Memo

City of Kelowna

Date: June 15, 2011

File: 1350-70

To: City Manager

From: R. Cleveland, Director, Infrastructure Planning
Report prepared with assistance of M. Tripathi, Traffic Engineering Technician

Subject: Neighbourhood Zero Emission Vehicles & Conventional Electric Cars
(SR #177189 and #192435)

Recommendation:

THAT Council receives, for information, the Report from the Director, Infrastructure Planning dated June 15, 2011 with respect to Neighbourhood Zero Emission Vehicles & full function Electric Cars;

AND THAT Council directs staff to report back to Council with amendments to Zoning Bylaw No. 8000 regarding the provision of electric car charging stations in all new residential, institutional, commercial and industrial developments;

AND THAT Council directs staff to submit a business case regarding options for electric vehicle charging facilities in key public locations and gas stations including the capacity of the local Fortis BC electrical grid to support market penetration of electric vehicles;

AND THAT Council directs staff to issue full function "electric cars" free "eco-pass" parking permits for downtown metered parking spots until such time that they have achieved reasonable market acceptance;

AND THAT Council directs staff, in the up-coming submission to renew the eco-pass program, provide an administrative mechanism to determine when "eco-pass" incentives are no longer required to promote fuel-efficient or non-renewable fuel vehicles;

AND FURTHER THAT Council directs staff to submit capital budgets for City-owned electric fleet vehicles (new and replacement) as appropriate.

Purpose:

COUNCIL RESOLUTION FROM THE AUGUST 23, 2010 P.M. REGULAR MEETING (SR #177189):

> THAT Council directs staff to report back with strategies to reduce car dependency in Kelowna and to improve Kelowna's rating for injuries and fatalities per vehicle kilometer; AND THAT Council directs staff to provide a map of the municipal roads that Neighbourhood Zero Emission Vehicles can operate on; AND THAT Council directs staff to report back to Council with recommendations regarding revisions to the City of Kelowna Zoning Bylaw No. 8000 to require electric recharging facilities in new multi-residential, commercial and industrial developments; AND FURTHER THAT once the above information has been considered by Council, Council will consider a bylaw for the operation of Neighbourhood Zero Emission Vehicles.

COUNCIL DIRECTION FROM THE APRIL 4, 2011 A.M. REGULAR MEETING (SR #192435):

> THAT the City Manager will look into the Service Request with respect to electric vehicles and report back to Council with an expected timeline.

Background:

This report is a follow-up and expansion of the scope of the previous report regarding "Electric Cars-Neighbourhood Zero Emission Vehicles (NZEVs)" dated July 20, 2010.

There is a growing demand for alternatives to the conventional fossil fuel powered passenger vehicle for many reasons, including but not limited to the following:

- the increasing cost of gasoline/diesel fuels and the greater political demand for energy security;
- the climate change impacts of Greenhouse Gas (GHG) emissions (in Kelowna 65% of GHG emissions are the result of on-road transportation, with building and industrial process energy as well as landfill emissions accounting for the remainder);
- the health impacts of driving that include air pollution related diseases and obesity;
- the increasing public cost of road infrastructure and the personal erosion of disposable income attributed to driving;
- the growing ineffectiveness of road building in counteracting congestion and grid-lock;
- the negative impact of vehicular traffic on the livability and safety of cites.

Both *demand* and *supply* management initiatives are being undertaken by the City. The *demand* initiatives include land use intensification and the encouragement of modal splits favouring sustainable transportation. The *supply* initiatives are focused on vehicles with cleaner propulsion technologies and higher fuel efficiency. Over time, these 2 sets of initiatives, along with increased fuel costs, changing demographics (both young and old are choosing alternative transportation) and regulatory and economic incentives/penalties to decrease GHG emissions, will collectively reduce Kelowna's car dependency. This will require patience as well as consistent investment and progressive decision-making.

Demand-side: The 2030 Official Community Plan (OCP) Chapter 7 makes it clear that public investment and programming for demand-side initiatives will be directed towards land-use designations that favour compact, livable, mixed use communities which in turn encourage trips to work, shopping and recreation by walking, biking, public transit, car-pooling, and then single occupancy vehicles, in that order. It is recognized that realistically, most residents will often need to choose a balanced variety of these transportation options. The 2030 - 20-year Servicing Plan and Financing Strategy will implement a number of infrastructure changes (traffic diversions to spread the load across the existing road network, more articulated road cross sections to accommodate multiple transportation options, increased facilities for walking and biking including a new multi-use pathway arterial system, etc.) to support these policy directions. The systematic integration of parking policy and infrastructure with sustainable transportation principles is still in early stages of development.

Supply-side: Kelowna has provided some incentives to encourage cleaner vehicles with reduced emissions of air pollutants and climate change gases, including eco-passes permitting free downtown parking for qualified vehicles such as Smart cars and hybrids.

The emergence of a new line of vehicles that are either fuel efficient or replace the need for gasoline with alternative fuels (ethanol and other bio-fuels, Compressed Natural Gas, etc), electricity, hydrogen, or some combination is clearly on the increase. The SMART car, hybrids, the light duty electric "neighbourhood zero emission vehicles" (NZEVs; e.g. Dynasty EV, ZENN, etc.), plug-in hybrid electric vehicles (PHEVs; e.g. Chevy Volt) and now full-function electric vehicles (EVs; e.g. Nissan Leaf, Tesla Model S & Roadster) signal that the trend toward alternative technologies is gaining momentum.

The "Assessment of Future Vehicle Transportation Options and Their Impact on the Electric Grid" (January 10, 2011, p.43) by the US Department of Energy states, following a thorough examination of the alternatives and various classes of electric vehicles (NZEVs, EVs, etc.), that "EVs hold perhaps the most significant promise for future development, particularly in the context of a Smart Grid supplied with renewable energy...EVs present the most complete overall package in terms of economics, performance, usability, and environmental sustainability." The ongoing question will be what further supply-side initiatives can and should Kelowna engage to encourage market acceptance of more environmentally benign vehicles. This report will address both classes of electric cars: NZEVs and EVs.

NZEVs:

On June 6, 2008, the British Columbia Motor Vehicle Act Regulations (MVA) were amended to include a definition for neighbourhood zero emission vehicles (NZEV). The safety requirements for NZEVs are regulated by the same standards as outlined by Transport Canada for low speed vehicles (LSVs). They are low weight (less than 1,361 kg), powered by an electric power train, and do not use fuel as an on-board source of energy. Low speed electric vehicles are federally regulated to travel at a max speed of 40 km/hr, and typically these vehicles have a range of approximately 60 km before requiring a recharge. This range addresses the 2-way daily commuting needs of the average Canadian.

As part of the MVA amendment, the BC Ministry of Transportation (MoT) now allows Municipalities to permit (via bylaw) NZEVs to travel on roads within their municipal boundaries with speed limits above 40 km/hr, but not greater than 50 km/hr.

Recently the communities of Oak Bay, Esquimalt, Sidney, and Colwood on Vancouver Island, the Resort Municipality of Whistler and the Cities of Vancouver, Port Coquitlam, Burnaby have each drafted bylaws to take advantage of this new opportunity. The previous report to Council provided a draft bylaw No. 10398 (see Annex 1 for a revised draft bylaw) for the introduction of NZEVs into Kelowna, but recommended that the safety of these vehicles in the mixed traffic found on Kelowna's road network did not support their introduction at this time. It also provided a research summary of *Safe Integration of Electric Low Speed Vehicles on Ontario's Roads in Mixed Traffic by* Ontario Ministry of Transportation & the National Research Council of Canada and background information on relevant sections of the Motor Vehicle Safety Act (Canada) and the Motor Vehicle Act Regulations, BC.

Transportation Association of Canada (TAC) studies indicate that Kelowna has the highest injuries and fatalities per vehicle kilometer (2006 data) of any Canadian city of similar size and the third highest in Canada behind Vancouver and Oshawa. This is related to a very high rate of vehicle ownership and a relatively high percentage of large trucks/SUVs. ICBC reports that the highest accident incidents occur at many of the intersections along Highway 97 (see Annex 1a & 1b). It is the structure of our community, and especially the central connectivity corridors defined by Highways 97 and 33, as well as the many main City arterials with speed limits in excess of 50kph that will limit the potential uptake of NZEVs across our community. The Motor Vehicle Act very clearly defined the scope of opportunity available to local governments in terms of enabling the broader use of NZEVs. While NZEVs can cross Highway 97 (south of Sexsmith Road) and Highway 33 (west of Gallagher Road) where posted speeds are less than 80kph, they are clearly not permitted to travel along the Provincially-controlled highways. This limits the movement of NZEVs to cross Highways 97 and 33 at specific intersections shown in Annex 2. This will also reduce the overall practicality of these vehicles within our community. Despite this, medium to large fleets based in the city area (including municipal operations, UBCO) and second car buyers of in-city-commuter cars might wish make use of this new opportunity.

The primary concern with NZEVS is that they travel in the same lane as other mixed traffic including heavy and light duty trucks, and all sizes of cars and SUVs, but they have lower legal safety standards. The probability of injury in accidents would be higher, but within the risk tolerance of the City. The following could be done to facilitate the safe movement of NZEVs in mixed traffic:

1. Provide warning signage regarding intersections where NZEVS are not permitted to cross Provincial highways and along municipal roads with posted speeds in excess of 50kmh (See Annex 3: this would include parts of Gordon, Benvoulin, Springfield, Swamp, De Hart, Chute Lake Road, McCulloch, East Kelowna, Byrns, Glenmore, KLO, Spiers, Clement, Dilworth, Rifle, Sexsmith, Old Vernon); and/or
2. Require owners of NZEVs to register their cars with the City (One Window Application Center) where they would be provided a copy of the Bylaw, advisory maps and specific advice on the special rules of the road for NZEVs;
3. Require that all NZEVs post orange "slow moving vehicle" signage on the rear of the vehicle to help reduce rear-end collisions (these could be provided to NZEV owners by the City with the registration of the vehicle);
4. Reduce the speed limit from 60 to 50kph on key City arterials to improve inter-city NZEV access, especially to Glenmore, Rutland, Black Mountain and South-east Kelowna, recognizing that

changing the posted speed does not necessarily change the actual speed driven;

- Note that there are significant capital and O&M costs to implement these actions and that action #4 above could have significant traffic implications.

EVs:
Consumer preferences for their principle car includes (1) safety equivalent to contemporary conventional vehicles, (2) a travel range of 480 km between re=-fueling and (3) a life-cycle cost/km roughly equivalent to current conventional internal combustion gas/diesel cars. The Chevy Volt PHEV (544km range) already achieves this, but the pure battery-powered EVs are still closer to the 160km range (Nissan Leaf), although research is quickly addressing the battery storage/weight conundrum to increase their range. The life cycle cost is provided in the following table (DOE, 2007, p.24). It assumes fuel costs at $2.60/gal, an electricity cost of $0.10/kWh, a vehicle life of 160,000km without major repair, and a $7,500 tax rebate on the vehicle cost (as provided in the US), and shows that the life cycle cost of the EV is already comparable to conventional internal combustion engine cars. Note that fuel costs in Canada are already twice the price assumed in the DOE model, further improving the cost-effectiveness of the EV relative to the gas car.

Vehicle	Capital Cost (US$- MSRP)	Capital Cost ($/mile)	Average $/mile fuel expense	Total cost ($/mile)
Chevy Volt (PHEV)	$41,000	$0.335	$0.02 - $0.048	$0.355 - $0.483
Nissan Leaf (EV)	$32,780	$0.252	$0.012	$0.274
Chevy Cruze	$17,000	$0.170	$0.065	$0.235

More importantly, EVs are achieving safety test results that exceed conventional internal combustion cars, and require no special permits for operation on any municipal streets or highways.

Electric Utility implications: A 2007 study by Kintner-Meyer et.al. ("Impacts assessment of Plug-In Hybrid Vehicles on Electric Utilities and Regional U.S. Power Grids") shows that 52% of U.S petroleum imports can be replaced by PHEVs without upgrading the current electric grid given non-peak load recharging practices. This is equivalent to the fueling of 158 million vehicles and a 27% overall reduction in CO_2 emissions. A 2008 study by Schneider, et.al. indicated that the northwest US distribution grid can support 18% penetration of PHEVs in its current form. A 2010 study by the Boston Consulting Group ("Batteries for Electric Cars, Challenges, Opportunities, and the Outlook to 2020") projects that North America will have achieved a 43% penetration of CNG, EV, and PHEVs by 2020. Considerable research and investment are being devoted to Smart Grid technologies to remotely control battery recharging to occur during off-peak load times and reduce new electric grid investments. In addition, research is being directed toward 'vehicle-to-grid' applications to use stored energy in EVs to supplement the grid during peak demand load times and provide additional revenue to the EV owners. EVs are projected to achieve remarkable market penetration over the next 10 years and if so, should be the focus of the City's long-term encouragement. It is expected that the advent of a competitive EV market, despite a higher price point than NZEVs, will dramatically reduce the appeal of the NZEVs for many customers. This trend in EVs and PHEVs requires an examination of the City's role in recharging facilities (the electricity equivalent to the gas station) considering local market conditions which could include licensing recharging operations in city right-of-ways or licensing off-road stations.

There are 3 battery charging levels based on currently available technologies and batteries: Level 1 (basic, 120V/15A plug, 16-18 hour charge time for the Nissan Leaf, already available in single family residential properties), Level 2 (conductive or inductive, 240V/40A, 7 hour charge time for the Nissan Leaf, suggested for new residential installations, ≈$1500 installed), Level 3 (480V/50-60A, 3 phase, 15-26 minute charge time for the Nissan Leaf, street kiosk, ≈$8-15,000 installed). Charging facilities would most likely be used at home during the night given appropriate utility price signals, but can be provided at places of work, at commercial recharging stations or at street parking stall or off street parking lot kiosks.

A number of contractors have been licensed to resell electricity for publicly accessible recharging networks. Viridian Power, an electrical contractor with a strong interest in sustainable practices, and Rapid Electric Vehicles of Vancouver (REV) have entered a partnership as Charge Northwest to build the infrastructure for the deployment of electric vehicle charging stations in Canada and provide the necessary

maintenance to Coulomb Chargepoint™ charging stations. On May 30, 2011, Surrey City Council passed an innovative new fuel initiative directing staff to develop a bylaw so that all new service stations in Surrey would be required to provide at least one alternative fuel source, such as hydrogen, compressed natural gas, or electric vehicle recharging, in addition to conventional gasoline, diesel and propane energy.

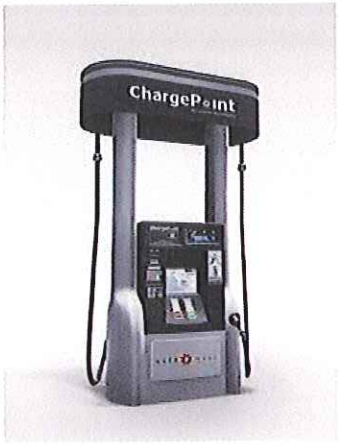


Figure 1: Commercial Level 3 charging stations

Figure 2: Residential Level 2 charging station

Existing buildings can be retrofitted to accommodate charging stations based on demand, with Level 1 being sufficient for NZEVS, but Level II being recommended for EVs. New development (residential, institutional, commercial, and industrial) could be required through the zoning bylaw to provide the rough-in and supply infrastructure for Level 2 charging stations for up to 50% of parking stalls by 2020 based on anticipated EV market penetration. Staff would need to investigate the business case for the options to provide publically accessible charging stations at public on-street parking stalls and parkades, and at commercial service stations, considering the capacity of the local Fortis electricity grid and local market dynamics.

Other incentives to encourage market penetration could include: eco-passes for free downtown parking, consideration for subsidized Level 3 recharging facilities at specific locations (an 80% battery charge is expected to cost about $2.25, but the capital investment is considerable), or vehicle purchase rebates as already provided in the USA (funding source not yet identified).

Internal Circulation:

Director, Civic Operations
Director, Corporate Services
Director, Real Estate & Building Services
City Clerk
Manager, Risk Management
Building & Permitting Branch Manager

Legal/Statutory Authority:

Regarding NZEVs:
The BC Motor Vehicle Act (amended June 6, 2008) permitted the Ministry of Transport to give municipalities the authority to create a bylaw which would allow NZEVs on streets with posted speed limits above 40kmh but no greater than 50 kmh. Kelowna's Traffic Bylaw No. 8120 makes no specific provisions for NZEVs. The proposed Bylaw No. 10562 in the Alternative Recommendation is consistent with the provisions of applicable legislation (further details were provided in the Council Report received on August 23, 2010), and exceeds the bylaws of other BC jurisdictions regarding registration and slow-moving vehicle signs.

Regarding EVs:
The City Parking Bylaw currently does not contemplate the operation of third party recharging vendors in the street right-of-way. The 2030 20-year Servicing Plan and Financing Strategy supporting the proposed 2030 OCP does not include electric recharging stations as part of any proposed road cross-section.

Existing Policy:

Kelowna's Corporate GHG reduction action plan for 2020 anticipates that a considerable part of its reductions will be achieved through more fuel efficient and electric vehicles in its fleet where appropriate. A federal gas tax grant application has been submitted to assist in the transition to lower GHG emissions.

Financial/Budgetary Considerations:

Eco-passes: Eco-passes issued for Smart cars and hybrids have increased from 93 to 103 over the last 2 years at a parking revenue loss to the City of approximately $20,000. It is suggested that these vehicles have successfully achieved market penetration and that their eligibility for eco-passes could be reconsidered with the expiration of the current program at the end of this year. It is also suggested, however, that eco-pass eligibility for EVs and PHEVs be implemented at this time.

Regarding NZEVs:

- Public communication and road signage regarding NZEV travel restrictions (a budget will be submitted in future budgets)
- Slow-moving vehicle signs at $30 each to be provided to vehicle registrants as an incentive along with specific guidance on the rules of the road including advisory maps.

Regarding EVs:

- A network of recharging stations could be provided either through a private contractor or by the City at specific on-street or off-street parking stalls or parkade locations at a cost of from $10,000 to $50,000 depending on the recharge speed (level 2 or 3), payment options and other customer amenities. Further study is required to understand the interest of 3rd party providers in the Kelowna market. Further study is also needed regarding a bylaw requiring service stations to provide alternative fuels.
- At the very least, an electric recharging facility would be required to service City-owned electric vehicles.

Personnel Implications:

The following additional work would need to be done by staff:

Regarding NZEVs:

- Develop amendments to the zoning and development bylaw for appropriate recharging stations in multi-residential, commercial, institutional and industrial developments; and
- Complete a needs analysis for the applicability of NZEVs in the City's corporate fleet and budget for new and/or replacement vehicles at the appropriate times.

Regarding EVs:

- Develop amendments to the zoning and development bylaw for appropriate recharging stations in multi-residential, commercial, institutional and industrial developments;
- Complete a needs analysis for the applicability of EVs in the City's corporate fleet and budget for new and/or replacement vehicles at the appropriate times.
- Complete research on the business case for publicly accessible re-charging stations; and
- Provide public communications on the location of public charging stations if and when provided by the municipality.

External Agency/Public Comments:

The RCMP and the BC Ministry of Transportation provided their concerns in conjunction with the previous report to Council.

Alternate Recommendation:

Staff recommends that the limited City corporate resources be prioritized toward supporting the introduction of full-function electric vehicles. Since Kelowna is trisected by two provincial highways and laced with a network of roads with speeds exceeding 50kph, NZEV safety remains a concern. Council has requested however, that after this report has been considered: "Council will consider a bylaw for the operation of Neighbourhood Zero Emission Vehicles." Bylaw 10562 has been drafted and will be submitted following this report. The key conditions of NZEV use provided in the bylaw are that the operator must:

- Observe all provincial laws including which roads and road crossings can be used;
- Register the Vehicle with the City to obtain the Bylaw and advisory maps; and
- Display a slow-moving vehicle sign when driving on roads and highways.

THAT Council gives reading consideration to Bylaw No.10562 being Amendment No. 18 to Traffic Bylaw No. 8120 regarding "neighbourhood zero emission vehicles" to be effective May 1, 2012;

AND THAT Council directs staff to invite dealers to showcase "neighbourhood zero emission vehicles" in Kelowna at the fourth reading of the proposed Bylaw No. 10562;

AND THAT Council directs staff to submit 2012 capital budget submissions for highway signs to advise NZEV drivers of roads and intersections where NZEVs are not permitted;

AND THAT Council directs staff to issue "neighbourhood zero emission vehicles" free "eco-pass" parking permits for downtown metered parking spots until such time that they have achieved reasonable market acceptance;

AND FURTHER THAT Council directs staff including Bylaw Services, to collaborate with ICBC and the RCMP, to monitor the use and impact of "neighbourhood zero emission vehicles" in Kelowna and submit an analysis of the success of the program for Council consideration in 24 months;

Considerations not applicable to this report:

Legal/Statutory Procedural Requirements:
Community & Media Relations Comments:

Submitted by:

R. Cleveland, Director, Infrastructure Planning

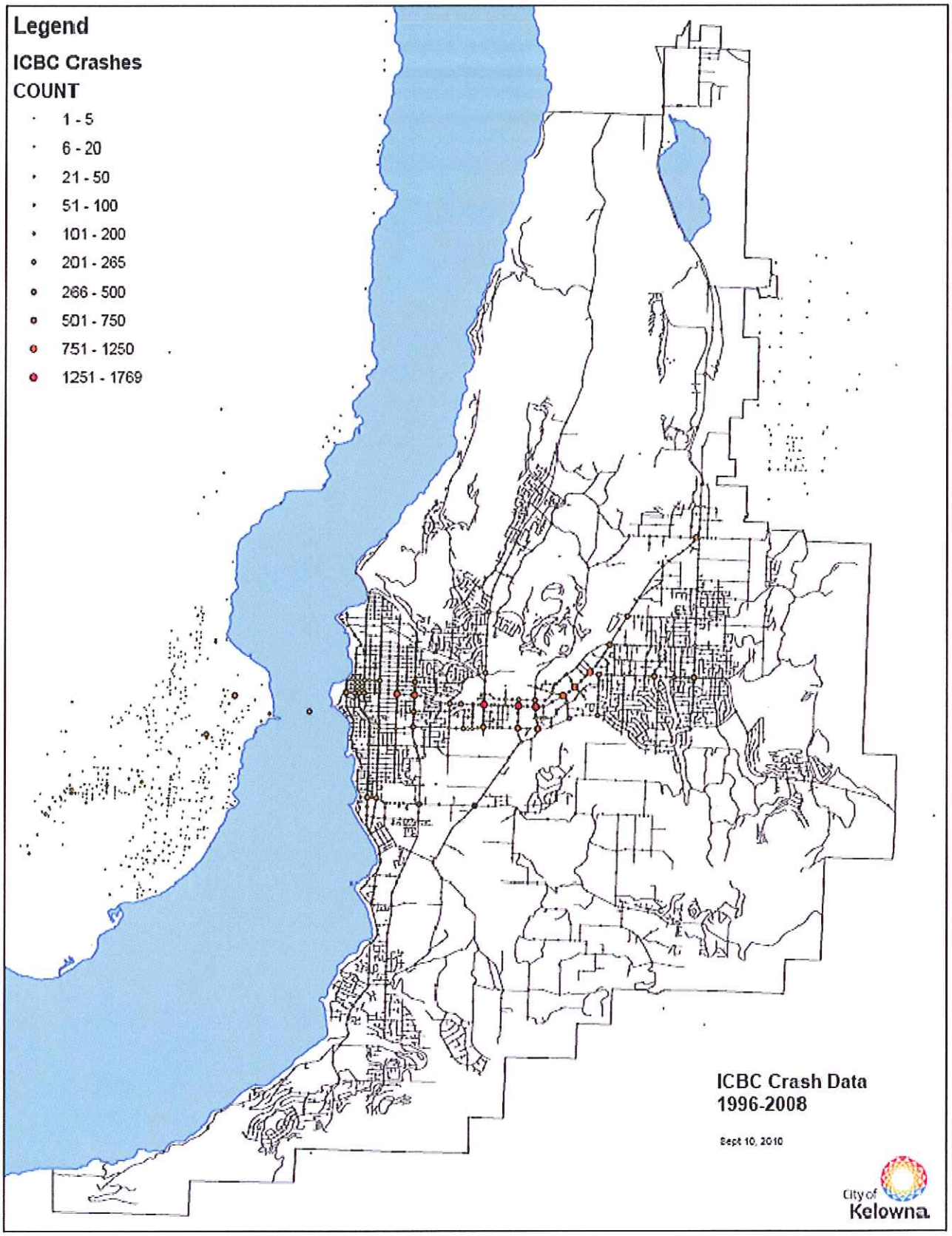
Approved for inclusion: J. Paterson, General Manager, Community Sustainability

Attachments

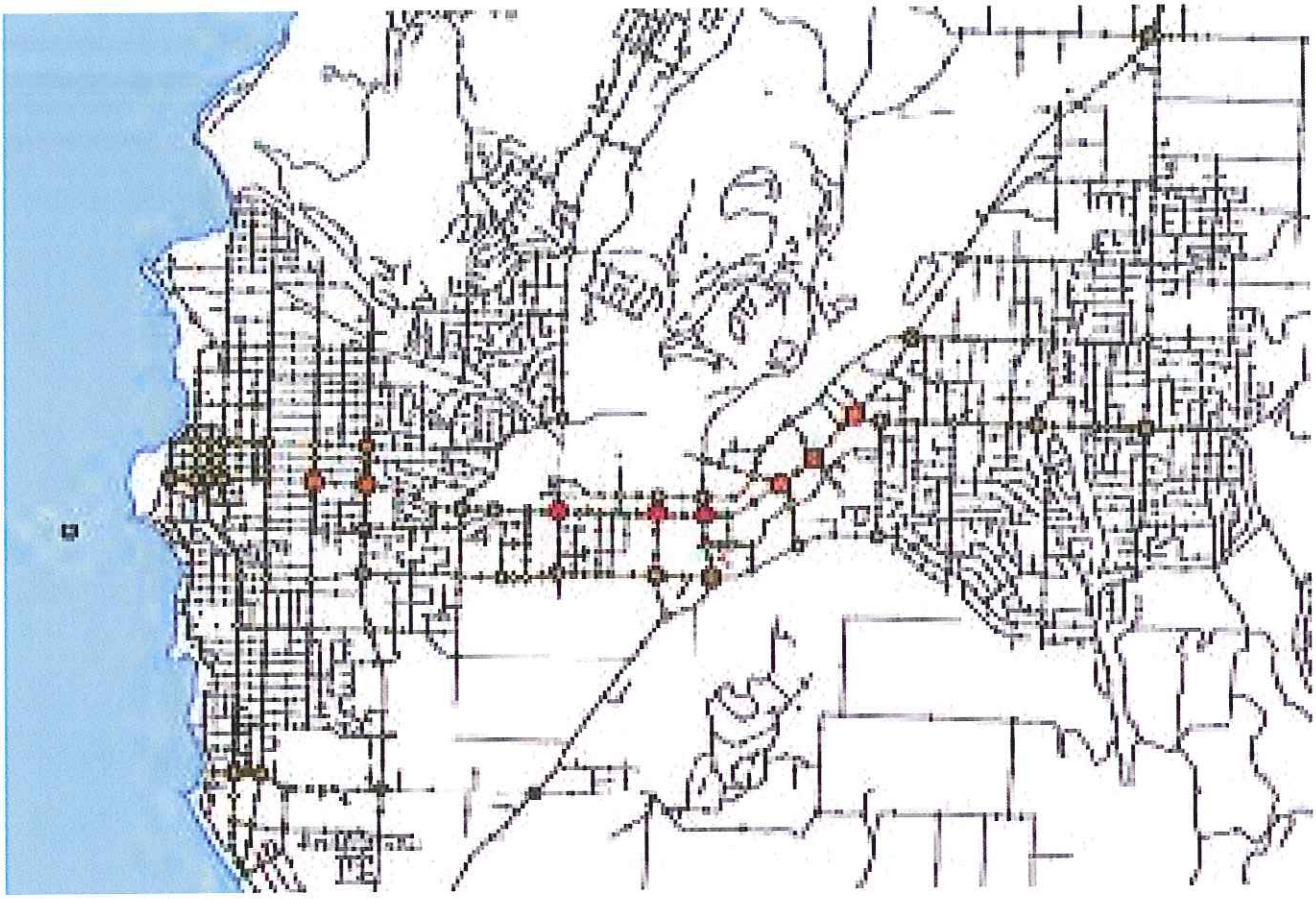
Annex 1a & 1b: ICBC Crash Counts in Kelowna, 1996-2008
Annex 2: Advisory Map for Low Speed Vehicles

cc: Director, Civic Operations
Director, Policy & Planning
Director, Land Use Management
Director, Corporate Services
Director, Development Services
Director, Community & Media Relations
Director, Regional Services
RCMP
ICBC

ANNEX 1a: ICBC Crash Counts in Kelowna, 1996-2008



ANNEX 1b: ICBC Crash Counts in Kelowna, 1996-2008 (detail)



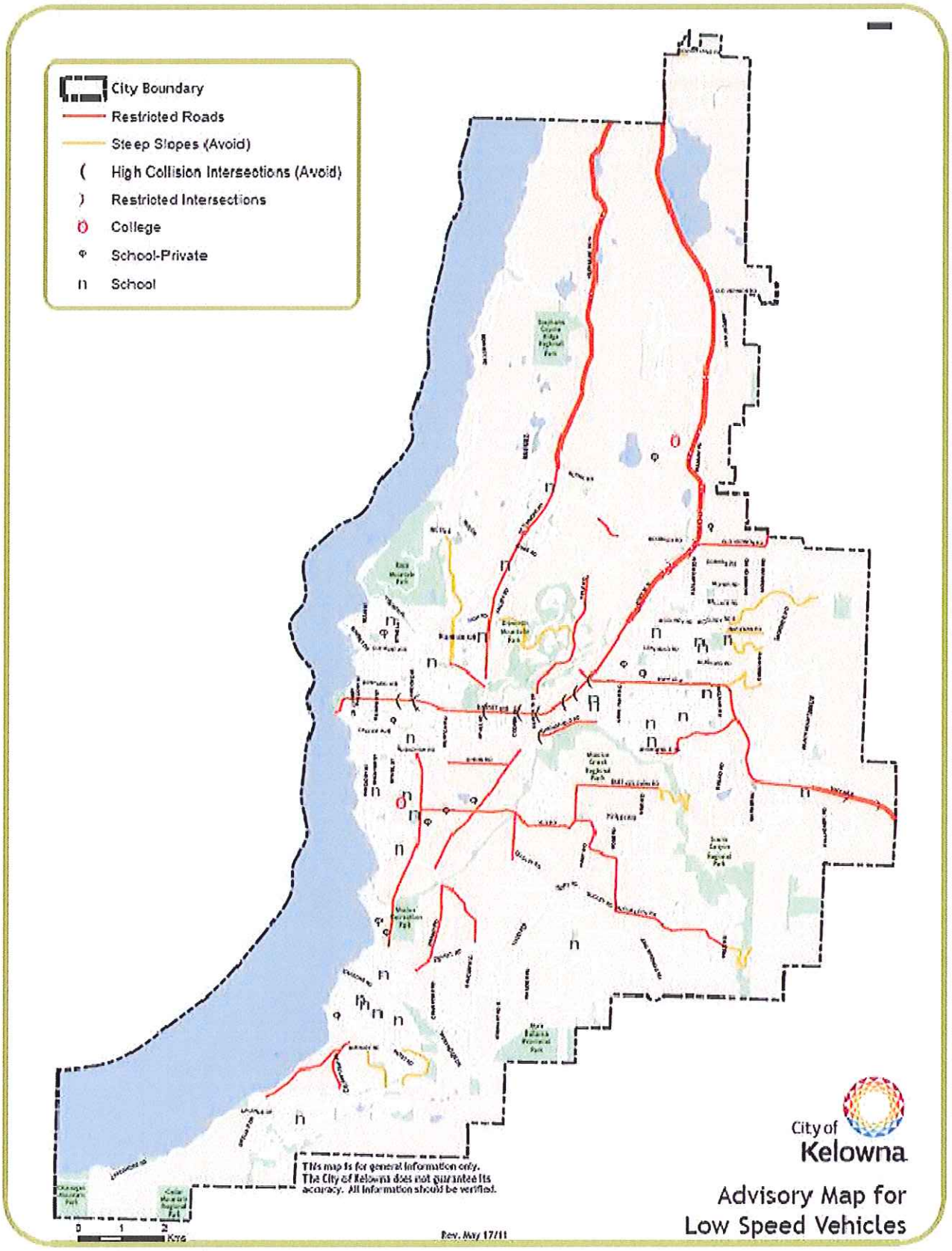
Legend

ICBC Crashes

COUNT

- 1 - 5
- 6 - 20
- 21 - 50
- 51 - 100
- 101 - 200
- 201 - 265
- 266 - 500
- 501 - 750
- 751 - 1250
- 1251 - 1769

ANNEX 2: Advisory Map for Low Speed Vehicles (including NZEVs)



NEIGHBOURHOOD ZERO EMISSION VEHICLES (NZEV) AND STANDARD ELECTRIC VEHICLES (EV)

City of Kelowna

Council Report, 2011.06.20

LIGHT DUTY VEHICLE PER CAPITA

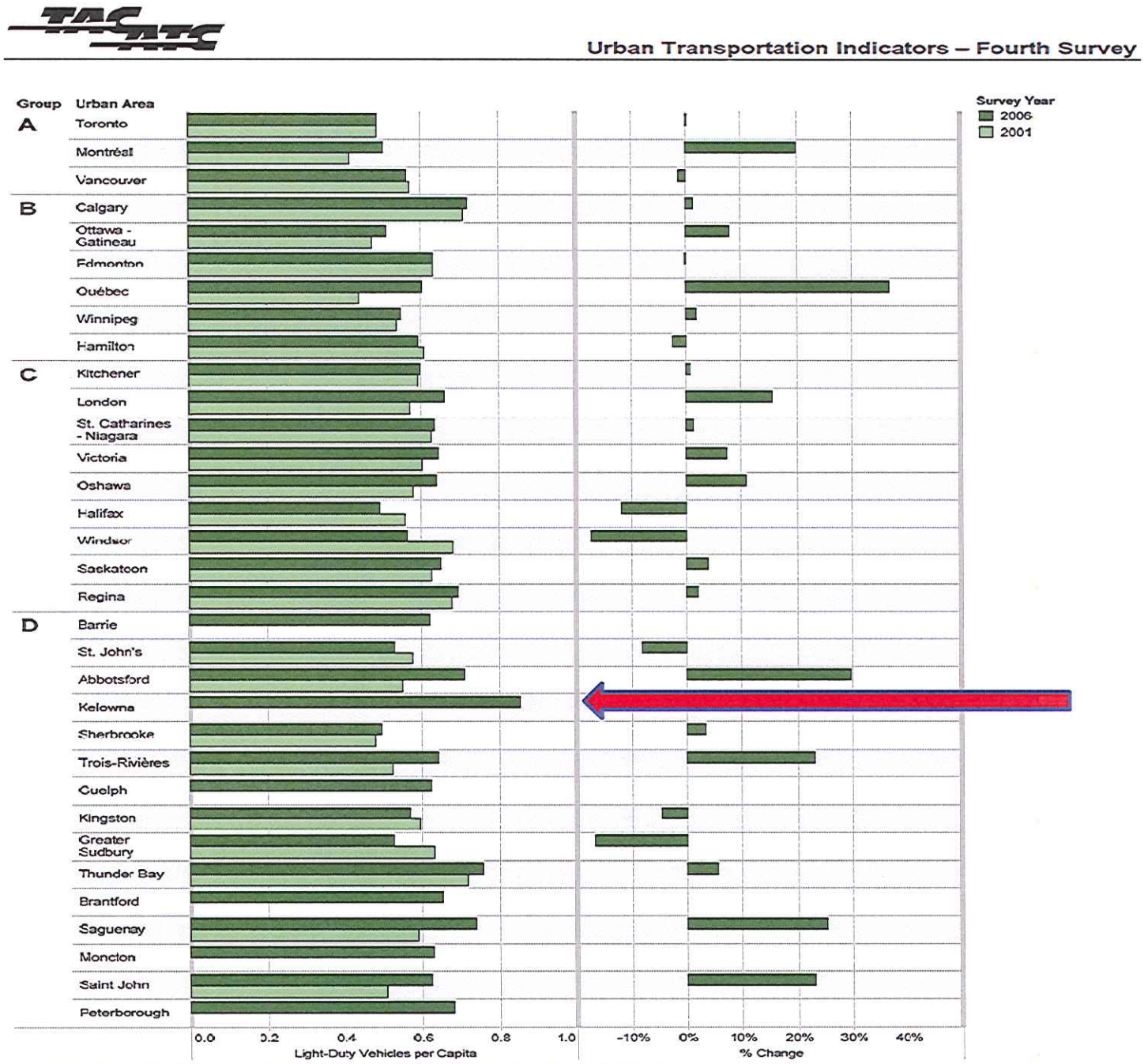


Exhibit 8.3: EUA Light-Duty Vehicles per Capita, 2001-2006 [41]

Source: Statistics Canada

CAR DEPENDENCY

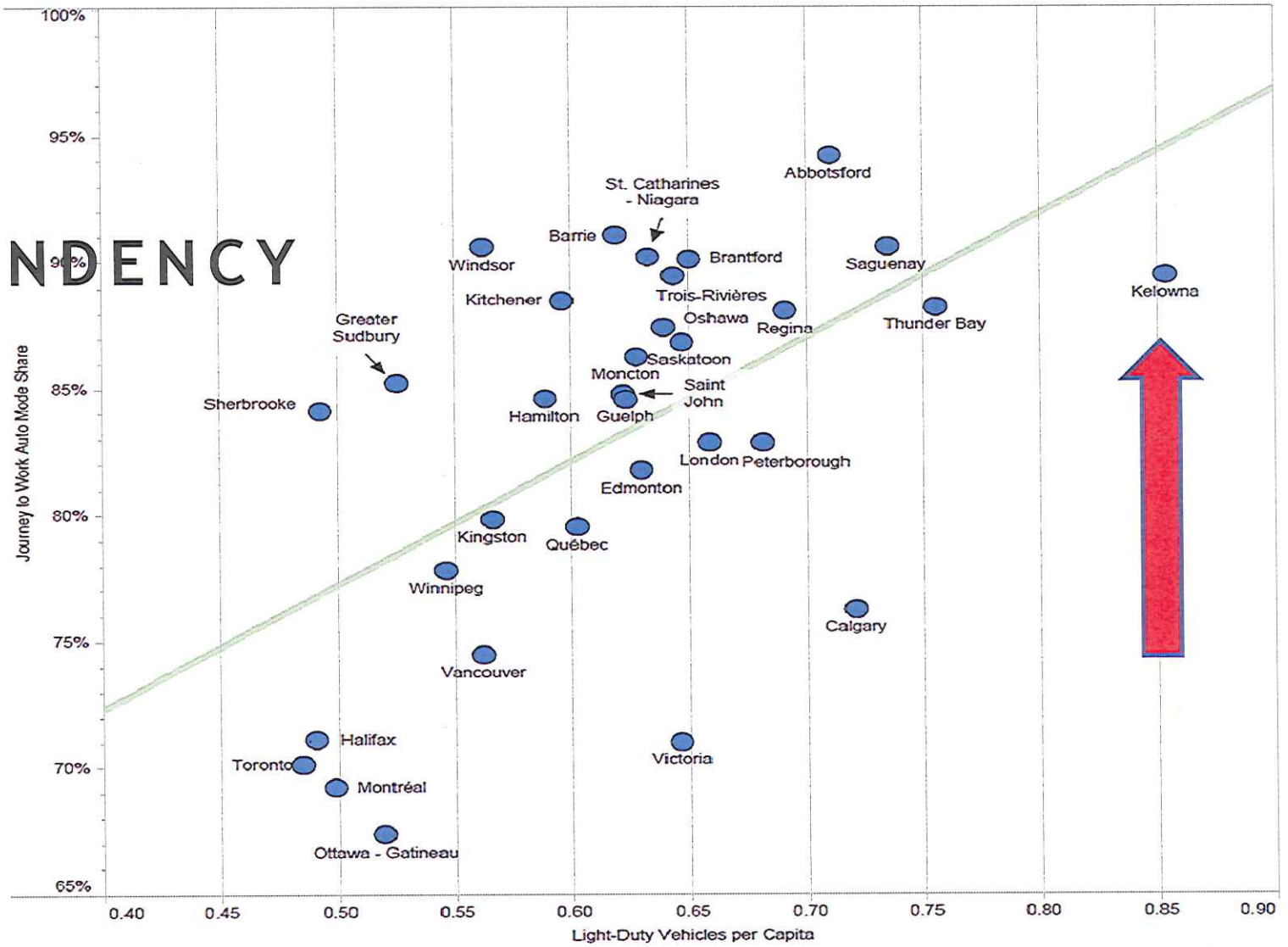


Exhibit 8.4: Trend in Light-Duty Vehicles per Capita and Journey-to-Work Auto Mode Shares, 2006 [42]

Source: Statistics Canada

INJURIES & FATALITIES PER VEHICLE KM

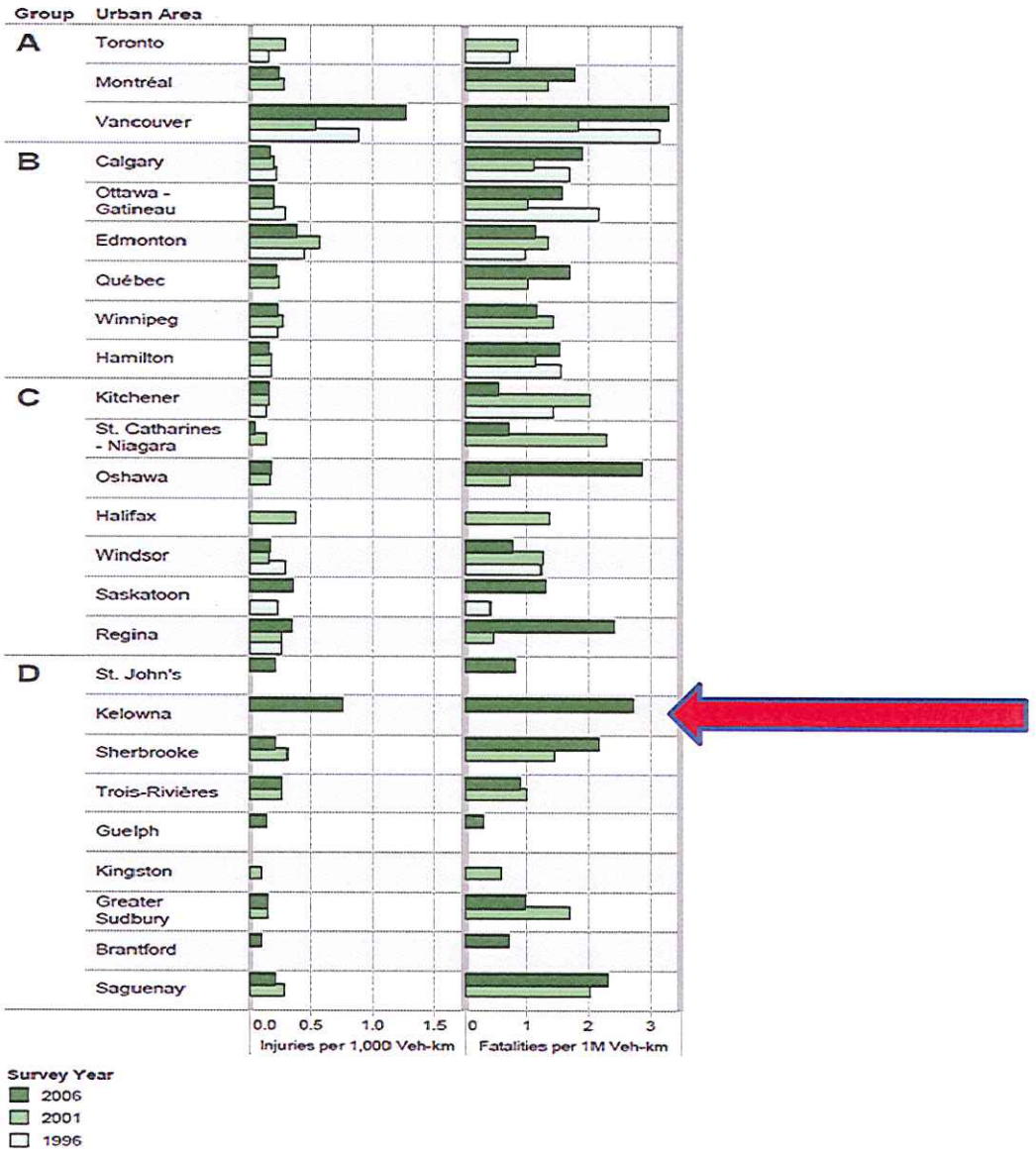
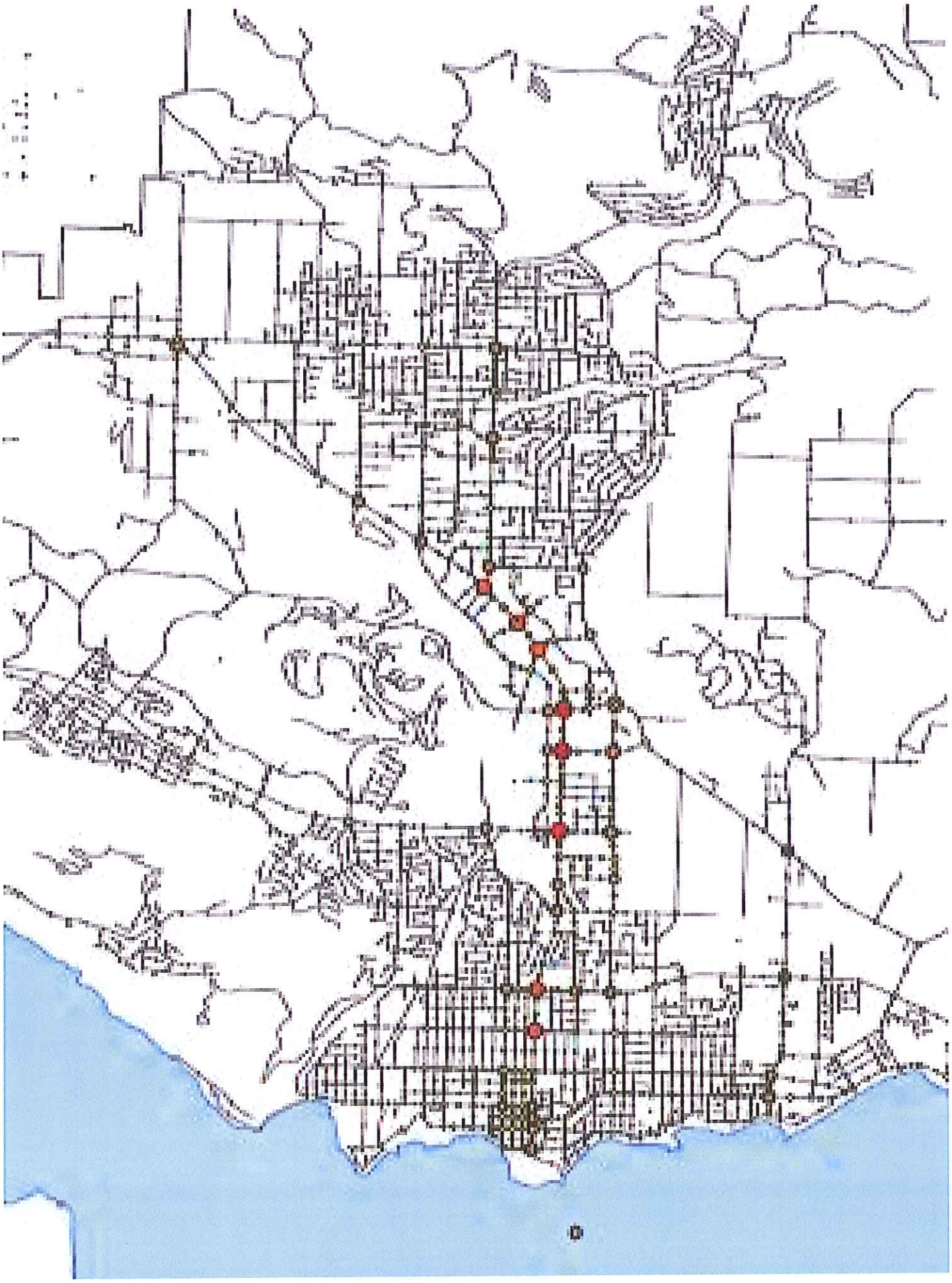


Exhibit 5.10: EUA Injuries and Fatalities per Veh-km, 1996-2006 [23]



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REDUCING CAR DEPENDENCY

- Demand-Side Initiatives
  - Intensified Land Use (mixed-use and density)
  - TDM (OCP, walking, biking, transit, carpool)
  - 2030-20 year Servicing Plan & Financing Strategy (traffic diversion, infrastructure optimization)
- Supply-Side Initiatives
  - Alternate propulsion technologies (Biofuels, Compressed Gas, Hydrogen, Electric, Hybrids)
  - Overlaid transportation choices, multi-use pathways

City of Kelowna

ELECTRIC CARS

- Neighbourhood Zero Emission Vehicles (slow moving vehicles): NZEV
- Full Function Electric Vehicles (EV) and Plug-in Hybrids (PHEVs)

WHAT IS A NZEV?

Federal Regulations :The Motor Vehicle Safety Act defines a Low Speed Vehicle(LSV):

- Designed for use on regulated roads
- Travels on 4 wheels
- Powered by an electric motor
- Does not use fuel as an energy source
- Attains a speed of 32 - 40 km/h
- Weighs less than 1361 kg

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WHAT IS A NZEV?

Canada's Motor Vehicle Safety Act states that LSVs must be self-certified by the manufacturer and be equipped with:

- Headlights
- Turning Signals
- Brake Lights
- Parking Brake
- Seatbelts
- Windshield
- Rear View Mirror

All NZEVs must be registered, licensed, and insured through ICBC. All operators must have a valid driver's license.

WHAT ISN'T A NZEV?

- Hybrid vehicles
- Flex Fuel vehicles
- Golf Carts
- Electric Scooters
- Electric Wheelchairs
- Smart cars
- Segway
- Motorized Scooter
- Motorized Skateboard
- Motor assisted bicycle

City of Kelowna

Provincial, not federal, responsibility to specify details of requirements, licensing, and use of NZEV's on public roads.

Currently, British Columbia, Ontario, and Quebec allow LSVs on streets.

The provincial regulations state that:

- NZEVs are allowed to travel on any road with a max speed limit of 40 km/h.
- NZEVs no longer have to display the LSVs flashing triangle.

- Individual municipalities are allowed to alter the bylaws to allow NZEVs on municipal roads with a maximum speed limit of 50 km/h.

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ADVANTAGES

- GHG emissions
- Transport cost
- Noise impact
- Infrastructure impact
- Initial cost ($12,000 to $25,000)

City of Kelowna

DISADVANTAGES

- Safety of "vulnerable users" in mixed traffic; enforcement
- Restricted highway and arterial access
- Limited range (commuter only)
- Recharging infrastructure

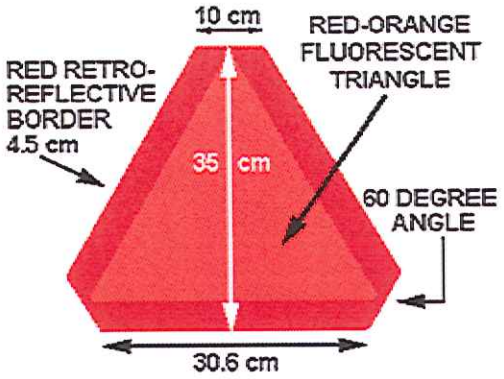
City of Kelowna

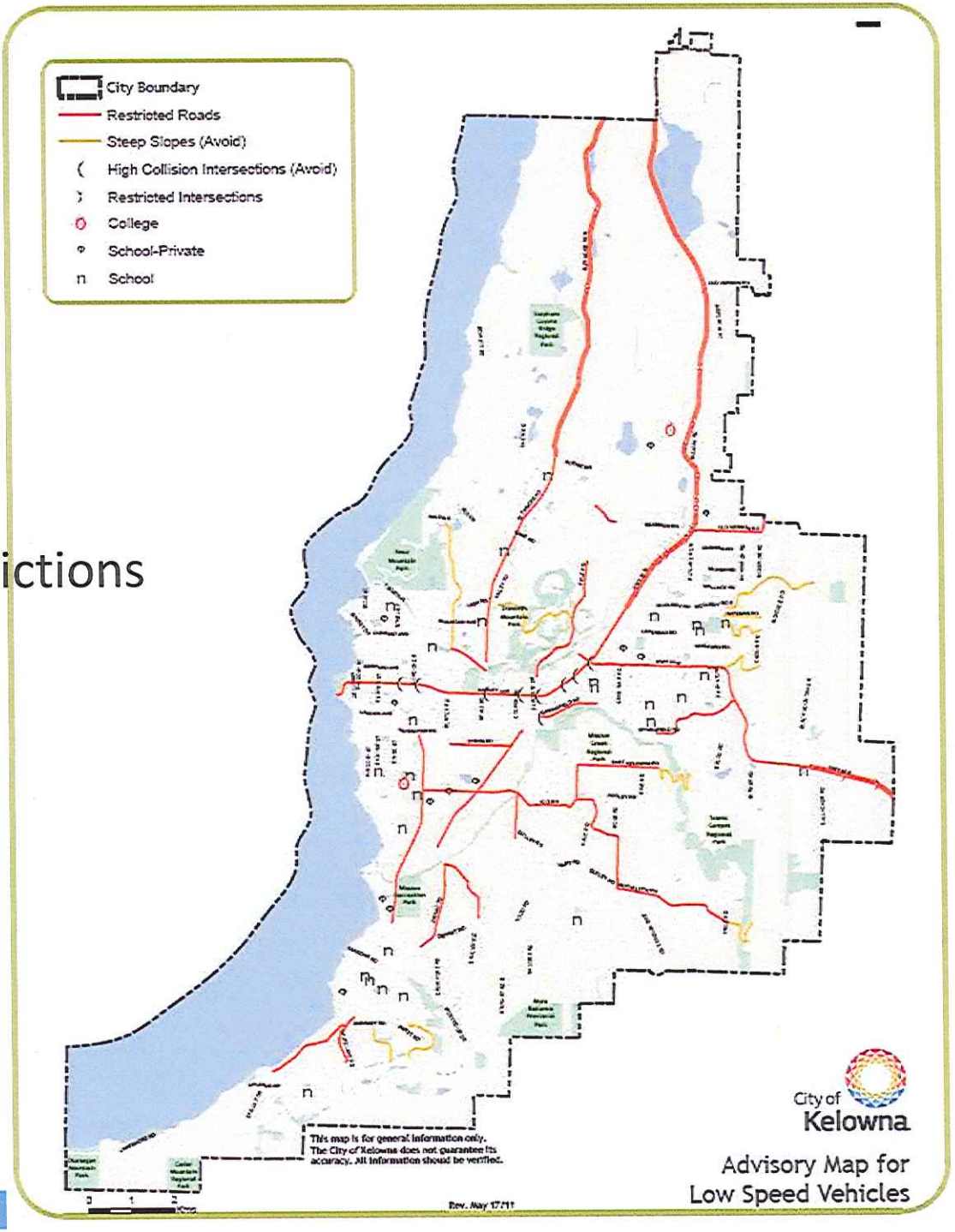
BC CITIES ALLOWING NZEVS

- **District of Oak Bay** (August 2008)
- **Vancouver** (September 2008)
- **Port Coquitlam** (March 2009)
- **Districts of Colwood** (July 2009)
- **Sydney** (May 2010)
- **Esquimalt** (April 2011)
- **Whistler** (November 2008)
- **Burnaby** (March 2009)

LSV-NZEV OPERATING CONDITIONS

- Road link restrictions
- Intersection crossing restrictions
- Vehicle registration
- Slow moving vehicle sign





City of Kelowna

INCENTIVES

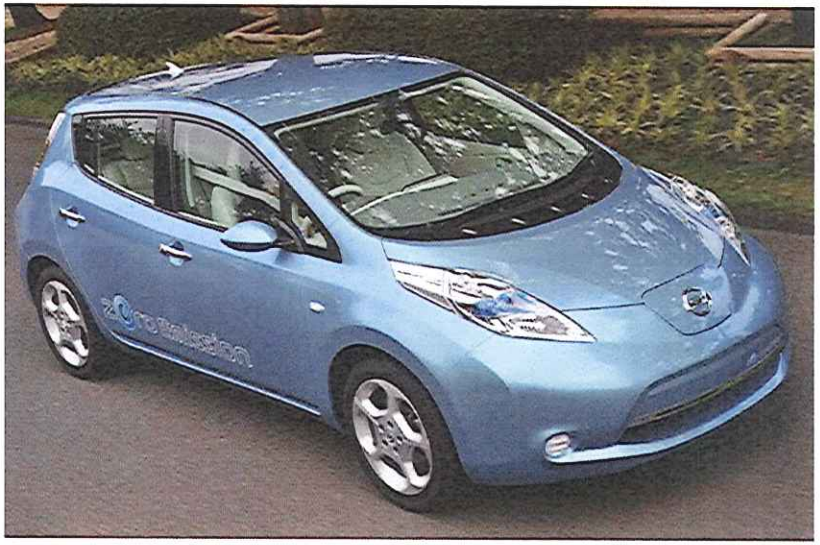
- Free Parking
- Public re-charging facilities
- Private re-charging facilities
- Appropriate road signage & info
- Free Registration
- Product information

PHEV AND EV

(FULL FUNCTION, SAFETY COMPLIANT)

- Chevy Volt PHEV

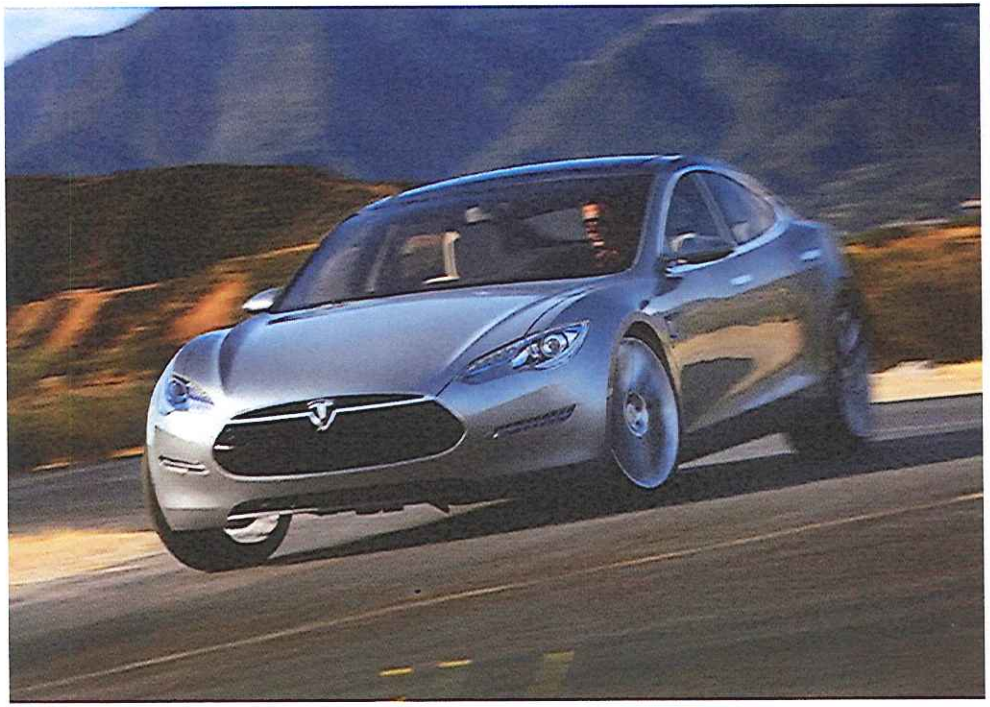
- Nissan Leaf EV



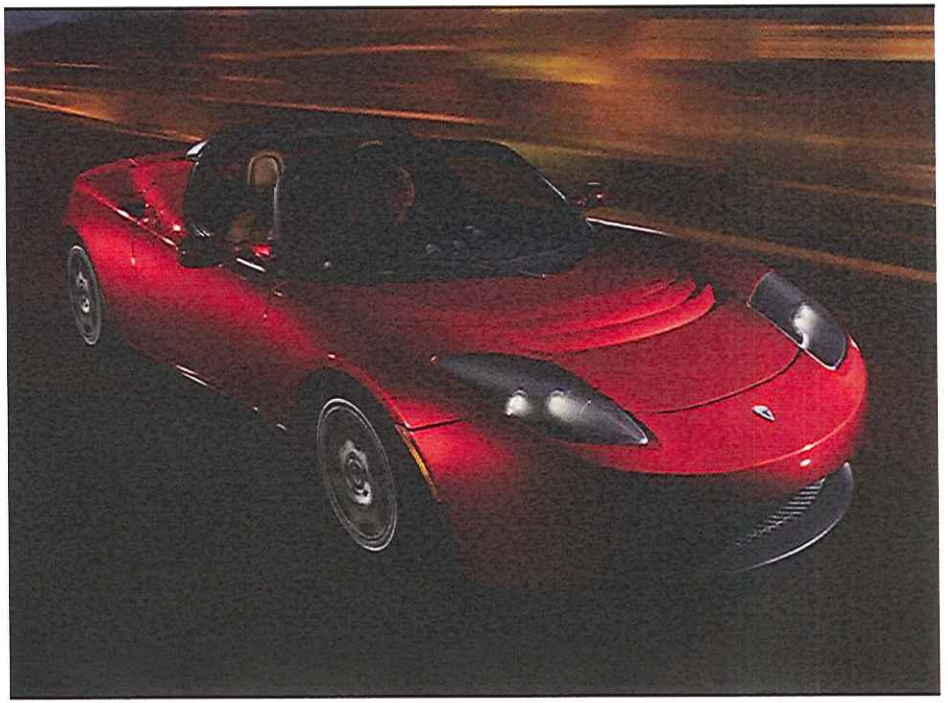
City of Kelowna

HIGH END EVS

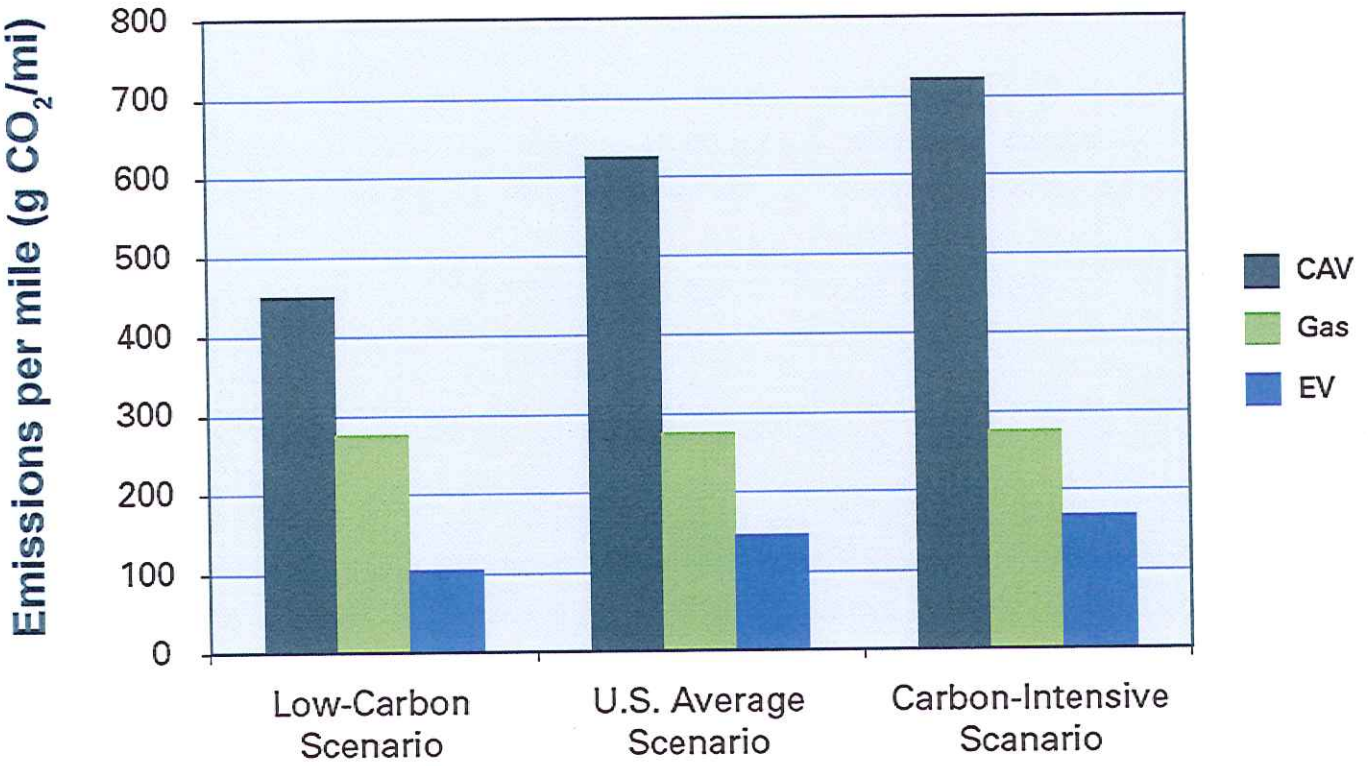
- Tesla Model S ($57k)



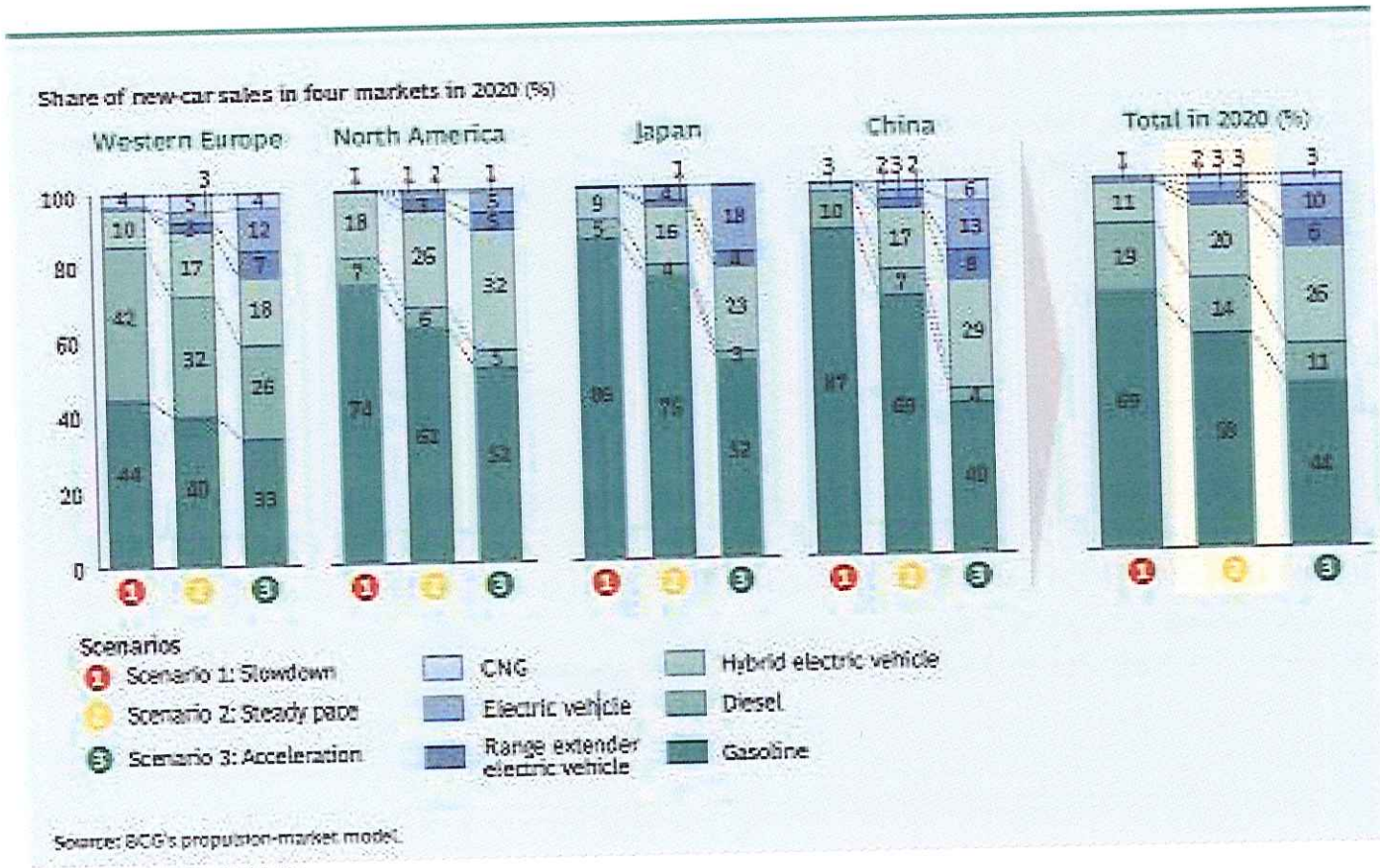
- Tesla Roadster ($109k)



CARBON FOOTPRINT: SELECTED VEHICLES

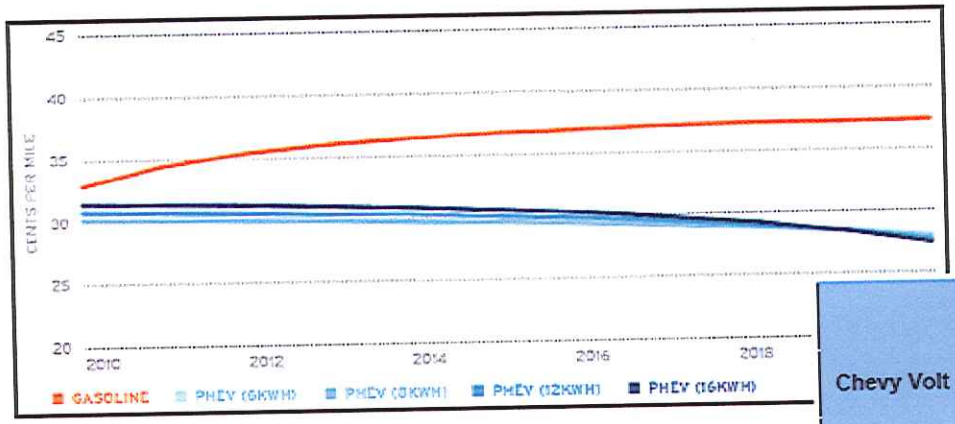


MARKET PENETRATION OF ALTERNATIVES



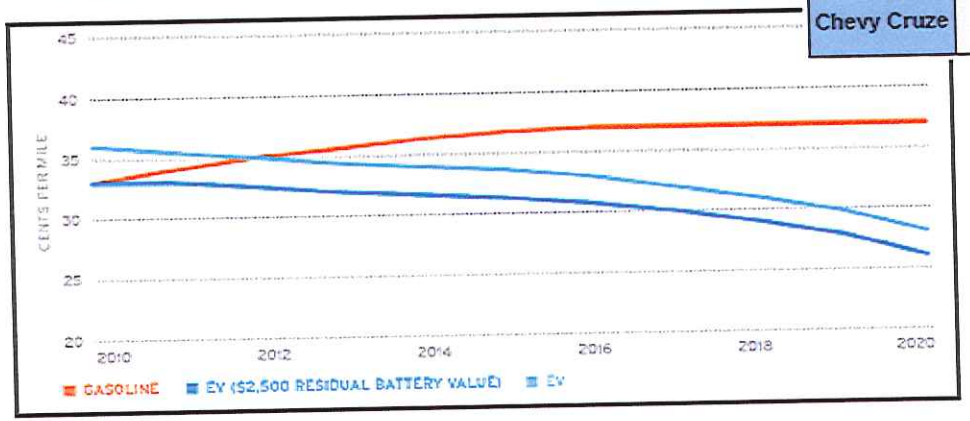
Source: (BCG, 2010)

PVEV & EV COST OF OWNERSHIP



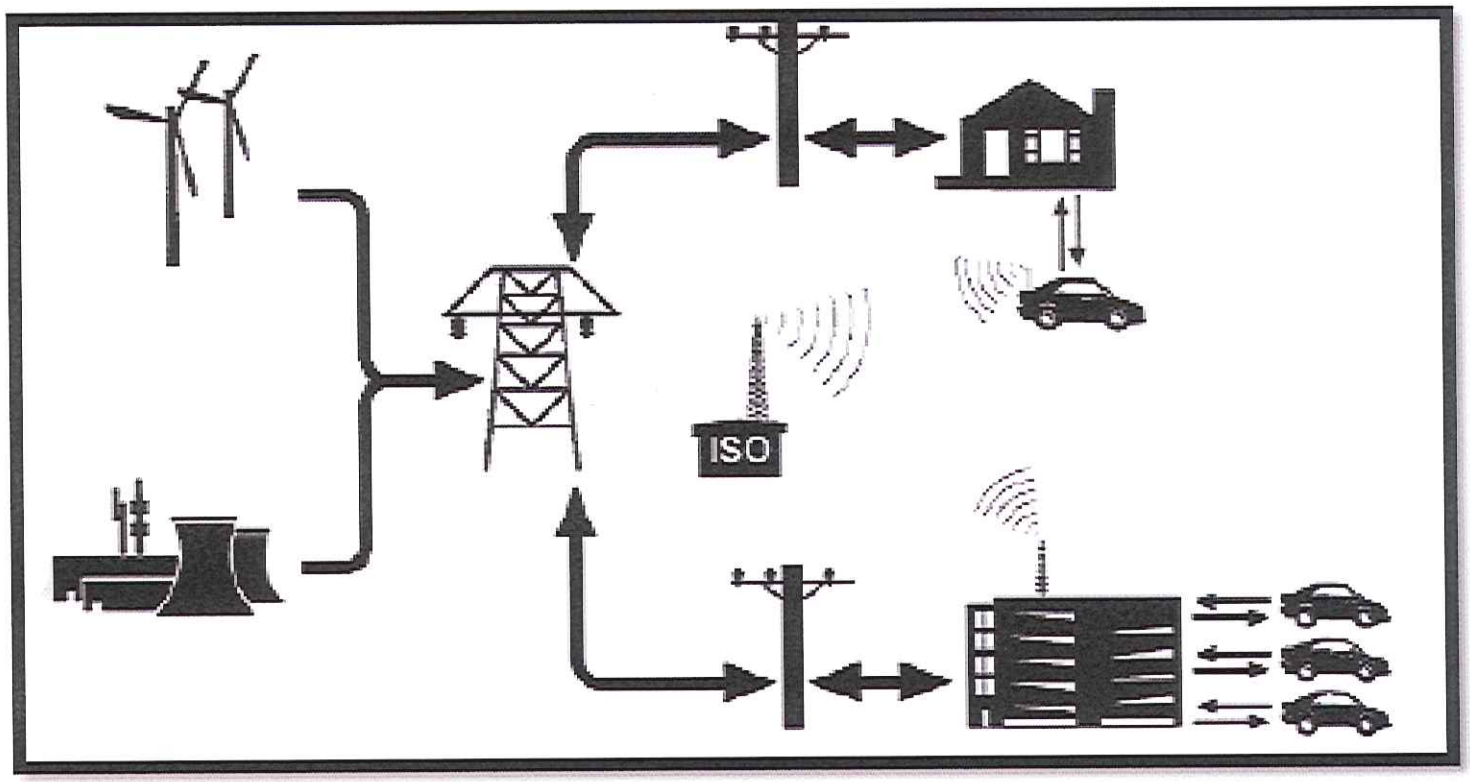
Source: (The Electrification Coalition, 2010)

	Capital Cost $/mile	Average $/mile fuel expense	TOTAL cost $/mile
Chevy Volt	$0.335/mile	Variable: $0.02 - $0.048/mile	Variable: $0.355 - $0.383/mile
Nissan Leaf	$0.252/mile	$0.012/mile	$0.264/mile
Chevy Cruze	$0.17/mile	$0.065/mile	$0.235/mile



Source: (The Electrification Coalition, 2010)

SMART GRID & VEHICLE TO GRID



Source: (Tomic, 2007)

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GHG AND GRID IMPACTS

- Existing US grid can support 52% import oil replacement today with Smart Grid and Vehicle-to-Grid applications
- GHG Reduction impacts

2050 Annual GHG Reduction (million metric tons)		Electric Sector CO_2 Intensity		
		High	Medium	Low
PHEV Fleet Penetration	Low	163	177	193
	Medium	394	468	478
	High	474	517	612

Source: (EPRI, 2005)

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RECHARGING STATIONS

R & ICI Zoning Requirements

RECHARGING STATIONS

Surrey Bylaw consideration for Service Stations

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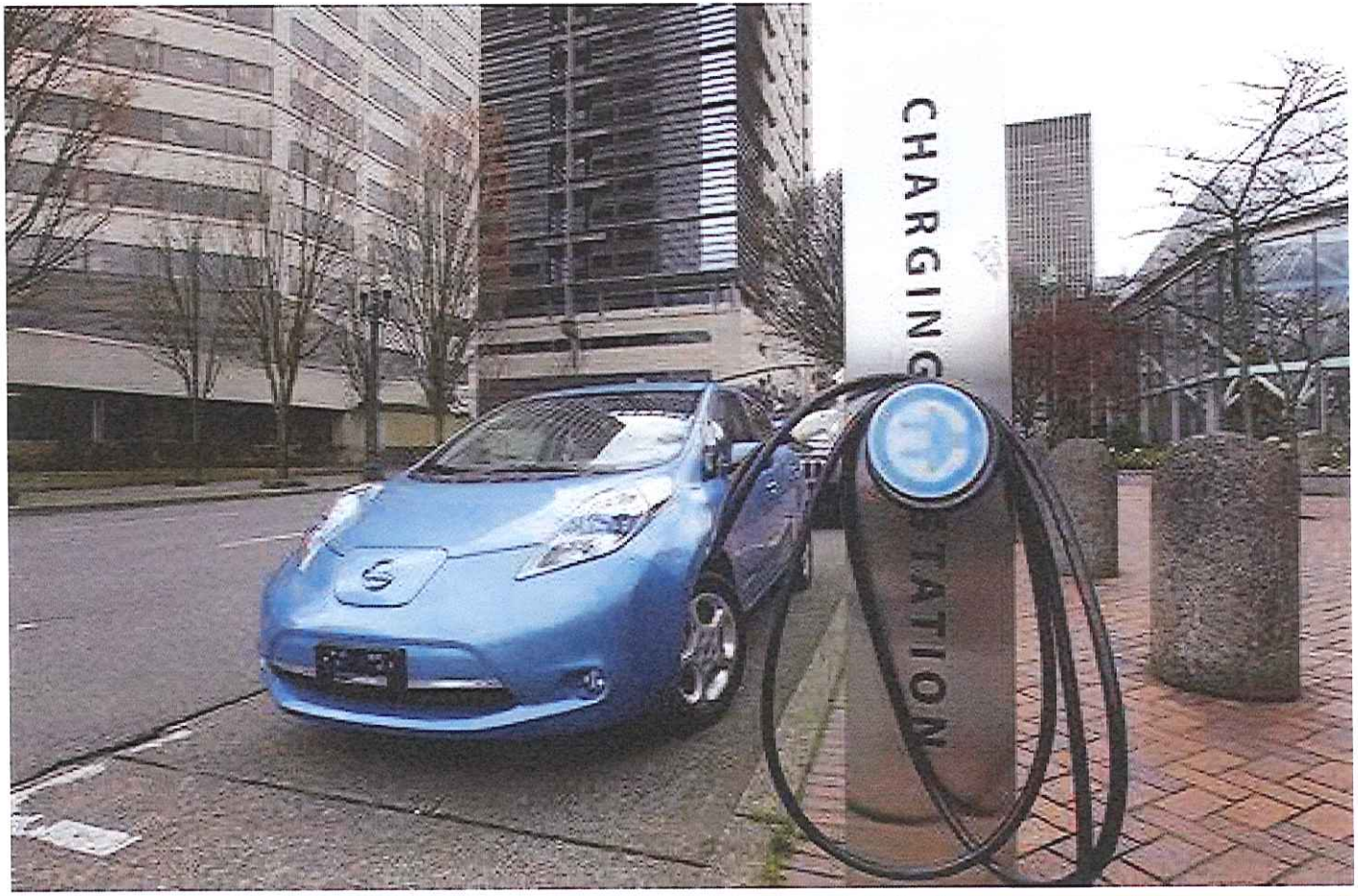
PUBLIC PARKING CHARGING STATIONS



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RECOMMENDATIONS

- Eco-pass for EVs & PHEVs, with sunset clause in program renewal
- Zoning Bylaw amendments for charging infrastructure in new residential and ICI
- Business Case for public recharging infrastructure options
- Future Capital submissions for Corporate electric fleet

ALTERNATIVE RECOMMENDATIONS

- Bylaw amendment reading consideration
  May 1, 2012: effective date
- Dealer showcase at final reading
- Eco-pass for NZEVs
- Road Signage Budget: 2012
- Program Evaluation