Power
- Seattle City Light
- PGE

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CURRENT & FUTURE OFFERINGS

Puget Sound Energy

- Incentive Charger Rebate
- \$500 for a Level 2 charger installed at a residence
- Maximum of 5,000 chargers and so far 1,000 have been installed

Avista

- Mixed Building Type EV Charger Pilot Program accepted by the WAUTC
- Maximum of 265 Level 2 chargers
- Smart chargers and Fast chargers will also potentially be included

EWEB

- Participating in a local bulk buy program in conjunction with a local dealer, University of Oregon and Nissan.



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EDUCATION & OUTREACH

Utilities providing key messaging to customers on the benefits of electric vehicles and resources to learn more about electric vehicles:

- **Seattle City Light**
 - Tips for customers that live in multifamily buildings
- **Idaho Power**
 - Time of use power rates
- **PGE**
 - Electric Avenue



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OREGON POLICY ON EV

Oregon Clean Fuels Program

Electricity counts as a clean fuel

Electric Utility are Credit Generators- An electric utility can generate credits, potentially for both residential and commercial charging stations.

Clean Electricity and Coal Transition Plan

AR 599- Applications for Transportation Electrification Programs

Rules are in process of finalization for PGE, PacifiCorp and Idaho Power on their long term electric vehicle strategy. Must be filed by 12/31/16.

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MARKET TRANSFORMATION OF THE TRANSPORTATION SECTOR

- Transportation is the largest industry in the Northwest with the most carbon emissions and it is the least energy efficient.
- We have an opportunity to address the transportation sector with decades of experience using the MT model to unlock long terms savings.
- Utilities can and should be at the center of this MT effort.
- Will require significant work with auto dealers, auto manufacturers, battery manufacturers and property owners. We have the track record and we can create deep savings in the transportation sector by working together.

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