



3

West Coast Market Opportunities by Sector

This section focuses on opportunities that:

- Score high on their ability to stimulate investment capital;
- Have net positive impacts on job creation;
- Advance clean energy goals and reduce fossil fuel consumption by developing clean, local sources of energy; and
- Are expected to stimulate significant benefits from regional collaboration in terms of workforce and market development, the harmonization of codes and standards, the economic gains from inter-jurisdictional trade, and other positive network externalities.

The opportunities presented are in many ways unique to the West Coast region, and are based on existing strengths, which include the availability of critical inputs such as investment capital, current public policy and program initiatives, access to research and development (R&D) clusters and education and training institutions, the engagement of local entrepreneurs and the private sector, and potential synergies that may be generated through region-wide collaboration.



Photo Source: <http://www.bchydro.com>

CLEAN ENERGY SUPPLY

The West Coast region has already established itself as the clean energy “power house” of North America, due in part to strong clean energy technology manufacturing, knowledge, and investment clusters, and an abundance of clean energy resources, including hydro, wind, solar, wave, tidal, geothermal, and biomass. Ranking at the top of their national indices for clean energy, California, Oregon, Washington, and British Columbia are front-runners in clean energy research, development, deployment, and financing (see Figure 5).

Figure 5: US/Canadian clean energy rankings by state/province.¹

US			CANADA	
Rank	State	Score	Province	Score
1	CA	95.3	BC	7.5
2	OR	79.4	QC	6.3
3	MA	71.8	MB	6.3
4	NY	63.1	NS	6.1
5	CO	60.2	ON	6.0
6	WA	60.0	PEI	5.2
7	NM	57.0	NL	5.0
8	MI	57.0	SK	3.7
9	CT	56.9	NB	2.9
10	VT	53.2	AB	1.3

Source: Clean Edge (2011) and Corporate Knights (2010)

¹ US rankings were prepared by Clean Edge; the index is measures of each state’s relative performance in each equally weighted category of technology deployment, public policy, and capital attraction. Scoring data is sourced from public and private sources, which are aggregated and analyzed as key indicators for each of the three categories. For more information, see: <http://www.pdxeconomicdevelopment.com/docs/cleantech/Oregon-Clean-Energy-Economy.pdf>. Canadian rankings were prepared by Corporate Knights as part of the 2010 Green Provincial Report Card. For more information, see: <http://static.corporateknights.ca/CK31-GreenProvinces2010.pdf>

Clean electricity as a percentage of total generation amongst the West Coast jurisdictions is growing due to established policy targets such as renewable portfolio standards (RPS). It should also be noted that British Columbia has no coal-fired generating facilities (although the province does import some coal-fired electricity), and Oregon and Washington have programs to phase out their coal power plants by 2020 and 2025, respectively.



In the US, revenues from wind power generation are expected to grow 11.2% annually to \$6.4 billion in 2016, and favorable national government legislation is expected to persist as the US diversifies its energy portfolio.

The Western states already account for almost 19% of US installed wind-generating capacity (California at nearly 8% of total capacity, Washington at nearly 6%, and Oregon at 5%), and additional opportunities for attracting investment in wind generation and related component manufacturing exist throughout the region.

BC has been a latecomer into the wind industry sector but is quickly ramping up with 2 projects now online with 246 MWs and 5 additional projects with electricity purchase agreements (EPAs) with the province's Crown utility.

The opportunities in clean energy supply can be considered in terms of their scale of development and deployment, as described below.

Utility Scale Energy Supply – At the utility scale (e.g., greater than 20 MWs in size), the real opportunity areas stem from the ability to use available clean energy resources effectively by promoting and showcasing the region as the clean energy hub and proving grounds for the North American marketplace in order to attract investment capital and a skilled labor force.

In its ten-year Regional Transmission Plan to 2020, the Western Electricity Coordination Council (WECC) recognizes a need for a cooperative planning approach to developing long-term sustainable transmissions connections.² The report states that in some cases, long-distance transmissions infrastructure to access renewable sources of power can augment localized renewable energy generation and can be more cost effective.

The study suggests the need for more demand-responsive transmission upgrades to alleviate the increasing congestion along existing connections and suggests an integrated Pacific-Northwest strategy from BC to California as a potential solution.

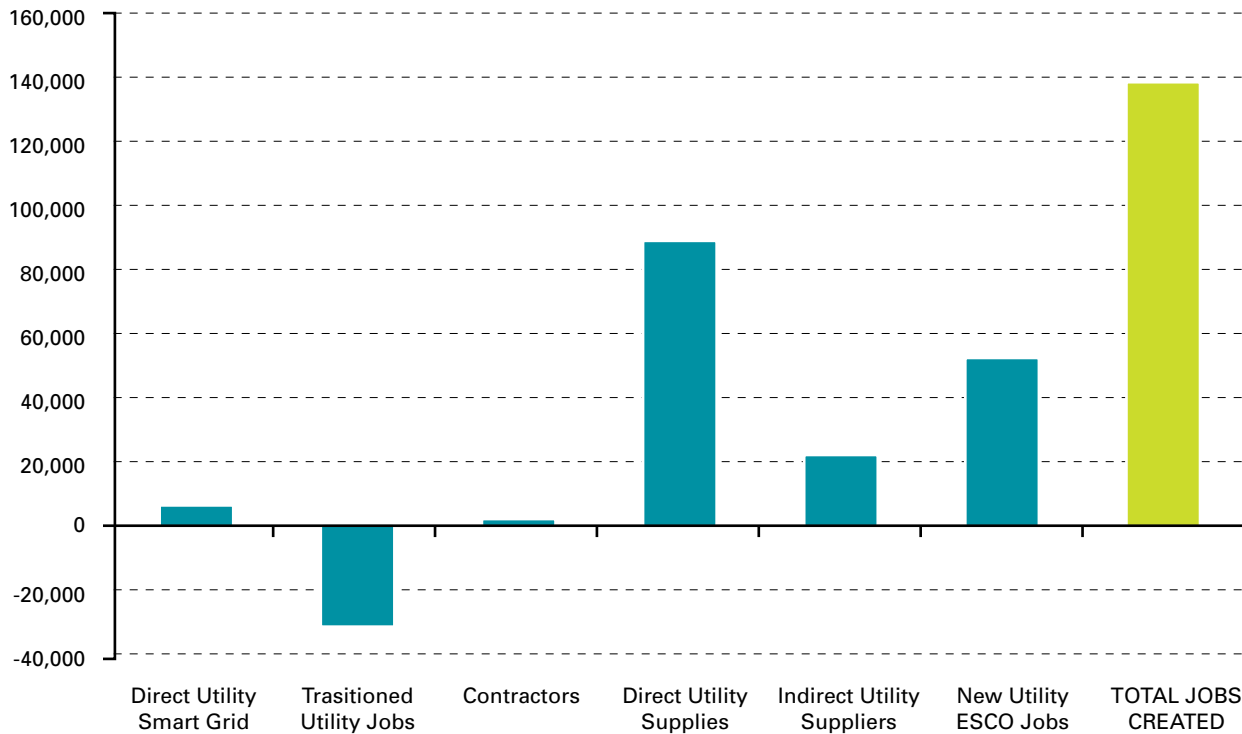
To be successful, it is essential that the transmission system and related interconnections allow for the efficient integration of clean, renewable energy into the grid. This also means incorporating climate adaptation strategies into the planning process for transmission infrastructure (e.g., transmission lines will have to be sited and designed to deal with increasing risks from extreme weather and storms) and incorporating smart grid technologies that improve system reliability.

The large, grid-connected, clean energy resources being developed to meet the region's renewable energy targets are largely intermittent in nature, such as solar photovoltaic (PV) and wind turbines with variable hourly outputs, and are being sited outside of demand (load)

² See: http://www.wecc.biz/library/StudyReport/Documents/Plan_Summary.pdf

It is essential that the transmission system and related interconnections allow for the efficient integration of clean, renewable energy into the grid.

Figure 6: Projected smart grid jobs created and transitioned in the US, 2009 - 2018



Source: KEMA, The US Smart Grid Revolution: KEMA's Perspectives for Job Creation, 2009

centers. The current and forecasted megawatt (MW) capacity of these intermittent resources will require additional electricity transmission capacity to carry these renewable resources to load centers. Transmission expansion and grid integration can also improve the reliability of the electricity system as the capacity to handle additional renewable expands in the future.

As illustrated in Figure 6, the job creation potential from improvements to grid reliability and operational efficiencies through new and existing transmission infrastructure initiatives are substantial, although capital requirements are also high.

In evaluating the California-Oregon Intertie (COI), "Pacific Northwest (PNW) and California entities have shown that there is no long-term capacity available on the COI to move Canadian and PNW renewables into California. If renewable projects in the PNW are to be financed and constructed, the projects will need power purchase agreements, and in order to deliver or receive the power under the agreements, construction of additional transmission capacity into California will be needed".³

In its call for regional collaboration, the Western Governors Association recommended in 2010 that an analysis be undertaken with respect to determining the benefits of "consolidation or virtual consolidation of the numerous Balancing Authorities into bigger regions, which can efficiently accommodate large amounts of variable output generation, better wind and solar forecasting, and mandatory grid reliability standards that support expanded renewable generation while maintaining grid reliability".

The region can work to develop policies that drive technical solutions to high-penetration renewable power grid operation, leading the way for policy adoption in the Western regional market. These opportunities include:

- Improved forecasting;
- Faster scheduling;
- Balancing area coordination; and
- Regional imbalance energy markets.

³ See the Executive Summary for the PNW/CA Transmission Investigations, May 2011, available at: http://www.oatiosis.com/TANC/TANCdocs/exec_summary_pnw_ca_trans_6_14_2011_clean.pdf

Progress on these actions can lower electricity rates and smooth the integration of renewables, as well as improve reliability, make more efficient use of existing transmission, reduce the amount of operating reserves required, provide new revenue streams for utilities that can market their flexible resources and transmission, and promote sharing of resources and closer coordination of electric systems across the region.

District Scale Energy Supply – Projects at the district or community scale (e.g., less than 20 MWs in size) have potential for some of the highest local job benefits.

In terms of district-scale solar power, the bulk of US capacity is located in the West. California leads in terms of both PV and thermal solar capacity in the US with approximately 67% of total capacity. Although recent concerns have been raised about whether California will be able to sustain its explosive growth in this industry, analysts predict the installation of more than 1 million residential solar projects in the state by 2020, adding on the order of \$30 billion to the economy and creating more than 20,000 new jobs per year⁴. Also relevant in terms of the local job creation potential in all four jurisdictions is the solar thermal/hot water industry, which can be stimulated through energy efficiency and targets such as net-zero energy building and related green building codes.

District-scale bioenergy projects also carry job creation potential for the region, particularly related to biomass-powered community energy projects, as well as those tied to the development of advanced biofuels in the areas of cellulosic ethanol and algae-based biodiesel. As one example of success, British Columbia's Bioenergy Network (BCBN) has successfully leveraged CAD \$61.7 million of partner investment from an initial CAD \$12.5 million to fund 21 projects with a range of bioenergy applications, creating local jobs in communities throughout the province.

Anaerobic digesters, methane capture at landfill sites, distributed heat, and combined heat and power (CHP) systems have the potential to displace dirtier fuels and create local jobs related to project design, construction, and operations, in both industrial and municipal settings.

Additional opportunities in bioenergy exist throughout the region for using waste streams to displace fossil fuels, promoting torrefied fuels to displace coal, developing transportation fuel demonstration projects, and promoting on-site biomass-to-energy systems in agricultural and industrial settings.

Jobs created through fuel switching initiatives exist in the commercial and industrial sectors, particularly around replacing diesel with natural gas and or co-generation in primary resource-based industries, such as forestry, mining, and oil and gas.

Summary of Key Opportunities:

CLEAN ENERGY SUPPLY

- Development and deployment of utility-scale renewable energy projects are important across the region, particularly in wind.
- Upgrades to regional transmission infrastructure and deployment of smart technologies to allow greater integration of renewable energy into the grid; this could also include consolidation of the numerous Balancing Authorities into bigger regions.
- Development of district or community-scale energy projects, including geo-exchange, solar thermal and PV, distributed heat, biomass CHP systems, and anaerobic digesters, as well as the deployment demonstration projects for proving emerging technologies and to serve as training facilities.
- Fuel switching to low carbon alternatives such as biofuels, natural gas, and renewable energy technologies in industrial applications that can create jobs, and reduce both operating costs and GHG emissions.

⁴ Building a Brighter Future, AECOM 2011



ENERGY EFFICIENCY & GREEN BUILDING

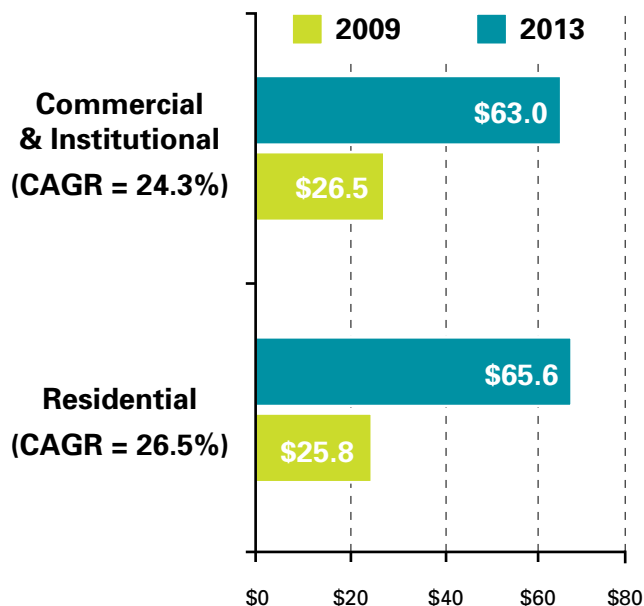
This analysis shows that the Energy Efficiency and Green Building sector has the highest potential for new, local job growth based on the policies examined (see Section 4 of this report). Opportunities in this sector are encouraged by governments at all levels leading by example and by encouraging demand within the residential, commercial, and institutional sectors through regulation (e.g., harmonized legislated energy efficiency targets, green building codes, and higher-performance standards). Encouraging consumer awareness through energy benchmarking and labeling programs for buildings is also important, as are economic incentives, creative financing mechanisms, and innovative partnership models to advance the sector.

According to McGraw-Hill, the combined value of the commercial, institutional, and residential green building market in the US is projected to reach \$128.6 billion by 2013, more than double its value of \$52.3 billion in 2009 (see Figure 7).⁵ The values include the retrofit and building renovation market, as well as new construction, and show significant compound annual growth rates (CAGR) of 24.3% and 26.5% for the Commercial/Institutional and Residential sectors respectively.

Green building requires a total systems approach that increasingly involves an Integrated Design Process (IDP) where architects, engineers, contractors, and other stakeholders work together during the planning phase to create synergies and to identify creative solutions, an approach that has had very positive results in terms of delivering energy and cost savings.

⁵ McGraw-Hill Construction Report (2008).

Figure 7: US green building market by segment, 2009 - 2013 projections (billions of US\$)



Source: McGraw-Hill Construction Report, 2008

The West Coast jurisdictions have more LEED-certified projects per capita than their national averages.

The West Coast region is a leader in green building from a North American perspective. As one example, the West Coast jurisdictions have more LEED-certified projects per capita than the national averages of 23.3 and 9.5 per 1 million people in the US and Canada, respectively (see Figure 8).

Figure 8: LEED-certified building deployment, December 2010

State/Province	LEED Projects Per 1M People	LEED Certified Projects (December 2011)
California	29.0	1,081
Oregon	59.9	231
Washington	56.7	380
British Columbia	19.7	89

Source: <http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx>

In Washington and Oregon, the Sixth Northwest Conservation and Electric Power Plan, produced by the Northwest Power and Conservation Council, is a key policy driver for progressive building codes in these states. The Sixth Northwest Power Plan is binding on the Bonneville Power Administration, and drives energy conservation requirements to all their customer utilities. The Plan outlines an electricity supply future for the Pacific Northwest that states that 80% of future electrical load growth will be secured through energy conservation.

In California, the work of the California Energy Commission, through its Energy Action Plan and a number of other programs, is important for driving state-wide energy efficiency initiatives. In British Columbia, the Energy Plan, the Energy Efficiency Act, the Energy Efficient Buildings Strategy, and programs such as LiveSmart BC, are critical drivers for improvements in energy efficiency.

Energy-efficient Whole Building Retrofits – The “low-hanging fruit” within this sector in terms of the clean job creation potential lies within building energy efficiency retrofits. Money saved on energy costs can be spent elsewhere in the economy. Governments at all levels have the potential to stimulate the industry and create jobs by encouraging retrofits of existing public and private buildings where appropriate, including personal dwellings, small businesses, and public institutions such as schools and hospitals.

California has shown leadership in this area, with its state-wide residential retrofit program “Energy Upgrade California”, designed to help overcome some of the key barriers facing this segment by providing a one-stop-shop with information on and access to rebates, financing, certified contractors, and home energy ratings.⁶

The private sector is rolling out creative financing mechanisms to fund retrofits. California’s investor-owned utilities (IOUs) commit more than 80% of their annual energy efficiency budgets to retrofits (amounting to approximately \$800 million/year in support of energy efficiency retrofits). The California Property Assessed Clean Energy (PACE) Program is administered through the Pacific Housing Finance Agency (PHFA), a California State Joint Powers Authority. Any city or county in the state can join the program, which is using its existing bonding authority to raise capital for projects that have been aggregated across multiple jurisdictions.

Using this aggregation approach, the program aims to secure greater access to capital and lower transaction costs for local PACE programs and the projects that they fund.⁷ It should be noted that this program is limited by federal regulations for the residential retrofit market and is just beginning for the non-residential market.

Other PACE programs are rolling out across the state in various counties and municipal jurisdictions focused on commercial building retrofits, including San Francisco and Los Angeles. In addition, the California Public Utilities Commission (PUC) is about to propose an “On-bill Energy Efficiency Repayment Program”, allowing building and home owners to obtain market-originated loans for energy efficiency and potentially renewable electricity generation projects, to be repaid through significantly lowered monthly utility bills.

In British Columbia, groundbreaking 2010 legislation under the *Clean Energy Act* has allowed for “improvement financing”, often referred to as pay-as-you-save or utility on-bill financing. This legislation enables utilities to introduce financing that is transferable between building owners and renters. In addition, the successful “Live Smart BC

⁶ See: <https://energyupgradeca.org>

⁷ See: <http://eetd.lbl.gov/ea/ems/reports/pace-pb-032311.pdf>



Location: Mead Center for American Theater (Washington, D.C.) Photo by Nic Lehous, courtesy of Wood WORKS! BC

Efficiency Incentive Program” continues to stimulate job growth by providing CAD \$30 million for upgrades to homes over 2 years, with a further CAD \$11.7 million available from the provincial utilities.⁸ The province launched a CAD \$15 million 3-year program in January 2011 to support small businesses through energy efficiency advisors, enhanced product incentives, equipment installation, and funding for innovative energy solutions.

In Oregon, Governor Kitzhaber launched the “Cool Schools” initiative to further accelerate the rate of energy efficiency retrofits in state schools to create jobs and save resources that could be directed to improve building performance. Cool Schools expands financing mechanisms for energy efficiency upgrades in public schools across Oregon and centralizes access to financial and technical support.⁹ Since Governor Kitzhaber signed the bill into law in June 2011, nearly 400 school buildings have received energy audits, while 11 school districts have applied for or secured more than \$9.5 million for school retrofits.

The Cool Schools effort builds on a decade of preparation and data collection. Since 2002, energy efficiency programs have stimulated a \$76 million net increase in Oregon’s wages and \$11 million in new business income for the state. In 2007 alone, energy efficiency programs created nearly 5,000 jobs in the state, and it’s been found that for every \$1 million invested in energy efficiency projects, up to 17 jobs can be created.¹⁰

Washington’s Weatherization Program, through its Department of Commerce, reduces the utility costs of

low-income families through home energy efficiency. Since 1993, the state’s weatherization programs have weatherized nearly 70,000 low-income households, creating new clean economy jobs and funding lasting improvements to the industry.¹¹

In addition to specific programs similar to those in other states, Washington has embraced an overarching policy of requiring all electric utilities to acquire all cost-effective conservation.¹² This relieves the state of much of the work of creating programs since it leaves to the electricity industry itself the formulation of the means to achieve this goal.

Building retrofits are expected to account for 25% of the expected savings estimated in the sixth NW Power Plan. Conservation programs to implement the Power Plan and the conservation requirements in Washington are expected to create 23,000 new jobs over the time horizon of the Power plan, including approximately 2,000 jobs from the building sector alone.¹³

Enormous opportunities exist for additional region-wide collaboration and leadership with respect to energy efficiency retrofits in terms of shared policy and program approaches, aggregated financing and partnership initiatives, and labor market education and training.

11 See: <http://www.commerce.wa.gov/site/500/default.aspx>

12 Initiative 937, also known as the Energy Independence Act, was passed by the voters in 2006. It requires that the largest utilities in the state that serve almost 90% of Washington’s electricity load acquire all cost-effective conservation calculated by using the methodology used the Northwest Power and Conservation Council, which in turn was created by the NW Power Planning and Conservation Act of 1980 in order to make conservation the resource of choice in utility planning.

13 Jobs and conservation numbers were computed by staff of the NW Power and Conservation Council using data from the Sixth Northwest Conservation and Electric Power Plan (2010).

8 See: <http://www.newsroom.gov.bc.ca/2011/04/increased-home-efficiency-rebates-help-families-save.html>

9 <http://www.oeonline.org/our-work/climate/global-warming-policy-solutions>

10 http://governor.oregon.gov/Gov/media_room/press_releases/p2011/press_111011.shtml

New Building Construction – Regional governments can continue leading by example with improvements to their state and provincial building codes to stimulate job growth in new green building construction. Established energy efficiency targets for new buildings, such as EnerGuide and LEED minimum requirements, and encouraging policies that support net-zero energy buildings, will stimulate demand in the sector for energy-efficient building materials and skilled labor.

Washington and California already require major facility projects funded in their capital budgets, or projects paid for through financing contracts, to be LEED Silver-certified. British Columbia has mandated a LEED Gold and a “Wood First” policy requirements for the construction of all new public buildings. Through its Power Smart program, the provincial utility has a “New Construction Program” offering considerable financial incentives for whole building, lighting, and system design.¹⁴

Inspired by Architecture 2030’s Challenge goals of “no fossil fuel use for buildings by 2030”, the California Energy Commission’s (CEC) changes to Title 24 require net-zero energy performance in residential buildings by 2020 and in commercial buildings by 2030.¹⁵ This comes on top of a 30-plus year history of requiring ever-higher levels of building efficiency, now surpassing levels of the US EPA Energy Star and US Green Building Council’s LEED buildings.

Provincial and state governments can continue supporting municipalities in the region by harmonizing building standards, codes, and regulations, and removing barriers to the deployment of green building technologies.

¹⁴ See: http://www.bchydro.com/powersmart/builders_developers/high_performance_building_program.html?WT.mc_id=rd_construction

¹⁵ See: http://www.energy.ca.gov/2007_energy_policy/index.html

Construction Waste Management and Deconstruction

– At present, construction, renovation, and deconstruction (formerly referred to as demolition) of residential and commercial buildings produce an enormous amount of waste. Despite increased recycling, most of the debris still ends up in landfills, with the US EPA estimating that construction and demolition waste in the US amounts to more than half of the municipal waste stream.

Oregon and California are showing leadership through local efforts in deconstruction. One successful example is a project in Portland that recycled 92% of the waste produced when several structures were torn down to build a new arena for the Portland Trail Blazers basketball team. Although deconstruction currently costs slightly more than demolition, the savings are expected to increase as contractors gain experience and the market for used materials grows. The key to making building material reuse economical is to design for disassembly. Potential for creating new employment opportunities throughout the value chain exist, including jobs in innovation and design, deconstruction, and waste/resource stream management.

While the deconstruction segment is a relatively new industry, it has a high growth potential and presents an immediate area ripe for job creation and region-wide collaboration. Although each jurisdiction has different building codes, establishing a common set of standards or requirements for deconstruction under a “West Coast Resource Recovery Initiative” would enable enterprises embarking on this nascent industry to share resource networks and business opportunities. Developing a region-wide market for recycled materials (e.g., reclaimed doors, brickworks, etc.) would create immediate employment opportunities, particularly in inner-city areas, and would help reduce the amount of potentially reusable material that ends up in landfills.

Green Construction Materials and Energy-efficient Technologies

– Jobs exist throughout the supply chain for green construction products and energy-efficient technologies. Energy-efficient windows and doors made from wood, innovative insulation materials, and laminated products are just a few examples. Engineered wood products, such as cross-laminated timber (CLT), have the potential to revolutionize the construction industry by replacing traditional building materials in certain applications.¹⁶ FP Innovations, the world’s largest nonprofit forest research institute, recently released a handbook on CLT, and the technology is being considered for inclusion in

¹⁶ Article published in Business in Vancouver Magazine, April 1, 2011. See: http://www.bivinteractive.com/index.php?option=com_content&task=view&id=4022&Itemid=61

green building codes in North America. The future could also see more building materials coming from nanotechnology-based industries that are much stronger and many times lighter than traditional steel and cement, with lower environmental impacts.

As well, establishing minimum efficiency standards for technologies such as televisions and set-top boxes, lighting, and other common household electronics will generate local economic growth by putting money back into consumers' pockets. These standards also yield environmental benefits by reducing energy demand and GHG emissions from power plants since "plug loads" are the fastest growing end use for electricity.

Appliance and equipment efficiency standards are one of the most effective ways of reducing energy use. Appliance efficiency standards reduce the market cost of energy efficiency improvements by incorporating technological advances into base appliance models, creating economies of scale and facilitating lower consumer energy costs and spurring efficient technology innovation.

Appliance and equipment efficiency standards can be implemented at the state/provincial level for appliances not covered by federal standards, or where higher-than-federal standard efficiency requirements are appropriate due to regional achievement of market transformation from voluntary measures utilities' demand-side management programs. In addition, in British Columbia, standards can be set for products manufactured within the province (e.g., windows, boilers), even if national standards are in place, as Natural Resources Canada regulations apply strictly to imports or inter-provincial-territorial trade.

Regional coordination of appliance and equipment efficiency standards increases the market size for retailers and manufacturers, raising the incentive to provide energy efficient product choices to consumers in all jurisdictions. For example, British Columbia has adopted California Energy Commission's Tier 2 energy efficiency standard for televisions. Supported by BC Hydro and California investor-owned utility programs, this appliance standard promotes market transformation in jurisdictions and will support nearly 7,000 GWh of electricity savings in BC and California, creating nearly 9,000 jobs as consumers re-spend savings in the economy.

In addition, extending and leveraging the existing energy efficiency knowledge base in the region serves as a springboard for leadership, job development, and the creation of new, specialized industries. Establishing a knowledge base on energy efficient technologies (through

governments, agencies, utilities, and academia) creates an economic opportunity to export know-how and establish niche industries such as hardware / software to support new demand for highly energy-efficient, global products.

The regional knowledge base and expertise in this area can be linked directly to green building strategies and requirements and stimulated through the sale and installation of technologies such as northern climate heat pump water heaters, smart appliances, demand-side meters and controls, efficient natural gas water heaters, boilers, and furnaces, solar thermal equipment, geothermal heat pumps, and heat recovery ventilators.

Summary of Key Opportunities:

ENERGY EFFICIENCY & GREEN BUILDING

- Recognizing that this sector shows the largest potential for new job growth to 2020, particularly in the areas of energy-efficiency retrofits and new building construction.
- Providing public sector leadership for early adoption of energy efficiency technologies through active projects involving public buildings, as well as aggressive targets (e.g., net-zero energy buildings) and green building codes and standards as drivers for industry growth and employment.
- Instituting a greater focus on deconstruction, waste diversion, and material recycling/reuse to provide a variety of jobs throughout the value chain.
- Promoting green building materials in construction and energy-efficient appliances through minimum standards that boost employment in industries such as forestry and value-added manufacturing, and reduce consumer costs with resultant economic spin-offs.
- Developing harmonized standards for energy-efficient appliances and equipment, lowering energy costs for consumers and stimulating the development of a regional knowledge base on efficient equipment that creates spin-off industries and jobs (e.g., smart appliances and grid technologies).

CLEAN TRANSPORTATION

The Clean Transportation sector includes enormous employment opportunities for the West Coast region related to the design, manufacturing, and deployment of clean-powered vehicles, development of alternative fuels and related infrastructure, and improvements to systems for the movement of goods and people. The sector includes land-based vehicle transport, public mass transit, marine and air transport (although air transport is not considered as part of this analysis), and non-motorized transport, as well as intelligent or “smart” transportation systems.



Employment generation within the Clean Transportation sector was considered from a three-pronged investment strategy¹⁷ as part of this study and encompasses:

1. **Avoiding** or reducing trips through integrating land use and transport planning and enabling more localized production and consumption. This may also include strategies that improve systems and promote changes in transportation patterns such as work-from-home initiatives.
2. **Improving** vehicles and fuels as a priority to reduce urban air pollution and GHG emissions. This also includes the manufacturing of clean vehicles and the development of new transportation technologies.
3. **Shifting** to more environmentally efficient modes, such as public mass transit, car sharing, and non-motorized transport (for passenger transport) and to rail and water transport (for freight) where applicable.

17 The three-pronged investment strategy was developed by the United Nations Environmental Programme (UNEP) work on the green economy. See: http://www.unep.org/greeneconomy/Portals/88/documents/ger/10.0_Transport.pdf

Avoiding Trips and Improving Systems – All West Coast jurisdictions have been actively working to integrate regional land-use planning, housing, and transportation along with incentives for developers to pursue projects consistent with regional and community sustainability plans. In California, for example, Metropolitan Planning Organizations (MPOs) in the state must prepare a Sustainable Communities Strategy (SCS) within their Regional Transportation Plans, which sets forth a vision for growth for the region taking into account the transportation, housing, environmental, and economic needs of the region.¹⁸ Sharing best practices for land-use and transportation planning across the West Coast region could help in terms of making existing systems and new developments more efficient.

From a systems perspective, intelligent transportation systems (ITS) include everything from traffic and transit controls, to sophisticated telematic systems for connecting electric vehicles (EVs) to the smart grid and for ship navigation. Such applications have positive effects on transportation system efficiency and sustainability, safety, the environment, congestion, and traveler mobility and convenience.¹⁹

The ITS industry is predicted to grow by 40% over 2009 to \$73 billion in North America by 2015, employing an estimated 203,000 people.²⁰

Washington and other jurisdictions along the West Coast are developing New Mobility Hubs that will enhance transit-oriented development features such as telework centers, workforce housing, and mixed use retail to help support sustainable communities. The network of New Mobility Hubs would benefit the region by providing real-time traffic and transit information; carpool, vanpool, and bike-buddy matching; and bicycle storage and cycling information, with jobs throughout the value chain.

Promoting Cleaner Vehicles & Related Technologies

– In terms of vehicle transportation, provincial and state targets in the region for reduced GHGs from the transportation sector and policies, such as low carbon fuel standards which require a 10% cut in GHG emissions intensity by 2020, are driving improvements in fuel efficiency and alternative fuel usage.

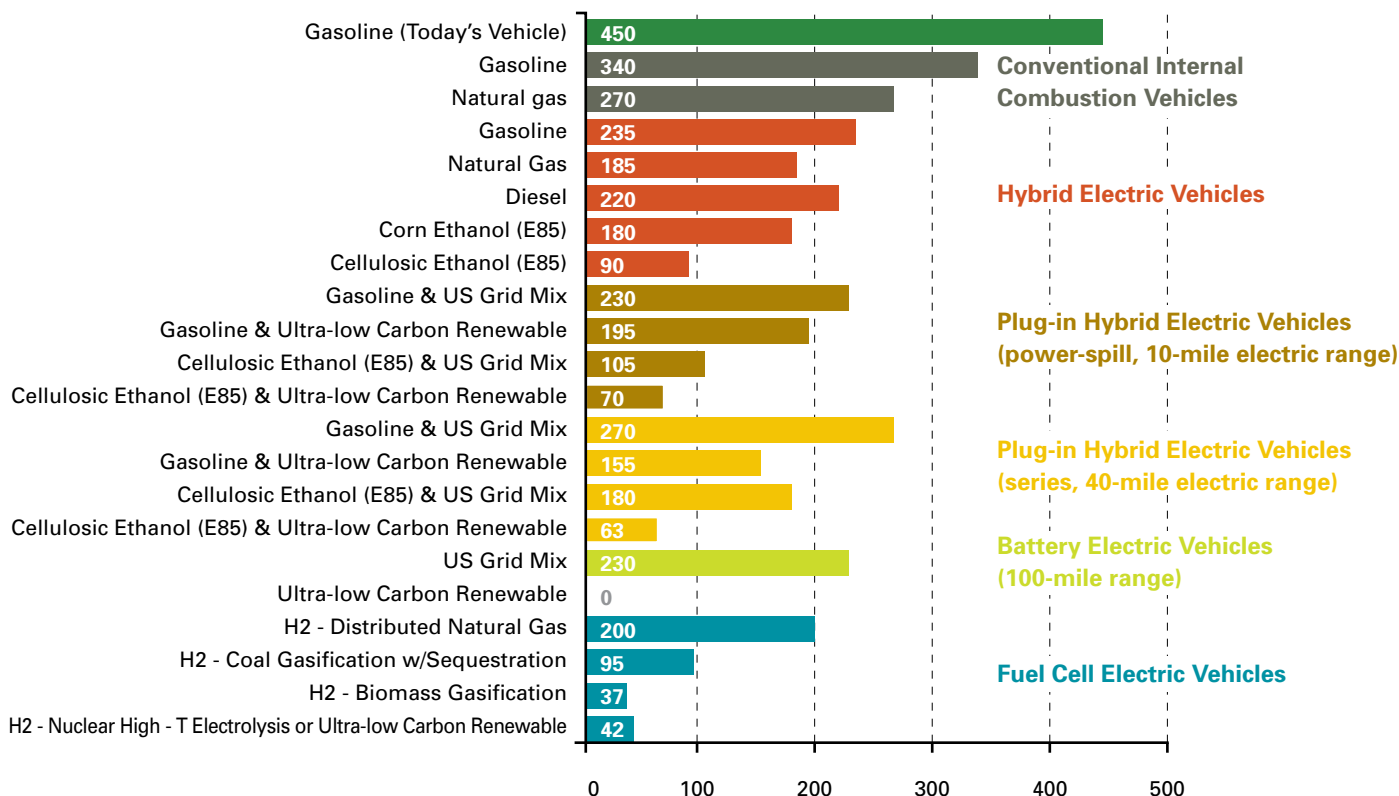
18 See: <http://www.arb.ca.gov/cc/sb375/sb375.htm>

19 The Intelligent Transportation Society of America (2011). Sizing the US and North American Intelligent Transportation Systems Market: Market Data Analysis of ITS Revenues and Employment

20 IBID

Figure 9 below gives an idea of the projected state of technologies in 2035-2045, based on GHG emissions (grams of CO₂) per mile for a mid-sized car.

Figure 9: Well-to-wheels GHG emissions for mid-sized car based on a projected state of technologies in 2035-45. Ultra-low carbon renewable electricity includes wind, solar, etc.



Low/high band: sensitivity to uncertainties associated with projected fuel economy of vehicles and attributes of fuels pathways, e.g. electricity credit for ethanol or hydrogen, electric generation mix, fraction of biomass-to-hydrogen plants with carbon sequestration, etc.

Source: US Department of Energy, 2010

What is apparent from Figure 9 is that hybrid electric and plug-in hybrid EVs, when combined with cellulosic ethanol-based biofuels, show significant GHG reduction potential over conventional vehicles fuelled by gasoline or natural gas.

It should be noted that the numbers for corn ethanol do not include GHG emissions from land-use change, which can significantly increase their overall footprint. In addition, the values presented for plug-in hybrid and battery EVs are based on the average carbon intensity for the US national electricity grid, which is considerably more carbon intensive than the grid for the West Coast region.

When battery EVs are fuelled by renewable or hydro electricity, these vehicles present the lowest GHG emission scenario of all and have the added benefit of being available for roll-out in the immediate term.

For example, EVs charged in Washington state at the present time produce about 35% of the GHG emissions produced by vehicles charged by the average US grid. Using Washington's current average grid mix with an additional 12% renewable content (a projected scenario for 2023 by Washington state), battery EVs produce a mere 84 grams of CO₂ per mile.

While hydrogen fuel cell vehicles also present a low GHG emissions scenario, fuel cell system technology is still under development, with the anticipated launch of commercial vehicles in the 2014-2016 timeframe (in the range of 10,000 vehicles). Several studies have shown that hydrogen infrastructure can be effectively deployed in tandem with vehicle roll-out with current technologies.

Advancing Alternative Fuels – The promotion of natural gas technologies as a fuel alternative, particularly for ferry fleets, large urban vehicle fleets, and long-haul intercity trucking, shows particular promise for the West Coast region.

At the recent meeting between the Governor of Washington and the Premier of British Columbia, a comprehensive suite of joint undertakings related to natural gas, renewable fuels, and clean transportation were announced. These ranged from sharing information on the possible use of Liquefied Natural Gas (LNG) for use in coastal ferries and in the heavy-duty vehicle sector, to joint reviews of regulatory oversight and information disclosure on the environmental impacts of shale gas recovery and natural gas storage to enable firming of intermittent electric generators.

The two jurisdictions committed also to work together to share information related to low carbon and renewable transportation fuels, including legislation and regulations to encourage the use and development of low carbon fuels, with a particular focus on creating a uniform market for biodiesel products across Washington and British Columbia. Information sharing on the development of advanced aviation fuels, including developing new markets for these fuels, was also part of the joint undertakings announced by the Governor and the Premier.

The West Coast Green Highway Initiative – The West Coast jurisdictions are focused on a number of sustainable transportation projects and have signed a Memorandum of Understanding (MoU) in support of an "Alternative Fuels Corridor" to help incubate the acceptance of alternative fuels and stimulate refueling infrastructure investment from BC to Baja California.²¹ The "West Coast Green Highway" is an initiative to advance sustainable transportation solutions and the adoption and use of cleaner fuels and vehicles

along the 1,350 mile Interstate 5 corridor, including biofuel, electric, natural gas, and hydrogen fuel cell powered vehicles, with the goal of using alternative fuels as a bridge toward a zero-emissions, fossil fuel-free corridor.



Source: Washington State Government

The "West Coast Electric Highway" would connect the major high tech hubs of Vancouver, Seattle, Portland, San Francisco, and Los Angeles with fast charging for EVs. The roll-out of these initiatives and related projects has large job creation potential in terms of the vehicles, the supply of alternative fuels and infrastructure, and logistics. West Coast jurisdictions are also evaluating joint procurement opportunities to accelerate the adoption of EVs and lower the per-unit costs.

In addition, Washington, Oregon, and California were among six states selected to participate in "The EV Project", a \$230 million US Department of Energy (DoE) project to spur electric vehicle ownership and infrastructure. Nissan North America and General Motors/Chevrolet are partners in The EV Project and will launch a total of 8,300 electric vehicles to select markets. Drivers of the Nissan LEAF zero-emissions electric car and the Chevrolet Volt plug-in hybrid with extended range, who qualify to participate in The EV Project will receive a free residential charger.

Expanding on The EV Project, Coulomb Technologies will deliver nearly free home and public EV charging stations through ChargePoint America, a \$37 million transportation electrification project through the DoE. The ChargePoint America program will provide a total of 4,800 charging stations to program participants in nine regions in the United States who purchase Ford, Chevrolet, and Smart USA electric vehicles. West Coast cities to benefit include Bellevue/Redmond in Washington and San Jose/San Francisco Bay Area, Sacramento, and Los Angeles, in California. In Washington, AeroVironment will manufacture, supply, install, and operate a network of fast-charging

²¹ See: <http://www.westcoastgreenhighway.com>

stations for EVs, located every 40 to 60 miles along stretches of I-5 between the Canadian border and Everett, and between Olympia and the Oregon border.²²

British Columbia has established MoUs with Mitsubishi, Nissan, Toyota, and GM to be the initial province in Canada to deploy their first EVs. The multi-stakeholder working group “Plug-In BC” has also designed a 1000-point Charging Infrastructure Project that will see the deployment of up to 1000 charging points in residential and commercial locations across the province. California, Washington, and BC also offer point-of-sale incentives for EVs and several cities in the region, including Vancouver, BC, have required EV charging infrastructure to be installed for new building construction as part of their municipal building codes.

Opportunities also exist for clean vehicle and related infrastructure manufacturing throughout the region. At the present time, each West Coast jurisdiction has developed specific strengths with examples such as Tesla in California, United Streetcar in Oregon, BMW in Washington, and the Automotive Fuel Cell Cooperation and Westport Innovations in British Columbia. The 21 companies that comprise Oregon’s EV industry saw employment gains of 9.1% in 2011 with 496 new jobs in total.

Other opportunities for improved efficiency in transportation involve work in ship design and revamping long-haul trucking and ferry fleets to be powered by alternative fuels such as natural gas.

Shifting to More Environmentally Efficient Modes

– Investment in public transport and infrastructure that promotes walking and cycling generates jobs, improves well-being, and can add considerable value to regional economies. The Economic Development Research Group (2009) and the Surface Transportation Policy Project (2004) suggest that \$1 billion spent on public transport generates some 36,000 jobs, which is 9% and 19% higher than the job-creation potential of road maintenance or new road projects. Public mass transit is already one of the largest clean economy segments in terms of existing local jobs in all four West Coast jurisdictions and there is room for further growth.

However, public mass transit tends to be a major issue in North America where, historically, low-density community development makes providing services a challenge to municipalities and operators, especially from a cost perspective. By embracing higher-density urban planning throughout the region, the success rate of public transit initiatives increases, and in turn, so do the employment benefits.

Portland, Oregon, is recognized as a North American model for public transit, due in part to the metropolitan area’s regional master plan which favors transit-oriented development by promoting mixed-use, high-density development around light rail stops and transit centers, as well as the investment of federal tax dollars into multiple modes of transportation that include cycling, buses, light rail, street cars, trams, and commuter rail.



Additional efforts to promote public mass transit initiatives throughout the West Coast region have resulted in success, including implementing dedicated express lanes for buses and adopting smart technologies such as transponders on buses that allow for traffic control in cities such as Los Angeles. High-speed rail corridors have also been identified between Vancouver, BC, and Portland, as well as Los Angeles and San Francisco. Investments in infrastructure and services have immediate pay offs in terms of local job creation.

Intermodal passenger terminals shared among bus, rail, transit, and possibly airports can facilitate shifts away from personal vehicles. This option would improve and expand the options, routes, schedules, and connectivity of the passenger rail system to encourage use of and the associated GHG reductions from more efficient transport.

Other clean transportation alternatives that have job creation benefits include the adoption of different vehicle usage patterns, including more use of car/van pools and car and bicycle sharing. A proliferation of car-sharing cooperatives has emerged in recent years where people rent cars for short periods of time, often by the hour. This provides access to vehicles for those who either cannot afford one, or choose not to own one, with the aim of contributing significantly to sustainable mobility patterns using various transport options rather than vehicle ownership and, in turn, generates jobs related to the operation and maintenance of these vehicle programs.

²² See: http://www.wsdot.wa.gov/News/2011/07/13_ElectricHighways.htm

One example is the Car2Go car-sharing operation that provides a fleet of free-floating, low-emission, self-service smart for two cars distributed throughout the participating cities for on-demand access.²³ Launched by Daimler in the southern German city of Ulm in March 2009, the West Coast region has operations in both Vancouver and San Diego. The program in San Diego is helping to support the city's green mobility strategy, allowing Car2Go to roll out the first zero-emission, electric drive car-share service in the world.



Source: <http://www.car2go.com>

Modal shifts in the goods movement sector also have potential for reducing GHG emissions from truck and car to rail and ship, for example. Increasing rail capacity will enable some freight to shift from trucks to rail as moving freight by rail is much more fuel efficient than by truck. In addition, rail infrastructure improvements could enable more use of the fuel-efficient double-stack rail cars. Economic assistance and regulatory streamlining could improve intermodal rail yards and relieve rail freight bottlenecks. Moving freight from highways to rail would also relieve congestion on highways, improving the fuel economy of the remaining vehicles on the road.

Finally, infrastructure projects that promote walking and cycling, such as designated bike lanes and pedestrian walk ways, have immediate benefits for local job creation.

Each jurisdiction within the PCC has demonstrated strong leadership in developing and integrating clean transportation initiatives. The West Coast Green Highway initiative has laid the groundwork for regional collaboration on several transportation-related market opportunities. The development of a broader West Coast Green Transportation initiative could enable the coordination of both existing and new transportation initiatives focusing on innovation for

moving goods and people within the region. The integration of natural gas vehicles into port activities, inter-regional ferries, high-speed rail, and long-haul trucking operations is an example of a market shift which stands to benefit from coordinating policy development and infrastructure resources.

Summary of Key Opportunities:

CLEAN TRANSPORTATION

- Promoting intelligent transportation systems through initiatives such as New Mobility Hubs to enhance transit-oriented development and create employment throughout the value chain.
- Improving vehicle efficiency and promoting alternative fuels through efforts such as the West Coast Green Highway and the joint procurement of EVs, as well as policies such as low carbon fuel standards, to bring benefits to local industry.
- Promoting a shift to more environmentally-efficient modes of transportation, including truck and car to rail and ship, as well as the greater use of natural gas for long-haul trucking and ferry fleets.
- Adapting building codes to allow for the installation of EV infrastructure to help advance the market adoption of these vehicles.
- Investment in public mass transit to generate higher job-creation spin-offs than new road projects or maintenance, and the further promotion of mixed-use, high-density urban development.

²³ See: <http://www.car2go.com>

ENVIRONMENTAL PROTECTION & RESOURCE MANAGEMENT

Opportunities in the Environmental Protection and Resource Management sector are linked directly to the preservation of clean water, clean air, and unpolluted soil conditions, as well as to the remediation of contaminated sites and the management of waste streams. Environmental protection-related goods and services are used to measure, prevent, limit, or correct environmental damage (both caused naturally or by human activities) to ecosystems. Business in this area is driven in large part by environmental regulations and legislation.

This sector already employs the highest number of clean economy workers in all four jurisdictions, particularly in the areas of conservation, organic food and sustainable farming, sustainable forestry, waste management and treatment, and professional environmental services. While a large amount of new employment growth is not expected from all areas in this sector to 2020, there are a number of key segments which show considerable promise in terms of job creation potential. These areas include GHG management and related services, water management and efficiency, natural resource management, climate adaptation work related to improvements to infrastructure, urban agriculture and forestry, and waste diversion, recycling, and reuse of waste materials for new products.

Air Pollution and GHG Management – In the US, the 1990 amendments to the federal Clean Air Act added provisions for addressing acid rain, ozone depletion, toxic air pollution, and proposed an emissions trading scheme. California's Air Resources Board (CARB), established in 1967, has been that state's clean air agency and a North American leader in limiting GHG emissions from motor vehicles through policies and programs, including its alternative fuel vehicle incentive program, low- and zero-emissions vehicle (ZEV) program, and the low carbon fuel standard (LCFS).



California's Air Resources Board (CARB), has been a North American leader in limiting GHG emissions.

In addition, California's Global Warming Solutions Act (AB-32) requires that the state's GHG emissions be reduced to 1990 levels by 2020, a reduction of approximately 30% from business-as-usual levels. At the core of AB-32 is a cap-and-trade scheme which sets a state-wide limit on sources responsible for 85% of California's GHG emissions and establishes a price signal to drive long-term investment in cleaner fuels and more efficient use of energy. These initiatives have been creating jobs throughout the clean economy supply chain, including in clean energy, energy efficiency and green buildings, transportation, and GHG management and related services.

California has been the driving force behind a proposed regional carbon trading market for GHG emissions, the Western Climate Initiative (now managed by WCI Inc.), with compliance set to start in 2013. The WCI partner jurisdictions have developed a comprehensive initiative to reduce regional GHG emissions to 15% below 2005 levels by 2020 and spur investment in and development of clean energy technologies and jobs.

British Columbia is also showing leadership in this area with a proposed LCFS and legislation targeting to reduce GHG emissions, including a province-wide, revenue-neutral carbon tax on fossil fuels and a mandated carbon-neutral public sector. The province is a committed member of the WCI. These initiatives and public policies are spawning clean economy-related innovation within industry and the public sector, and have created a carbon credit and offset market in the province managed by the Pacific Carbon Trust (PCT).

Washington and Oregon, while no longer part of the WCI, have joined the North America 2050 (NA 2050) Partnership for Progress, which facilitates state and provincial efforts to design, promote, and implement cost-effective policies that reduce GHG emissions and create economic opportunities. NA 2050 is open to all US and Mexican states and Canadian provinces and accomplishes its objectives through working groups that focus on different aspects of energy, climate, and economic challenges facing each jurisdiction.

Washington has adopted a set of coordinated policies to meet its statutory GHG reduction targets for 2020 and beyond while creating clean economy jobs. The adopted policies are mainly focused on transportation and energy efficiency.

Throughout the West Coast region, many economic development and revitalization programs underway target jobs designed that prevent or mitigate environmental pollution or jobs tied to technologies, goods, and services that boost clean energy production, promote energy efficiency, and reduce GHG emissions.

Further opportunities exist for employment creation and investment promotion by strengthening policies and legislation in these areas and linking them directly to economic development initiatives related to clean energy technology development and deployment, clean transportation services and infrastructure, enhanced energy efficiency in the built environment, and green building design, construction, and retrofitting. Employment and investment promotion also exists in the management of GHG reduction strategies and the use of creative financing tools for the initiation and deployment of technologies and demonstration projects that serve these ends.

It should be noted that while some of the air pollution and GHG reduction policies mentioned above overlap with other sectors of the clean economy presented in this report (such as Clean Transportation and Energy Efficiency), job numbers and employment impacts were quantified using the methodology outlined in the Methodology Document that assigns these policies to specific sectors to avoid double counting.

Water Management and Efficiency – There is a need for improved water infrastructure and water-efficient technologies (such as water meters and controls) in order to balance commercial, industrial, and municipal interests for this finite resource.



Jurisdictions such as BC, Washington, and Oregon (which rely heavily on water for their hydropower) and California (which relies on water particularly for its agriculture industry) are preparing for a changing climate by developing adaptation strategies that address water shortages in key areas.

As such, the "Pacific Northwest Regional Water Quality



Program” was started as a partnership among land grant colleges and universities, water research institutes, and the US EPA Region 10 to provide leadership for water resources research, education, and outreach to help communities, industry, and governments prevent and solve current and emerging water quality and quantity problems throughout the Pacific Northwest.²⁴ This partnership is being supported in part by the USDA’s National Institute of Food and Agriculture (NIFA).

In California, the Department of Water Resources is focused on integrated water management with the “California Water Plan” providing a collaborative framework for all stakeholders and the public that evaluates different combinations of regional and state wide resource management strategies to reduce water demand, increase water supply, reduce flood risk, improve water quality, and enhance environmental and resource stewardship.²⁵

In Washington, the “Columbia River Water Supply Program” is a good example of a collaborative framework for all stakeholders to aggressively pursue development of water supplies to benefit both in-stream flows and out-of-stream uses.

As a shared resource that crosses jurisdictional borders, a collaborative approach to water management and efforts to improve water access for all users will help to spur investment and employment opportunities throughout the West Coast region.

Natural Resource Management & Climate Resiliency

²⁴ See: <http://www.pnwwaterweb.com/index.htm>

²⁵ See: <http://www.waterplan.water.ca.gov/index.cfm>

– Natural resource management is inclusive of a number of traditional industries that have direct links to the clean economy – in particular, sustainable forestry management, agriculture and horticulture, and fisheries and aquaculture. Protecting jobs through sustainable resource management practices that build resilience into the planning process are seen as essential to the clean economy.

Fortunately, the policy-related clean economy job growth estimates for this study so far suggest the economic and employment gains from the transition to the cleaner economy outweigh displacements. Many new jobs will arise from the more sustainable exploitation of the West Coast region’s natural resources, particularly in the forestry and agricultural sectors.

A more recent area of focus and job creation throughout the West Coast region is the growth of urban agriculture, as well as forestry practices that are increasingly including carbon sequestration benefits into their management strategies.

The impacts of a changing climate are painfully evident in the region’s forestry industries where increasing risks from forest fires and infestations by insects such as the Mountain Pine Beetle have had devastating impacts on some communities. Similar job losses have been felt in the local fisheries and aquaculture industries, due in part to increased ocean acidification and declines in shellfish and wild fish stocks. New opportunities for employment gains in the private and public sectors are linked directly to conservation, ecosystem restoration, and climate adaptation initiatives.

In September 2006, the Governors of California, Oregon, and Washington launched the West Coast Governors’ Alliance on Ocean Health (WCGA), a proactive, regional collaboration to protect and manage ocean and coastal resources along the entire West Coast. British Columbia,

through the February 2010 PCC commitments, has joined the other jurisdictions in many of their ocean and coastal initiatives. Additional examples of collaborative efforts include the scientific research-focused seafloor observatories in BC (e.g., VENUS and NEPTUNE projects) and the US Ocean Observatory Initiative efforts in Washington, Oregon, and California (e.g., RSN and MARS).

While natural capital valuation is a relatively new concept in the business community, recent research clearly points toward the economic and social value of preserving natural resources as whole ecosystems. Several governments and supporting organizations throughout the West Coast region have shown leadership in attempting to quantify and index the capital value of their natural resources. Opportunities exist for the West Coast jurisdictions to coordinate research efforts and to identify priority areas for leveraging the region's environmental assets. These initiatives tie in to current climate adaptation efforts and initiatives to improve regional resiliency, whether it be through shoreline restoration, protecting against tidal surges, or building better cities which appreciate the health benefits and the economic value provided by green spaces and ecological preserves.

Improving the availability of information for local communities to evaluate risks and vulnerabilities to climate impacts is also an important aspect for building stronger communities throughout the West Coast region.

Finally, emergency management response and preparedness with respect to climate-related disasters is another area of opportunity for collaboration that has employment spin-offs and would benefit West Coast jurisdictions through coordinated, preemptive disaster mitigation and response plans focused on floods, droughts, and wildfires. As one example of success in the region, the Pacific Northwest Emergency Management Arrangement (PNEMA), originally signed in 1996, provides for the coordination of resources and support during emergencies.

It is in the area of risk and disaster relief management where preparedness and mutual cooperation are most critical. Under conditions of major calamity, normal channels of communications and relief management may be stressed to the breaking point, inhibiting fast response by emergency personnel and other first responders. The recent tsunami in Japan bears testimony to this tragic reality. Members of the PCC need to anticipate the worst in relation to climate related disasters and to plan ahead to establish protocols for expedited mutual assistance and post disaster impact management.



There are no quick fixes to the problems of climate change; that much is clear. But there are significant opportunities associated with risk reduction initiatives and activities to mitigate the impacts of climate change. And because climate change is a shared, region-wide challenge, great benefit can be derived from shared policies and programs for the proper management of natural resources, collaborative data collection on climate risk minimization initiatives, cooperative research on such matters as marine, coastal, and terrestrial ecosystem restoration, and sustainable forestry and agriculture practices.

Waste Diversion, Recycling, and Green Consumer

Products – Solid waste management is integral to a cleaner economy as the countless by-products of human consumption and economic activity represent an almost unlimited supply of materials that require collecting, processing, and either disposal or repurposing. Waste streams include industrial and municipal solid waste, hazardous wastes, organic wastes, and electronic waste (e-waste).

The bulk of new jobs, however, will come from the recycling and reuse of products and materials. Recycling systems are driven by a number of factors including population growth, public awareness, regulations and legislation concerning waste management, and the availability of recycling infrastructure and services. Consumer demand for recycled products is increasing and businesses are looking to lower costs through reduced packaging, trends that are growing the demand for recycling systems and related jobs.

Recycling systems are increasingly and successfully converting traditional waste streams into profit streams, including bio-chemicals, bioenergy, and manufactured items. Organizations in communities across North America have developed waste-to-profit networks to find new uses for

waste streams and are investigating innovative solutions for turning them into profitable opportunities.²⁶

Within the manufacturing sector, a focus on energy efficiency and lean manufacturing is allowing for considerable cost savings and improved product and packaging design. In addition, firms are now approaching product development by looking at the whole life cycle of the product and considering “closed-loop” or “cradle-to-cradle” processes.

Programs and policies such as Extended Producer Responsibility (EPR) and Recycled Content are encouraging manufacturers to take greater accountability for their products at the post-consumer stage. In 2009, the Canadian Council of Ministers of the Environment approved a Canada-wide Action Plan for EPR and a Strategy for Sustainable Packaging.²⁷

The US EPA, as another example, has recycled content policies that require a certain percentage of products to come from recycled materials.²⁸

Increasingly stringent regulations and policies, combined with industry leadership, will continue to drive product and packaging innovation in the West Coast region. Local municipalities, innovative businesses, and organizations such as the BC, Northwest, and California Product Stewardship Councils are working together to identify opportunities and set up networks to divert waste from landfills and repurpose the materials for businesses in need of resources and inputs. Employment in this area include on-the-ground jobs in managing materials into the reverse distribution chain, jobs in innovation around product redesign and packaging, and jobs in repurposing materials in resource pools to create more value-added, locally manufactured products.

Technology advances are also enabling green product developments. As one example, new technology is now enabling municipalities to convert waste sludge into biogas and fertilizer at wastewater treatment plants. The same technology has the potential to reduce costs for the pulp and paper industry by reducing the nutrients added during anaerobic digestion.²⁹

Summary of Key Opportunities: ENVIRONMENTAL PROTECTION & RESOURCE MANAGEMENT

- Efforts to limit air pollution and GHG emissions have the potential to create a wave of employment opportunities in carbon management and related services and would serve in part to help resolve existing uncertainties in the national and regional policy landscape.
- Projects focused on water infrastructure improvements, land remediation, brownfields redevelopment, and ecosystem restoration show large local employment potential.
- Improving water management and efficiency through the deployment of technologies such as water meters can help build resiliency to climate change and generate jobs.
- Coordinating the collection, monitoring, and sharing of environmental data and information can help build more resilient communities, protect natural resources and related jobs, and help in preparing for climate-related emergencies.
- Promoting new jobs in waste management and diversion related to recycling and reuse, driven in part by industry-led initiatives and public policy requirements such as EPR.

26 The Illinois Manufacturing Extension Center (IMEC) is an organization working to set up waste-to-profit networks across the state of Illinois. See: http://www.imec.org/imec.nsf/All/Waste_to_Profit?OpenDocument

27 See: http://www.ccme.ca/ourwork/waste.html?category_id=128

28 See: <http://yosemite.epa.gov/ee/epa/eed.nsf/a8aa55f234e-6571a852577420067397e/e74cae64d8cd4cef85257746000afeea!OpenDocument>

29 Article published in Canadian Plant West, March/April 2011. See: <http://www.canadianmanufacturing.com/fabrication/pulp-sludge-is-green-gold-29801>

Organizations must embrace a new innovation paradigm that promotes collaboration between all players, fosters creativity, and emphasizes solutions that meet local needs.



KNOWLEDGE & SUPPORT

The Knowledge and Support sector comprises post-secondary educational institutions and training organizations, as well as aspects of government and public service agencies that are dedicated to advancing the transition to a cleaner economy through regulation and compliance, policy design, and program implementation.

It has been said that innovation will be one of the most important drivers of a cleaner economy. Many believe that the greatest innovations of the 21st century will be those that address human needs, such as improved health and environmental quality, better energy security, and increased access to education, with the notion of “doing well by doing good”. Findings from a GE Global Innovation study that was released in January 2011 and involved a survey of approximately 1,000 business executives from 12 countries reinforced the notion of innovation as the main lever for building more competitive economies.³⁰

The study also highlighted the importance of strategic partnerships as a key to innovation. Partnerships will be important to ensure that companies remain competitive and can retain a productive and efficient workforce. As stated in the report: “Innovation in the 21st century requires a new blueprint, one that topples the top-down approach and engenders collaboration among companies, governments, and communities...organizations must embrace a new innovation paradigm that promotes collaboration between all players, fosters creativity, and emphasizes solutions that meet local needs.”³¹

³⁰ See: <http://www.globe-net.com/articles/2011/january/30/how-the-rules-of-innovation-are-changing.aspx?sub=15>

³¹ See: <http://www.globe-net.com/articles/2011/january/30/how-the-rules-of-innovation-are-changing.aspx?sub=15>

All West Coast jurisdictions have been investing in innovation through a variety of programs and initiatives. In Oregon, for example, a partnership between the private sector, state government, and the state's four research universities have created the Oregon Innovation Council, which is working to create jobs, incubate companies, and bring outside dollars to the state.³² It has been estimated that the program generates more than \$7 for every legislatively invested dollar. Increased collaboration and partnerships to this end will only expand the pie further.

In addition, under a federal "Jobs and Innovation Acceleration Challenge" grant awarded recently for clean economy workforce innovation, 20 workforce, economic development, and education providers from the Greater Portland metropolitan region and South-Western Washington will focus on three core economic development strategies: technology commercialization, supply chain development, and product diversification and re-engineering.³³ The "Clean Tech Advance" initiative will further integrate two of the Portland metro region's prominent industry clusters to accelerate clean technology innovation and production to meet growing global demand. This grant will allow the bi-state region to build, support, and diversify the clean technology manufacturing cluster and its workforce in a truly equitable, collaborative, and coordinated way.

In Washington, "Innovate Washington" is working to accelerate technology-based innovation through a highly-collaborative ecosystem that brings together entrepreneurs, large companies, state government, investors, and industry leaders.³⁴ In this environment, the organization creates custom economic development plans for identified technology sectors, helps promising companies receive the growth capital they need, and supports entrepreneurs through an array of focused tools and services. A public-private hybrid, the organization's first sector of focus is clean energy to achieve sustainable job growth for the region.

Creating a network of existing "centers of excellence" could enable collaboration on research and development that would lower the costs associated therewith and help reduce costly duplications of effort. For example, British Columbia's bioenergy test facility at the University of Northern BC in Prince George could be made available to researchers from other jurisdictions, and in return, the door would be open for researchers from Canada at research facilities in California, such as the Agricultural Sustainability Institute at the California State University Institute for Sustainability.

Education and Training – Workforce development, the education of a new generation of managers, and the training of the labor force on low carbon and clean economy practices will also be key factors in society's transition toward systemic changes that promote sustainability. Science and technology graduates will be critical to the knowledge or "innovation" economy and, in combination with increased technology adoption rates and R&D investment, can lead to higher productivity, which will be important for jurisdictions struggling to grow business opportunities with a shrinking labor force. An earlier study by GLOBE in 2010 found that BC could face skilled labor shortages in the range of 60,000 workers if actions are not taken to address the issues.³⁵



West Coast jurisdictions have been supporting education and training through investment in education funds and programs and by providing training tax credits, for example. However, there continues to be a large number of graduates from specialized energy efficiency, renewable power, and green building training programs who are struggling to find work or are under-employed and waiting to apply their skills in well-paid positions within the clean economy. Opportunities exist for a collaborative education and training strategy around clean economy jobs to ensure supply for skilled labor meets demand in potential high-growth sectors.

Public Sector – The public sector also has a large role to play in shaping the opportunities in the clean economy. Through forward-looking, strategic, and broad-based programs and policies, government can instill and inspire positive, sustainability-focused changes within the public at large.

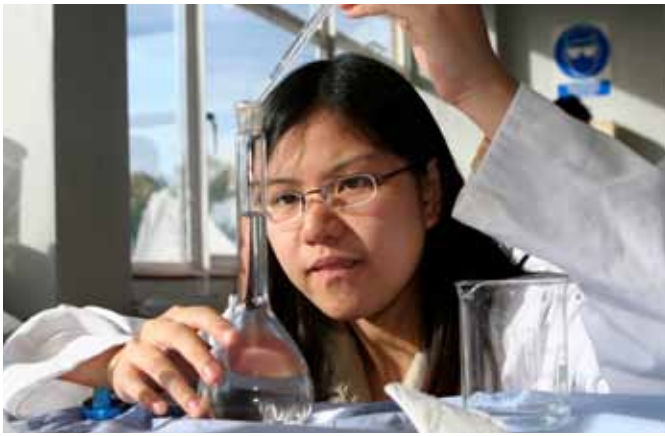
One of the greatest opportunities relates to the facilitation of knowledge sharing and collaboration across jurisdictions.

32 See: <http://www.oregon4biz.com/Innovation-in-Oregon/Oregon-Innovation-Council>

33 See: <http://www.greaterportlandinc.com/news-events/2011/09/23/federal-jobs-and-innovation-grant-awarded-to-portland-vancouver-region>

34 See: <http://www.innovatewashington.org>

35 See: http://bcgreeneconomy.globeadvisors.ca/media/6723/globe_bc_green_economy_report_ii_final.pdf



The PCC is a prime example of how regional collaboration among governments can lead to greater opportunities and benefits which are unattainable by any individual jurisdiction. Through a shared strategic vision and the pooling of human and financial resources, the PCC is able to act as a model for advancing public sector leadership throughout the West Coast region.

The public sector can continue to drive innovation within the clean economy by supporting synergies among local universities, various levels of governments, the private sector, and the NGO community. Enhanced collaboration among the region's public sector institutions has led to thriving networks of innovation, joint research opportunities on emerging clean technologies, the sharing of sustainable design and green building practices, a greater understanding of climate change issues, and progress for the region's collective knowledge on ocean sciences.

West Coast jurisdictions, through various government commerce and innovation agencies, have been integral in developing entrepreneurial talent and fostering commercialization. These agencies have supported entrepreneurs by providing education and training programs, as well as engaging them with their private sector peers through mentorship initiatives. As an example, the California Governor's Office of Business and Economic Development (GO-Biz) provides support to pre-venture and startup firms within the state.

Continued regional cross-collaboration amongst public sector departments could provide greater access to resources to build capacity and leverage region-wide strengths and technical capabilities.

Summary of Key Opportunities:

KNOWLEDGE & SUPPORT

- Promoting innovation as the key driver for change and investment in the knowledge economy through innovative partnerships, as well as strengthening regional collaboration through centers of excellence that can help to grow opportunities in the knowledge sector.
- Strengthening the education and training of the region's skilled workforce to maintain a competitive advantage in the clean economy.
- Promoting clear, consistent policy frameworks and regulatory environments that support key sectors and encourage private sector investment and employment growth in the clean economy region-wide.