

CANADIAN GREEN ECONOMY TRANSITION

DISCUSSION PAPER:

COMPREHENSIVE ROADMAP ON OPTIONS

FOR A BETTER ECONOMIC PARADIGM

Latest metamorphosis: 26 02 16

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**Part 1: Global Green Economy Rapidly Evolving, the Canada Green Economy Gap,
Setting Targets and
Federal-Provincial/Territorial Collaboration**

**1.1: Preface: A Fast-Forward Canadian Green Economy Plan for Catching up Entailing Learning from
Those More Advanced than Canada and Canadian Past Experiences**

While the Paris COP21 agreement constitutes progress on a global scale, it merely requires countries to set non legally binding targets and review progress on these targets every five years. That said, the Government of Canada implied, at COP21, that it will be enhancing Canada's targets from the levels proposed by the previous government.

Notwithstanding their respective COP21 "commitments," the intensity of efforts, or roadmaps, for nations to achieve their respective COP21 targets, are at the discretion of the participating nations. The Roadmap for Canada presented in this document, places 98% of the emphasis on options on "**how to make a timely Canadian transition to a green economy paradigm.**

Regarding the order of magnitude of the challenge, Canada has a lot of catching up to do on the global high job creation green economy in relation to actions on climate change in China, the EU, the US and elsewhere. Prior to COP21, Canada was already way behind its competitors, [rating 56 among 61 nations on a 2016 Global Climate Change Performance Index](#). Put another way, Canada's share of global clean tech markets is [1.3% and falling](#).

Against this backdrop, this discussion paper on a Canadian transition to a green economy offers government elected representatives and employees; environmental organizations; research entities; clean tech firms; and other key stakeholders, comprehensive choices of paths for a fast-forward catch up with Canada's competitors. This highly detailed Roadmap is based on 1) models from around the globe, adapted and improved upon for "Made in Canada" applications and 2) my own experiences as a former Government of Canada employee, regarding sustainable development policies, legislation, programs, projects, etc., up to my retirement in June 2012. The latter consideration provided insights on how to best to adapt measures from elsewhere to suit Canada, as well as insights on lessons to be learned from past Government of Canada climate change action plans -- what has worked and not worked, what needs improvement, organizational structures, federal-provincial relations, etc.

As the above-mentioned status of Canada in the global green economy suggests, developing a comprehensive plan to close the green economy gap with Canada's competitors is a tall order.

In 2014, there were [371,000 jobs and 1.2M jobs in the German and EU renewables sectors](#) respectively and [3.5M jobs in EU green sectors](#) at-large.

China, the world's most aggressive country on the green economy, [had 1.9M jobs in their solar electricity and solar heating/cooling sectors in 2014 and 356,000 in their wind sector.](#)

Not only are the job numbers mind-boggling, but the return on government investments for job creation are equally significant. There are [6 to 8 times more jobs per government investment unit](#) for investments in the green economy compared with that of the traditional resource economy.

Of course, it is the staggering rate at which newly installed renewables capacity is being added around the globe that explains the awesome employment growth in the domain.

China's total installed capacity for [wind farms stood at 145 GW in 2015](#) and for solar farms at [28 GW in 2014](#). An incredible total of [30.5 GW](#) on new windpower capacity had been added in 2015. The solar PV sector saw [16.5 GW added in 2015](#), a world record! For 2020, the projected installed capacities for wind and solar farms stand at [up to 200 GW each!](#)

Germany, [with 43 gigawatts \(GW\) of installed wind capacity in 2015](#), is Europe's largest windpower market.

In the US, the recently approved extensions of subsidies for wind technologies through to 2019 and for solar technologies through to 2021 will bring the current US installed wind capacity of [74.5 GW](#) and present solar capacity of over [24 GW](#) to a projected additional capacity of [103 GW by 2020 for these two sectors combined](#). The prospects that the US will meet the 2020 projections are looking good in that [68% of new electric power installations in 2015 were associated with renewables](#), the second year in a row that clean energy capacity exceeded fossil fuel additions.

In what may be a good omen coming from the US, US advances in energy efficiency has meant that [since 2007, US energy consumption has fallen while its GDP rose 10%](#). **Growth can happen while energy consumption declines!!**

Turning to the subject of impacts of clean energy tech growth on emissions, China, the world's largest energy consumer, with its growing massive investments in renewables, [\\$89.5B in clean energy in 2014](#), and was largely responsible for a 2014 global plateau in GHG emissions. In that year China's GHGs and coal consumption declined!

In 2015, China invested an astounding [\\$110B in renewables and energy efficiency](#) and [coal consumption slumped for the second year in a row in 2015](#), from 4% to 5%.

What's more, China's continuing amazing shift to clean energy and linked to its ongoing "war on coal" has made it possible for China, the world's largest producer and consumer of coal, to now commit to closing [down 1000 coal mines in 2016 and not opening any new coal mines for the next three years](#) (2016-2019). Confirming the trend, the year 2015 saw the rate of [China's coal consumption decline for the second year in a row, this time by another 4.5%, topping the above-mentioned decline in 2014](#). This has significant positive global repercussions.

It is because nations around the globe are increasingly getting more aggressive on climate change and the costs of clean technologies are rapidly declining, that the flattening of demand for fossil fuels is not cyclical, as some traditional economists would want us to believe, but part of a growing trend favouring a migration to a green economy.

As such, [the business model of Big Oil is collapsing](#) because it is premised on strong growth to 1) contribute to high prices and, in turn, 2) render economically viable, the exploitation of expensive to develop, non-conventional fossil fuels, such as the tar sands and shale oil and gas.

And while the green economy has yet to have a major impact on the transportation sector -- currently nearly 100% dependent on petroleum -- **policies in place in China, California and Norway indicate that the transition to significantly less fossil fuel dependent vehicles is imminent.**

Beginning this year, 2016, [30% of all Government of China vehicle purchases are to be electric](#) and the country intends to [manufacture 2M eco-vehicles per year by 2020](#). Add to the equation, 1) in China, in [the first nine months of 2015, 136,700 electric vehicles and plug-in hybrids were sold and 144,200 were produced](#); 2) in 2015, [Beijing restricted new vehicle registrations to electric vehicles and plug-in hybrids](#); and 3) Shenzhen targeted to have more [than 3,000 electric taxis, 5,000 hybrids and 1,000 electric urban transit buses](#) on the road in 2015.

Not to be outdone, California has put in place an impressive package of policies to reach its target of [1.5M zero emission vehicles \(ZEVs\) on the it's roads by 2025](#); including requirements that 1) ZEVs represent 15.4% of vehicles sold by each manufacturer by 2025; 2) there be enough charging stations to support 1M ZEVs statewide by 2020; and 3) 10% of the state's light duty vehicle purchases be electric, as of 2015.

In Norway, thanks to multiple incentives, in [2015, 25% of January to August new car sales were electric vehicles.](#)

What are the ramifications of the preceding global developments in terms of changes towards a new economic paradigm? Well, even the [BP Chief Economist, Spencer Dale](#); [UBS](#), the world's largest bank; and [Mark Carney](#), Governor of the Bank of England, have concluded that, with the increasingly aggressive government actions on climate, the fossil fuel glory era is nearing its end, **meaning much of the world's proven reserves will become stranded assets, or liabilities.**

To sum up, to close the green economy gap, Canada must learn from 1) the models of nations more advanced than Canada and 2) past Canadian experiences on actions on climate change. And most critical, if we are to be serious about changing the economic/energy paradigm, we have got to move beyond mantras of "magic/tired old solutions" to a comprehensive economy-wide game plan covering all the main bases. The idea here is to have the very extensive sets of Roadmap components, that collectively, and in a synergistic fashion, foster the desired transition.

This entails reviews leading to solutions that 1) are broken down, policy-by-policy, program-by-program, etc.; 2) include organizational mandates; 3) specify sources to finance new measures and 4) back up all of the above with proposals on legislation and fiscal measures, incentives/disincentives, etc. **This is what Sections 2 to 14 are all about, presented by way of options for government and other stakeholders to choose from, or cherry pick, as per their respective preferences.**

On item #3 above, the order of magnitude of the potential for a new sources of financing the transition to green economics could be enormous in light of the International Monetary Fund estimate that in 2015 the annual subsidy for petroleum, natural gas and coal in Canada stood at \$46B (USD). More on this in sub-section 2.1.

1.2: Setting Targets and Making up for Lost Time

While the lion's share of the guidelines in this document are focused on "**HOW TO**" achieve a Canadian migration to a green economy, **much importance should also be attributed to targets for several reasons.**

Some of these reasons are: 1) to follow through on the Paris COP21, where the Government of Canada expressed interest in more ambitious GHG reduction commitments, in line with the COP21 objective of limiting the aggregate global rise in temperatures to 1.5 degrees centigrade ; 2) to offer Canada a means to assure it is on track for closing its green economy gap when compared with other nations currently more advanced on GHG reductions -- in particular compared to the EU nations, with their ambitious targets and levels of efforts contributing to high success rates on their targets; and 3) to compare Canada with the incredible pace of green economy advancements in China, a pace which saw the aforementioned dips in GHGs and coal consumption in 2014. The expectation is that when the 2015 data is in, it will show that China's GHGs incrementally declined further in 2015, thanks to China's global leadership in clean tech investments, manufacturing and other related activities.

Expanding on item #2 above, Europe is a good place to begin both for inspiration and international comparisons on closing Canada's green economy gap.

The EU has fixed 2020 targets for a 20% reduction in GHGs, a 20% improvement in energy efficiency and a 20% renewables goal, based on 1990 levels. For the same period Germany has set a target of 40% reduction in GHGs. And the European Council, or Heads of State of the EU, recently endorsed a 40% GHG reduction target for 2030.

Of course the EU is coming from a big head start, that includes the myriad of complementary policies by EU member nations in support of a migration to a green economy. -- Indeed, this is why much of the EU wide and EU nation-specific policies on climate are integrated in this document in the form of applications for a Canadian context.

But how can Canada catch up? On one hand, it would be nice if Canada could match the EU with a reduction of GHGs by 20% over 1990 levels by 2020. But this may not be realistic in light of the fact that Canada's GHG's have spiked up under the reigns of previous governments for several decades. This includes the period when Canada was committed to Kyoto Protocol targets.

Accordingly, one option would be to set a target for a 20% reduction by 2022, leaving wiggle room to initiate the catching up with the EU. However, this wiggle room - 20% by 2022 -would come with the caveat to the effect that there would be a 2025 target for a 25% reduction of GHGs.

In this way, Canada would have some flexibility in starting from behind our competitors while putting the right pieces in place to develop a green economy momentum to match, or come close to matching, the EU, with a 35% to 40% GHG reduction target for 2030.

1.3: Collaboration with the Provinces and Territories on Targets and Initiatives

On the matter of federal collaboration , the Government of Canada could take a page from the German party, SPD (social democrats), specifically from their 2013 election campaign, calling for an energy Council that would oversee the distribution of responsibilities between the federal government and the German states, the Bundesländer.

Specifically, it is recommended that the aforementioned GHG national targets outlined in sub-section 1.2 be a starting point, from which a newly created Federal-Provincial Climate Council of Energy and Environment Ministers (or some other new entity of the government's choosing, as appropriate) would thrash out 1) provincial/territorial GHG reduction targets and 2) national and provincial/territorial targets on renewables, energy efficiency , clean transportation, low carbon buildings and other considerations.

The Climate Council, or otherwise named entity, would also assure national and regional policy synergies and oversight for optimal effectiveness plus advise on related matters concerning best practices pertaining to policies on clean energy, energy storage, low carbon buildings and clean transportation and so on. (See sub-sections 1.5; 1.7; 3.1; 4.4; 5.1; 5.2; 6.2; 9.1; 9.2; 10.1; 10.2; 10.3; 10.4 and 12.3). These measures would follow in the footsteps of the EU model to assure that the 28 member states do not stray from agreed targets and the policy synergies necessary to achieve the goals are put in place.

Accordingly, the Climate Council -- or otherwise named entity -- would issue a report every two years that covers recommendations on modifications to existing policies and new initiatives.

1.4: Price on Carbon: Fixed Price for Carbon and Cap & Trade are Not Magical Solutions

With different provinces having different choices on the path to be taken, cap and trade versus a fixed price on carbon versus no price on carbon at all etc., the outcomes of Government of Canada negotiations with the provinces would **primarily be political decisions reflecting the art of the possible and covering permutations and combinations of "solutions."** And of course these political decisions should be consistent with the political decisions on targets outlined in sub-sections 1.2 and 1.3

Political considerations aside, it needs to be stressed that a price on carbon is only helpful when combined with other measures to advance a green economy. On this question, it is important to keep in mind that Europe has the most longstanding cap and trade scheme but it is their extensive, ever expanding and increasingly aggressive palettes of the other types of climate initiatives -- measures which have been largely integrated into this Roadmap -- that have been the keys to 1) achieving their Kyoto objectives and 2) being on track for their 2020 GHG reductions. Refer to sub-section 2.6 for some of the details on EU setbacks on the price of carbon.

And it is particularly questionable what impact a price on carbon would have when oil prices are low. And they may remain low for a long time to come with the advent of rapidly expanding markets for clean technologies contributing to a flattening of demand for fossil fuels! (see sub-section 1.1)

Refer to the sub-section 2.6 regarding the use of revenues streams from a price on carbon.

1.5: International Community Efforts

Lastly, the Government of Canada would become a constructive contributor to 1) the establishment of fair global, country-specific and region-specific targets within the UN Framework Convention on Climate Change and 2) the recommendations of the UN Intergovernmental Panel on Climate Change.

Part 2: Sources of Financing for the Canadian Green Economy Transition

The financing of the migration to a green economy will be derived from many sources.

2.1: Re-allocations -- Subsidies and Carbon Price Revenues

According to the [International Monetary Fund](#) (IMF), the projected 2015 global level of subsidies in US dollars for petroleum, natural gas and coal, is \$5.3T for the year , when indirect costs associated with health and climate change are factored in. **In Canada, the IMF annual fossil subsidy figure works out to an incredible \$46B/year and \$1283/capita(USD).** Forget equalization payments, this is a bigger issue, one for which all parts of Canada are contributing -- to the problem!

Along the same lines, in 2013, the [International Energy Agency](#) estimated that subsidies for fossil fuels work out to \$110/tonne.

The flip side of the coin is that the [European Wind Energy Association](#) has suggested that the wind sector could live without subsidies, in the event that fossil fuel subsidies were to be eliminated.

It is clear that **the time is ripe to stop subsidizing the problem, which in turn, could free up huge amounts of funds for investing in clean tech solutions.** This would be in keeping with the new Government of Canada objectives to shift these "savings" stemming from a reduction of fossil fuel subsidies over to clean technologies. Here, clean technologies should not only include renewables, but also all technologies that are integral parts of a green economy, such as clean transportation, low carbon buildings, pollution abatement, emission reduction, energy storage, waste to energy technologies, etc.

However, the key determinant of a successful shift of federal subsidies, would be the order of magnitude of the reduction of fossil fuel subsidies. Modest symbolic reductions in the annual \$46B (USD) in fossil fuel subsidies would constitute "greenwashing."

The other shifting of resources formula is that of allocating government carbon price revenues to the Canadian migration to a green economy. In this way, the public sector could both provide economic signals to reduce GHGs while simultaneously financing it's green economy initiatives. **BUT**, when the price of fossil fuels are low, as is currently the case, coupled with the collapse of the Big Oil business model (see sub-section 1.1), the government revenue streams from a carbon price would represent the majority of benefits applied to the green economy.

Also, refer to sub-section 2.6 regarding the allocation of 2% of these revenues for green projects in developing countries.

2.2: Diversification of the Canadian Fossil Fuel Sector

Consistent with the Alberta government's interest in economic and energy diversification, a shift of some of the \$46B/year currently directed towards fossil subsidies to investments in the high job creation and growth green economy (see sub-section 2.1), could include new fiscal structures that encourage the fossil fuel enterprises to become highly diversified energy companies. The idea would be that of significantly increased investments in clean energy/clean technologies, expressed as a percentage of total company-specific investments. These measures would include support for the training of fossil fuel workers to participate in green jobs stemming from the aforementioned diversification. (see sub-section 3.1)

By supporting energy diversification of the fossil fuel sector, the Government of Canada would be doing the fossil fuel industry, Western Canada and Canada at-large, a great service. As outlined in sub-section 1.1, 1) the collapse of the Big Oil business model and 2) the perspectives of global economy leaders -- including UBS, the BP Chief Economist and Mark Carney, Governor of the Bank of England -- suggest that we are at the precipice of a global transition to a new global economic paradigm, green economics. This may be described as an equivalent to the industrial revolution and it's only a few years away from now.

Thus, with the right economic signals from the Government of Canada, the large financial resources of the fossil fuel sectors, could not only be transformed into improved investments opportunities in Western Canada via a shift to more diversified, healthier and less vulnerable green economy, but also could create a precedent setting path for Big Oil and other fossil sectors to offer new business opportunities in the rest of Canada.

No longer would these former traditional energy sector firms be tied to markets for resource products in very specific regions of Canada. Rather, they would have a newfound flexibility associated with always having some strong cards by way of more reliable corporate-wide revenues. This could support maintaining corporate-specific levels of investment while providing a small margin of manoeuvre for transferring employees and re-assigning suppliers, as appropriate.

Diversification models for reference purposes include 1) Norway's Statoil which recently approved low carbon/renewable technologies as [one of its 3 principal thrusts](#); has set up [a new renewables division;](#) and created [Statoil Energy Ventures](#) to invest in clean tech start-ups and 2) Denmark's [Dong Energy](#), 60% owned by the Danish Pension Fund, which plans to shift from around 85% of its investments in fossil fuels and 15% in clean energy to a reversed ratio by 2040. -- Dong is the world's largest investor in offshore wind.

2.3: The Issuing of Green Bonds and Other Green Financial Portfolios

The Government of Canada could join the global movement on the issuing of green bonds, projected to reach [up to \\$100B \(USD\) in 2015](#). Whether these bonds should be issued by the Government of Canada or by the Business Development Bank of Canada (BDC) -- [as per the examples of national development banks](#) in Germany (kfw), Europe (The European Investment Bank) France (Agence Française de Développement) and the Netherlands (NWB) -- should be considered subsequent to the review of sub-section 2.4, on BDC role options.

While the above examples pertain to major investment portfolios, note that in some instances, bonds are issued for local community participation in small projects. (see sub-section 5.5)

With regard to private banks, the greater are the business opportunities created by government action on a green economy, the greater are the incentives for private banks to follow suit by issuing their own green bonds. The UK banks, [Barclay's](#) and HSBC are cases in point with 1) the former having committed \$1.5B (USD) in green bonds for 2016, the second year in a row and 2) the latter (HSBC) [having underwritten \\$1.5B in green bonds](#) by Fall 2015.

Recognizing the investment opportunities are shifting in favour of the green economy, some financial institutions are committing to substantial green investments without the issuing of green bonds. To this effect, [Goldman Sachs recently committed to \\$110B](#) in clean energy finance by 2025, subsequent to a previous \$40B engagement. In early 2015, [Citi Bank announced the dedication of \\$100B](#) for all forms of sustainable solutions.

Lastly, another form of green investment portfolios is that of corporations issuing green bonds to support the greening of their enterprise -- everything from recycling, material recovery and re-use; improving the energy efficiency and lowering the environmental footprint of their buildings; corporate renewable energy projects; etc. Such is the case of Apple which issued \$1.5B of green bonds in February 2016.

2.4: The Role of the Business Development Bank of Canada and the Leveraging of Private Sector Financing

The Government of Canada climate action plan could have the [Business Development Bank of Canada \(BDC\) play a lead role](#) in supporting clean technology investments and leveraging private sector contributions, as is the case with the [UK Green Investment Bank model, with an aim to raise \\$2 to \\$3 from the private sector for every dollar of BDC clean tech commitments](#).

To get into the act, the BDC could offer low rate loans, as is the case with [Brazil's Banco Nacional de Desenvolvimento Econômico e Social at 60% to 65% below market rates](#) and/or venture capital as practiced by the Caisse de dépôt et placement du Québec. Note, Brazil's Banco Nacional is also responsible for the nation's tendering processes for wind and solar projects. (see sub-sections 3; 4.2; 5.4; 5.5; 6.2; 10.3; 10.4; and 12.3)

Concerning the Caisse, it recently acquired [25% equity in the London Array](#), presently the world's largest offshore wind farm project, 630 MW, off the UK coast of Kent and Essex.

Another source for BDC revenues to finance its clean tech portfolio could be green bonds, either issued by the BDC or the Government of Canada, as per sub-section 2.3

To assure Canada retains optimal benefits stemming from the BDC clean technology portfolio, while concurrently recognizing the advantages of combining Canadian capabilities with those of potential foreign partners -- for a project to be eligible a project for the aforementioned BDC support -- a project could need to represent 50% Canadian content. Under this model, Canadian ownership would be considered as an advantage but not a condition for project approval. This is less demanding than the aforementioned [Brazil's Banco Nacional model which requires 60% local content for windpower projects and 56% for solar projects](#) while also specifying that certain key technology components be manufactured in Brazil. (see sub-section 5.4)

Another factor favouring domestic content criteria is the phenomenon to the effect that going green sometimes means more outsourcing by manufacturers, hence providing a basis for government to expand local content requirements to better reflect potentials for the participation of Canadian suppliers. (More on this in sub-section 6.2)

As for opportunities to classify Canadian content criteria under the category of regional development, this would have to be reviewed in light of international trade agreements and WTO considerations. Federal regional development organizations and provincial organizations that enjoy a trade agreement exempt status, such as Hydro-Québec, could be the vehicles for safeguarding local content criteria.

Also important, to bring the BDC up to a clean tech gold standard, the BDC would join the [International Development Finance Club](#) which has set common criteria on green financing.

In parallel, the BDC and/or the EDC could join the [International Green Bank Network](#), created in December 2015, and fostered by the OECD, regarding investments in global clean technology markets.

2.5: The Role of Export Development Canada

Export Development Canada (EDC) would expand its clean tech bonds portfolio in collaboration with the Ministries of Foreign Affairs and International Trade, and possibly other government organizations. This expansion of the mandate would offer advantageous support for the participation of Canadian clean technology firms in projects in developing countries, subject to a 30% Canadian content requirement, much like the US Export-Import Bank.

With respect to foreign-owned manufacturing facilities in Canada, support for exports could be linked to the upside to local content rules by way of BDC support for Canadian manufacturing facilities, (see sub-sections 1.5; 2.4; 3; 5.1; 10.4; and 12.2)

Sources of financing for the EDC expanded role could comprise of a fixed percentage of carbon price revenues, as per sub-section 1.5, as well as sources identified in preceding sub-sections 2.1; and 2.3.

The aforementioned mandates could be combined for a program co-managed by the BDC and EDC.

2.6: Revenues from Putting a Price on Carbon and Federal-Provincial Collaboration

Putting aside the matter of a fixed price on carbon versus cap & trade, the Government of Canada focus on carbon credit revenue schemes could be along the following lines in collaboration with the provinces and territories:

- Create a mechanism for carbon price reviews every two years to:
 - assure market effectiveness in light of declining prices of clean techs and market impacts in the event of prolonged low prices for fossil fuels;
 - identify best green economy investment strategies to be supported by carbon price revenues, covering a wide range of options including incentives for clean tech alternatives, selective reduced taxes on specific green items, etc.;
- In the event, the Government of Canada opts to work with the provinces and territories on a national integrated cap and trade scheme -- it would :
 - Establish a base for international cap and trade agreements;
 - Create a mechanism for reviews every two years of the supply and demand of emission credits, coupled with adjustments to the supply, as appropriate, to preempt the recent EU situation whereby the European Parliament, in July 2013, withdrew 900M CO2 certificates from the market to maintain the effectiveness of the EU Emissions Trading Scheme.

The reviews described above would be synchronized with the every two years reviews of the Federal/provincial/territorial Climate Council on targets and policy synergies (see sub-section 1.3).

For the largest emitting sectors, the merits of offering free carbon credits for specified base levels of emissions could be assessed.

Should the Government of Canada wish to dedicate some of carbon price revenue to support its commitments to developing countries, among the options it could consider are:

- Allocating 2% of carbon credit/price revenues to help developing countries re GHG reductions and climate adaptation, with the possibility of an expanded role of Export Development Canada that could include Canadian content stipulations of around 30%, as per the model of the US Export-Import Bank in sub-section 2.5;
- Using the above-mentioned 2% allocation to match -- or independent of the 2% allocation, and match -- non-government donations to a Canadian registered/certified clean tech charity for developing countries; (see sub-section 2.5); and
- Focusing on both remote community and utility scale economic development solutions. For example, over 900M in Africa South and the Sahara Desert have no access to electricity and

the costs of installation centralized distribution networks can be prohibitive in remote areas. At a relatively [small cost, solar micro-grids with energy storage technologies could bring electricity to small communities in Africa. Also significant, large solar farms could become a source of economic development](#) that includes exporting clean energy to supply up to 15% of Europe's electrical needs.

2.7: CPP Investment Board (Canada Pension Plan Investment Board)

A sixth category of financing would come from the creation of a Canadian clean tech portfolio of the CPP Investment Board. This is a logical step as 1) the values of shares in the [fossil fuel sectors are plummeting while clean energy sectors are performing reasonably well](#) and 2) [Bloomberg Americas Clean Energy Index \(for North and South America\)](#) has indicated that the return on clean energy companies in the past two years (2013-14) was 32% while the ROI for the 40 conventional-energy companies in the Standard and Poor's 500 Energy Index was 1%.

2.8: Other Sources of Financing

Yet other sources of financing could 1) come from non-compliance penalties pertaining to Canada's environmental legislation; 2) be derived from the raising of corporate taxes to the level of the G7 average to allow the Government of Canada to tap into some of the estimated \$630B currently lying dormant in corporate liquidity; and 3) stem from fiscal and program (cost sharing) measures introduced by the Government of Canada to encourage private investors to increase investments in clean technologies in collaboration with, or independent of, federal government initiatives.

Part 3: Clean Technology Manufacturing and the Greening of Large Industrial Emitters

3.1 Support Options for Clean Technology Manufacturing

In support of clean technology manufacturing, combinations of options for grants, tax credits, loan guarantees, low interest loans and job training packages would be reviewed.

As appropriate, priority for job training will go for those affected by the decline of in the fossil fuel sectors. (See sub-section 2.2)

Regarding product development and pre-commercialisation demonstrations, refer to Section 4 on technological innovation. BDC and EDC support are additional options in this regard. (See sub-sections 2.4 and 2.5)

But regardless of the nature of support for clean tech manufacturing, in some cases, this will fall into the "one-of category," whereby a unique negotiated package is conceived by a government with an outside-of-the-box "avant-garde" private sector firm, for a holistic agreement tied to a multiple-faceted business investment opportunity. Such was the situation of when the Government of Ontario negotiated a comprehensive agreement with a consortium led by Samsung for the production of 1369 MW of wind and solar projects in return for several clean tech manufacturing plants in that province. Similarly, there is the example of the former government of NS which brokered a deal with Daewoo Wind for the manufacturing of wind turbine blades and towers in exchange for government investments in wind projects in that province. (see sub-sections 3.1; and 5.4)

That said, the **basic eligibility criteria** should be more or less generic for green manufacturing facilities, covering both technological and economic/employment considerations:

Technological Considerations

- The potential for the reduction of emissions, pollution abatement and /or lower environmental impact/footprint; and
- Technological innovation advantage, in particular, by comparison with competing products and international competition;

Economic/Employment Considerations

- The ratio of private to public investment;
- Opportunities and capabilities for broad and rapid market penetration including export possibilities;
- The development of a domestic supply chain (including relocation support); and
- Job creation, and economic/regional diversification.

Finally, delivery of this support could be through Natural Resources Canada in collaboration with federal regional development agencies.

3.2: Optional for Large Industrial Emitters of GHGs Interested in Significantly Reducing Their Emissions

Canada's largest industrial emitters interested in significantly reducing their GHGs, could be eligible for one-time 1) 30% grants or tax credits or 2) loan guarantees, to a) convert some of their energy intensive industrial processes from fossil fuels to renewable energy sources and/or b) significantly improve the energy efficiency of industrial processes and buildings.

Clean energy micro-grids to serve an industrial building and/or an industrial group of buildings (e.g.: an industrial park) would be eligible.

Part 4: Clean Technology Innovation, Strategies Plus Program and Organizational Structures

4.1 Context -- Generic versus Technology-Specific Support

It is not the role of government to choose which clean technologies should be favoured as parts of the solutions to reduce greenhouse gas emissions, curb pollution, and develop world class Canadian clean technologies to serve domestic and export markets.

More important, the role of government would be best to encourage a plurality of technological solutions to optimize opportunities for innovation/entrepreneurship and regional participation. This is to say that the goals associated with the technologies best prevail as eligibility criteria, including emissions reductions, pollution abatement, energy efficiency, market prospects, potential for Canadian supply chain development, economic feasibility, potential for employment creation, etc.

As well, rather than playing the role of a prophet to predict which clean technologies will be predominant in future years, it is always best to establish a context for a multiplicity clean technology solution capabilities/skills/expertise. (see sub-sections 4.2; 4.3; 4.4; 6.1; 6.2; 11.1 and 11.2)

4.2: Supporting Technological Innovation (Excluding the Transportation Sector)

To level the playing field for Canadian clean technology innovators with foreign competitors, it is recommended that funding be available for the following categories:

- R & D including foci on bringing down the costs of clean technologies;
- pre-commercialization demos; and
- venture capital leveraging and export support (Business Development Bank of Canada and Export Development Canada, see sub-sections 2.4 and 2.5);

4.3: National Network(s) of Clean Technology Research Centres

Further on leveling the playing field for Canada's clean technology innovators, in particular to compete with the [exceptional support of US government and government financed research centres](#) -- the US support for [clean energy R & D in 2015-16 is \\$6.4B](#) -- it is recommended that (a) national network(s) of clean technologies research centres be set up, each with its own area of specialization.

Each of the lead clean tech-specific centres could be part of, or engage, an existing clean tech-specific network sponsored by Natural Sciences and Engineering Research Council (NSERC), or another existing clean tech-specific network, as appropriate.

Furthering its mission of supporting Canadian leadership in various green technologies, each clean tech-specific centre/network that would have a role getting involved in partnerships with the private and academic sectors and assuring that a significant portion of activities would be dedicated to small and medium size enterprises and consortiums.

As alluded to above in reference to NSERC, in certain instances, a clean tech-specific centre or network could entail expansions of mandates of existing clean tech-specific research centres/networks.

Among the more evident considerations for national innovation centres centred in the greater Montreal region and reflecting this region's world class leadership are 1) a zero emission vehicle/electric vehicle research facility and 2) wind technology research with the support of Technocentre éolien in the Gaspésie.

With respect to item #1, sub-section 6.2, as well as Annex 1, substantiate the merits of having a ZEV R & D national centre in the Montreal area, Montreal area being the only area in Canada with a significant critical mass of electric vehicle stakeholders in the region. As for item #2 above, this is merely to confirm Quebec leadership in this field.

Going one step further, taking a page from [the International Solar Alliance launched by France and India](#), announced in December 2015 and supported by 120 countries, each clean tech-specific research centre/network could pursue participation in international research initiatives to 1) attract investments from various public and private sources, 2) foster common approaches on R & D, standards and training, 3) enhance technological performance, 4) reduce the technology and financing costs and 5) support technological transfers to poorer nations.

On the matter of collaboration with poorer/developing nations, international alliances of the type described above could entail commitments for stable funding for research centres in the poorer nations, as with the case of the International Solar Alliance which will house its facilities at India's National Institute of Solar Energy.

Finally, all of the clean-tech specific research centres/networks would work with the National Clean Technology Integration Centre for the reasons outlined in the sub-section which follows.

4.4 National Clean Technology Integration Centre

The key to Canadian world class clean technology leadership pertains to its capacity to integrate the various categories of environmental technologies to complete all of the sets of the many puzzles essential for green economy models, models for turn-key solutions.

Accordingly, a national clean technology integration centre would be established coordinate activities of the aforementioned research network of clean-tech-specific research centres (see sub-section 4.3) and engage in initiatives linking multiple sources of clean energy with clean transportation, smart grid/energy storage platforms, electric vehicle bi-directional charging stations, low carbon buildings and other options supporting optimal technological synergies. This would be done in collaboration with clean energy, clean transportation and low carbon buildings stakeholders. (see sub-sections 6.1; 6.2; 8.2; 10.4; and 10.5)

Among the models to be reviewed in the planning of such a centre, special attention would be given to the [US National Renewable Energy Laboratory](#) in Golden Colorado, a 327 acre campus, with more than 1500 employees, more than 40 countries represented on staff and, most important, an ambitious program to work with the private and academic sectors on leading edge innovation initiatives.

Part 5: New Clean Energy Installations and Collaboration with the Provinces and Territories

5.1: Flexibility to Accommodate National and Provincial/Territorial Targets, Policies, Programs and Domestic Content

Support for new sources of renewable energy production sites in collaboration with the provinces/territories, would be consistent with national and province/territory-specific targets and programs, including local content and other requirements.

As such, the form of support provided for new renewable energy production sites would be part of the federal-provincial Climate Council's review of every 2 years to assure policies are effective for reaching the desired goals (see sub-section 1.3). This consideration is especially important with regard to new clean energy production sites to properly reflect the rapidly declining technology costs and a greater abundance of clean energy technologies.

Where there isn't a provincial/territorial program in place, a joint federal-provincial/territorial agreement on parameters for a new program would be negotiated.

5.2: Federal and Provincial/Territorial Cost Sharing Models: Flexibility and Options

Two models are presented below for federal support of new sources of clean energy production with a view of optimizing the possibilities for what works best under cooperative federalism.

Model 1: The Feed-in-Tariff, Cost Sharing on Subsidies per Unit of Clean Energy Production

In 2000, Germany introduced a Feed-in-Tariff (FIT) concept for renewable energy that has since been adopted by about 100 jurisdictions around the globe, including Ontario under the province's Green Energy Act. As indicated in 5.3, Germany is now abandoning FIT in favour of a tendering process.

Under the FIT concept, suppliers of renewable energy -- whether they be renewable energy project developers, community or cooperative projects and/or individual citizen's rooftop solar installations-- would be entitled to a premium above market rates per unit of production of energy, for example per kWh. Also, typically to complete the business case, this model includes the Right-to-Connect in the package, meaning that developers, producers and/or managers of the new clean energy sources are guaranteed access to local markets, specifically access to the transmission grid network in question.

This concept takes into account that all new sources of production, whatever the source, cost more than the sources that have long been paid for, or other sources that went into production many years before. Thus, while offering incentives for clean energy development, this concept should not entail additional costs normally associated with the traditional models for creating **new** electrical generation capacity.

Nevertheless, the FIT price must be the subject of ongoing reviews because of declining clean tech costs. [Wind and solar PV technologies have respectively declined 60% and 80%](#) over the past decade.

As well, with the [US Congress budget extensions of subsidies for new wind and solar energy installations through to 2019 and 2021 respectively](#) that include scheduled incrementally declining levels of financial support, one could expect the industries concerned to target lowering costs consistent with scheduled subsidy reductions. To this effect US support for windpower via the Production Tax Credit (PTC) of 2.3¢/kWh and solar energy projects via the Investment Tax Credit (ITC) of 30% for solar installations will decline along the following lines: Wind projects will get 80% of the present PTC if they enter construction in 2017, 60% in 2018 and 40% in 2019. For solar projects, the ITC rate will continue through to 2019, then fall to 26% for projects for which construction begins in 2020 and subsequently 22% in 2021.

Another proviso on applying the FIT/premium price model concerns linking FIT to energy storage. Such a stipulation would reflect empirical evidence from the US which suggests certain pre-requisites should be associated with any federal support. Such pre-requisites would include 1) smart grid/energy storage technologies are, or are committed to be, in place to store surplus energy during excess supply periods and redeploy stored energy, as required and 2) there be no charges to government sponsors or energy clients for any unused surplus energy.

To do otherwise, risks the perverse effects of adding costs to both the supporting governments and to consumers for the production of clean energy that is not consumed. -- Examples include surplus solar energy produced during mid day or surplus wind energy produced during the wind velocity peaks at night when energy demand is low -- in the absence of energy storage technologies.

Model 2: Cost Sharing for Construction Costs

Certainly cost sharing of construction expenses has as its attraction being that of a one-time payment for a given project, thereby simplifying program management requirements. Sub-options within this option include loan guarantees and cost sharing grants, tax credits and low-interest loans.

For similar reasons to those described in Model 1, 1) energy storage capabilities could be built into project evaluation criteria to optimize the utilisation of clean energy produced and 2) the levels of subsidies would need to be reviewed regularly to take into account descending costs of clean technologies and the influence of scheduled subsidy declines in the US on the tech costs.

5.3: The Tendering Process, With and Without FIT and/or Local Content Requirements

In Quebec, wind energy projects are the subject of tenders, with 60% Quebec and 30% Eastern Quebec (Bas-St-Laurent and Gaspésie regions) content requirements.

In Ontario, prior to a World Trade Organization ruling, Ontario's FIT tenders integrated local content stipulations for wind and solar energy projects at 50% and 60% respectively. This gave rise to a significant renewable energy manufacturing sector in the province. However, subsequent to the WTO ruling, Ontario is now going the route of FIT tenders without local content rules.

Evidently it is best that the Government of Canada remain flexible on a negotiating model for supporting clean energy production in order to accommodate any province-specific frameworks already in place and/or preferences.

That said, taking stock of what Germany is doing on tenders as a replacement for the Feed-in-Tariff (FIT) model -- with the exception of small projects under 1 MW -- could be highly instructive for Canada. Indeed, so much of what Germany does on the green economy is worth watching given its world leadership, especially because Germany surpassed its Kyoto 2012 target of a 21% reduction in GHGs with a 23%-24% reduction instead, relative to 1990 levels. A synopsis of what Germany is doing by way of revamping its energy transition model can be found and will be regularly updated in Annex D.

Yet another tendering model is that under the authority of Brazil's public bank which provides favourable financing in return for local content. See sub-section 5.4 for more details.

5.4: Local Content leading to Local Manufacturing: Taking a Deeper Look

Local content rules is a sub-option that can be combined with any of the two models described in 5.2, and with or without a tendering model, as per sub-section 5.3.

This being the case, the parameters of federal-provincial/territorial agreements to support new clean energy projects could entail national content requirements of up to 50%, where 1) local content rules already exist consistent with the provincial/territorial programs or 2) provincial/territorial governments might wish to set up new criteria in this regard, in collaboration with the Government of Canada. Both of these sub-options would be pursued via provincial/territorial regional development mechanisms exempt from international trade agreements such as the Hydro-Quebec windpower tenders that are trade agreement exempt.

As well, such initiatives would require a favourable ratio of private to public investment.

Yet another approach on local content is that of one-time project-specific agreements. Here the former NDP government in Nova Scotia presents an interesting example. In 2011, under a joint venture agreement between Daewoo/deWind and the provincial government, a wind turbine tower and blade manufacturing plant was opened in Pictou County, a plant that would reach 300 employees after 3 years. The province contributed \$60M for 51% of the shares. The Atlantic Canada Opportunities Agency invested \$10M in the project, \$5M by way of a repayable loan and \$5M for adjacent land improvements.

Then there is the Ontario government one time model concerning its agreement with Samsung, Korea Light and Power, CS Wind and Pattern Energy -- outside of the Ontario Green Energy Act. The original deal entailed \$9.7B for 2500 MW of renewables in exchange for 4 manufacturing plants but was scaled down in 2013 to \$6B for 1369 MW. In accordance with the agreement, Siemens set up a wind turbine blade manufacturing plant in Tillsonburg, Samsung partnered with Canadian Solar for a manufacturing facility in London and CS Wind set up a wind turbine tower plant in Windsor.

The aforementioned "one-of" examples illustrate the advantages of custom-tailored creative arrangements involving an exchange of benefits for both the public and private sectors. At the same time, there are some generic considerations to integrate into clean tech manufacturing opportunities that are best adhered to and described in sub-section 3.1.

A more proactive local content model is Brazil's 60% and 56% local content requirements for wind and solar project proposals respectively that are solicited under their tendering process, a process for which the country's public bank, Banco Nacional de Desenvolvimento Econômico e Social, is the tendering authority. The Banco nacional also stipulates that specific key technology components be manufactured in the country.

In keeping with the latter Brazil example, in Canada, such as indicated in sub-section 2.4, a model to be considered is that of the Business Development Bank of Canada playing the lead role for new renewable energy production sites on behalf of the Government of Canada. (see sub-sections 2.4 and 5.5)

Should other provincial and territorial jurisdictions be so interested, additional variations of local content rules could be explored, providing that exemption paths from international trade agreements are identified.

5.5 The Participation of Communities, Cooperatives, Farmers, Individuals and Other Small Stakeholders

Community clean energy projects not only provide local solutions on climate change, but also direct energy dollars traditionally exported elsewhere, to stay within the community for reinvestment and local jobs. (see sub-section 11.2)

Starting with Canadian examples, among the more interesting models for community engagement on renewable energy projects is that of [La Régie intermunicipale de l'énergie Gaspésie-Îles-de-la-Madeleine \(Régie\)](#) in collaboration with Hydro-Quebec in that 1) the Régie represents 5 Municipalités régionales de comté (regional governments) for the Gaspésie and the Îles-de-la-Madeleine plus 37 municipalities representing 96% of the population in the region and 2) in October 2015, the Régie issued a call for tenders for its fourth project, a 6 MW wind project, a first wind project for the Îles-de-la-Madeleine and 3) the Régie, as co-owners of wind projects, estimates that it's revenues from all their projects will reach \$3.5M/year beginning 2017.

The significance of the Îles-de-la-Madeleine project is that represents a first step for this island territory to replace diesel-powered electrical generation with considerably less expensive renewable energy, a first step representing 30% of the area's electricity needs. For Hydro-Québec, the project is also a precedent for establishing synergies between non-renewable and renewable energy sources for a local grid.

With respect to Ontario, it offers a more formalized model with its MicroFit Feed-in-Tariff program specifically designed to support projects of 10 kW or less in size, for homeowners and others to set up very small renewables projects on their respective properties. Under this program, suppliers are guaranteed price over a 20 year term for all the electricity delivered to the respective local grids. For 2015, the annual MicroFit target for newly installed renewable energy capacity is 50 MW.

One other Canadian model is that of the previous NDP government of Nova Scotia, the COMFIT program. This program was established to specifically support renewables projects that are at least 51% community-owned with eligible stakeholders including municipalities, First Nations, co-ops, universities and non-profits. The aim was to drop imported coal based electricity from 75% to 40%. In 2015 coal represented 60% of NS power production and natural gas and oil another 15%. However annex D, the current Liberal [government in that province terminated COMFIT in August 2015](#).

On foreign models for small scale/local development renewables initiatives, Germany stands tall among nations with 50% of renewable production under the control of small stakeholders. However, Germany which invented the Feed-in-Tariff (FIT) concept -- a concept that has been copied by over 40 jurisdictions around the globe -- is now in the process of revising its renewables strategy to take into account the rapidly declining costs of clean energy technologies. Under the revised strategy, FIT will be dropped and replaced by a tendering system for large utility-scale projects but some form of FIT will continue to exist for projects under 1 MW. Accordingly, as indicated in sub-section 5.3, the upcoming revised German renewables strategy, is worth tracking in this regard. Refer to the outline of developments to-date on the new German renewables strategy in Annex D .

Other foreign models to watch are those of 1) Denmark which launched a [new tendering systems for inshore wind projects that calls for 20% of shares to be locally-owned](#) and 2) Brazil's public bank, Banco Nacional de Desenvolvimento Econômico e Social, which encourages the [sale of local bonds for small community projects](#) to complement the bank's attractive financing for renewables projects. This constitutes yet an additional model for green bonds, as per sub-section 2.3.(see sub-sections 2.3; 2.4 and 5.4)

For communities seeking support to get started on local clean energy initiatives, one can refer to Quebec's Val-Éo for wind projects <http://www.val-eo.com/> or the US government's Guide to Community Energy Strategic Planning <http://energy.gov/eere/slsc/guide-community-energy-strategic-planning>

5.6: Making Available Federal Lands for Clean Energy Production Sites and Transmission Corridors

Lastly, it is recommended that Natural Resources Canada establish a new office to identify and designate federal lands appropriate for 1) the development of renewable energy production sites and 2) the inclusion of clean energy transmission lines. (see sub-section 11.2 on East West grids)

Part 6: Clean Transportation Innovation, Product Development and Manufacturing

6.1: Clean Transportation Innovation

Establish a federal-provincial/territorial technology innovation program on clean transportation with a minimum of \$150M/year federal contribution for developing alternatives including electric vehicles, high performance and high storage capacity batteries, and smart level 3 (high voltage) bi-directional electric vehicle supply equipment; hydrogen-powered vehicles and other clean gas alternatives; and non food-based renewable fuels. The new program would also include research dedicated to reducing the costs of components for, and/or the manufacturing of, low to zero emission vehicles.

The new clean transportation innovation program would replace programs of the previous Government of Canada with a new program to:

- support technological innovation in partnership with stakeholders that would manufacture the technologies, or refine the renewable fuels, in Canada;
- encourage partnerships with electric power utilities, the future National Clean Technology Integration Centre (see sub-section 4.4), and technology integrators, e.g. smart grid stakeholders, concerning the linking of clean energy to clean transportation and where appropriate, low carbon buildings; (see sub-sections 4 and 10)
- encourage the participation of public transit authorities regarding subway, light rapid rail and electric buses, as appropriate; (see sub-sections 3.1; 6.2; 11.2 and 11.3)
- support the private-public-academic research partnerships/consortiums including support for academic and private research centres, as appropriate;
- position the National Clean Technology Integration Centre (see sub-section 4.4) to become a one-stop-shopping centre for the sharing of information on low and zero emission vehicle developments, in Canada and around the globe, in particular in relation to 1) technological linkages to clean energy, low carbon buildings, energy storage and micro-grids, and where appropriate, 2) dovetailing its role re item 1, to encompass facilitating multidisciplinary interprovincial and international partnerships on innovation. (see sub-section 4.2)

6.2: Clean Transportation Product Development, Commercialization and Manufacturing

Support would be provided for product development, commercialization, venture capital and export assistance for innovative clean transportation products, as per sub-sections 2.4; 2.5; 4.2; 4.3; 4.4; 8.2; 10.5; 11.1; and 11.2)

As appropriate, priority status would be extended for the above-described support for cluster development and a supply chain hub, in collaboration with provincial governments.

For example, the significant critical mass of the emerging electric vehicle sector in Quebec could be the object for priority status under a federal-provincial collaboration framework. (see Annex A on Quebec's electric vehicle sector -- includes 2 battery manufacturers; 2 charging station manufacturers; a developer of an electric motor wheel; an electric bus under development; and research facilities)

What's more, in reviewing the options for framing new government initiatives, it should be taken into account that the potential for component suppliers in the electric vehicle sector differ favourably when compared with opportunities for suppliers of parts for internal combustion engines. This is so because 1) the traditional [powertrains are one of the last areas for which the automakers are the masters from design to the finished product](#) and 2) electric vehicle motor and system components plus batteries are largely outsourced.

Such considerations could be factored in to conditions for government support to maximize business opportunities for Canadian suppliers when reviewing government investments options. This applies to other clean tech sectors as well, whether by way of BDC for investments, by government research and demo programs and/or manufacturing support initiatives. (see sub-sections 2.4; 3.1; 4.2; 4.3; and 4.4)

But for now, **Quebec's electric vehicle sector presently remains largely abandoned by both the federal and provincial governments.**

For a powerful message on the possibilities associated with a Canadian the green economy, **support for the Quebec electric vehicle sector, coupled with links to the Ontario auto industry, could be presented as an inspirational combined interprovincial and federal-provincial collaboration model.**

Part 7: Vehicle Manufacturers, US Cloning versus Canadian-specific Requirements to

**1) Reduce the Aggregate Fuel Consumption and GHGs of New Vehicles Sold in Canada
and 2) Accelerate the Introduction of Low and Zero Emission Vehicles in Canada**

7.1: Corporate Average Fuel Economy (CAFE), the US "Loopholes" and Canadian Opportunities

Canada emulates the US on the application of corporate average fuel economy (CAFE) standards or the annual targets for the **aggregate fuel consumption of vehicles sold** by a vehicle manufacturer in a given year. (sales-weighted average consumption). These standards become incrementally more stringent over a given period

[In May 2009, the Obama administration announced a new National Program](#) -- a complex US government engagement with the auto manufacturers and other key stakeholders, backed by 300 pages of complex legislation and 1500 pages of related documents. -- The announcement pertained to a new approach for calculating a manufacturer's CAFE for the model years from 2011 to 2016, with a CAFE target of 6.6 litres/100km for 2016.

[In August 2012, the US government extended the National Program to its second phase, the phase for the 2017 to 2025 period](#) with the CAFE standard to reach 4.3 litres/100km for cars and light duty trucks in model year 2025.

The Canadian reasoning for the cloning of US targets and policies on vehicle fuel consumption has always been that the North American market is an integrated market leaving no room for Canada to adopt **any** differences in its approach.

This is faulty reasoning because 1) most manufacturers' sales mix of models in Canada are different than those in the US; 2) as a result of item # 1, Canada has plenty of wiggle room for more demanding targets than the US; and 3) the aforementioned highly complex US legislation and government agreements with the auto makers provide each vehicle manufacturer with considerable scope for non-compliance with the overall US CAFE/fuel consumption/GHG reduction targets for a particular model year . Regarding item 3, the US legislation allows for a manufacturer to make up for a CAFE year-specific setback(s) with better averages in subsequent years, (see sub-section 7.2) -- to perform better than the CAFE targets for those subsequent years.

These "loopholes" in the US legislation are considerable **and Canada-specific modifications are essential if Canada wants legislation that is effective in reducing GHGs from the transportation sector and a meaningful incremental shift to low and zero emission vehicles.**

The following sub-section describes these loopholes in more detail and proposes corrective measures for Canada.

7.2: The 300 Page US Legislation: Not a Model for Canada

The aforementioned highly complex 300 page law and associated agreements, **place the CAFE emphasis on fuel consumption targets for each footprint category of vehicles. Footprints are based on multiplying the wheelbase length, by the width between the wheels, to produce a footprint expressed in US square feet (or square metres in Canada).**

Prior to the CAFE standards for the 2011 to 2016 period, the CAFE simply applied to all vehicles sold by a manufacturer, without regard to vehicle categories.

The problem with the system introduced in 2011 is such that, in the event a manufacturer's sales are heavily weighted to favour the large and high energy consumption categories, the manufacturer's overall CAFE target -- the average fuel consumption based on all vehicles sold by a manufacturer -- would be adjusted to be that of a higher average fuel consumption permitted by law for the model year in question. In other words, the more a manufacturer's sales are weighted in favour of the high consumption vehicles, the less stringent would be the overall model year-specific CAFE target with which the manufacturer would have to comply -- an incentive for producing more large high consuming vehicles! This is referred to an August 2012 EPA Regulatory Announcement as "compliance flexibility."

The above-mentioned Regulatory Announcement goes on to say the following. "The final standards preserve consumer choice -- that is, the standards should not affect consumers' opportunity to purchase the size of vehicle with the performance, utility and safety features that meet their needs" "This idea has been promoted by U.S.-based automakers for many years because their truck- and SUV-heavy sales mix was pulling down averages."

As indicated in sub-section 7.1, to compensate for the reprieve in the form of a less demanding CAFE target(s) for a given manufacturer for a given model year(s), targets get adjusted for improved fuel economy in subsequent years, all with a view of reaching the overall 2025 CAFE standard of 4.4 litres/100km. Accordingly, the 2017 to 2025 US CAFE standards "provide for a mid-term evaluation to allow the agencies to review their effectiveness and make any needed adjustments."

With cloned from the US "compliance flexibility" in Canada, manufacturers, there is the risk that manufacturers resort to dumping high consuming vehicles in Canada to "adjust" to US CAFE targets.

7.3: Canada has Plenty of Wiggle Room For more Stringent Standards/Targets than the US

Without engendering any undue burden on the North American auto industry, there is considerable scope for the modification of the Canadian 2017 to 2025 vehicle fuel consumption framework **with simpler and more effective legislation to assure greater priority in Canada for vehicles with low fuel consumption/emissions and zero emission vehicles.**

This can be accomplished by modifying the regulations of legislation on CAFE standards for new vehicles to:

- Return to the simpler -- prior to 2011 - CAFE model, a concept based on aggregate fuel consumption related to the total sales of a given manufacturer for a given year, thus abandoning the footprint (vehicle category) targets;
- Be more stringent than, and independent of, those of the US, and
- Include requirements for each manufacturer to achieve minimum percentages of total annual Canadian new vehicle sales that must be zero and low (eg.:plug-in hybrid) emission vehicles, beginning in year 2018, and incrementally becoming more demanding through to 2025.

The vehicle manufacturers would be able to comply with the above-described stipulations by adjusting the distribution of models each manufacturer places on the Canadian market -- different than the distribution of models placed on the US market. (Note, every manufacturer has differences in the line up of models in the US versus what is offered in Canada, and as noted in sub-section 7.1, the mix of models sold has always been considerably different in Canada compared to the US.)

And by bringing back the "old CAFE model" reflecting the aggregate fuel consumption of **all** vehicles sold by a manufacturer, the Government of Canada would pre-empt scenarios whereby the manufacturers would exploit US and Canadian "compliance flexibility" to dump high consumption vehicles in Canada that cannot be sold in the US. -- Moreover, the complexity of **the 300 page US legislation offers a great way to obscure what constitutes compliance.**

To achieve acceptable economies of scale and the political clout necessary for the requirements on percentages of zero and low (plug-in hybrid) emission vehicles sales in Canada, Canada would adopt the state of California requirements in this regard, requirements that are mandatory in 7 other states, namely Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont. (Note, the US CAFE legislation allows for zero and low emission vehicles to count for more than one vehicle in a manufacturer's compliance calculation, but the initiative of the US states referred to above, provides a more trustworthy approach for reaching the sales volume goals for these types of vehicles on the road.)

As well, by dispensing with the US clone policies, Canada would be guided by considerations as to what targets are within the realm of the possible. For example, the current Canadian --identical to US -- average emissions/vehicle CO₂ target is 93 grams by 2025, while the EU target is 95 grams for 2020. Evidently, if the EU can do better than the US, Canada can do so too!

7.4: Canadian Fuel Consumption Data

Beginning with the model year 2015, Natural Resources Canada introduced new fuel consumption testing methods that are more consistent with 1) what drivers can expect on the road and 2) US Environmental Protection Agency (EPA) data for the same and similar vehicles. (Prior to 2015, the Canadian fuel economy data was considerably better or exaggerated when compared with EPA data, vehicle-by-vehicle.)

But despite the improvements in the reliability of the Canadian fuel consumption numbers, the Canadian glass remains half full.

On similarities, or the glass being half full, in both the US and Canada, the fuel consumption data is supplied by the respective manufacturers. However, for the other half of the glass, unlike the US market for which the US government does random testing of 15% of the vehicles on the market to keep the manufacturers honest, there is no random testing in Canada. In conjunction with random testing, the [EPA tracks on the road fuel consumption by consumers](#) to identify anomalies.

In light of the fact that there are important discrepancies for certain vehicles when the EPA and Canadian data are compared, the Government of Canada should reserve the right to do its own testing in the event of 1) significant differences between US and Canadian data, 2) sizable numbers of consumer complaints and/or 3) other grounds for questioning manufacturer-supplied data.

7.5: Corporate Average Fuel Economy and Emissions Trading System Among Manufacturers

In the US, the Environmental Protection Agency (EPA) offers a little-known option to vehicle manufacturers to the effect that in lieu of meeting the CAFE requirements for a given year and the emissions reductions that go with it, a vehicle manufacturer [would have the opportunity to exchange carbon credits with other carmakers](#).

Since 1) the EPA approach is consistent with overall targets to reduce GHGs in the vehicles sector and 2) cap and trade principles penalize those that miss the mark and reward those companies which do better than the prescribed target (CAFE) for the year in question, the EPA model on exchanging carbon credits is a sensible for Canada as well. This is a particularly worthy approach should Canada implement more stringent CAFE standards than those of the US, along with percentage sales targets for low to zero emission vehicles sold in Canada, beginning in 2018.

Accordingly, Canada could establish a motor vehicle manufacturer emissions cap and trade credit system to complement the new vehicle measures described in the preceding sub-section 7.3. This emissions trading system **would allow vehicle manufacturers to exchange Canadian credits exclusively within Canada** among vehicle manufacturers operating in Canada.

Part 8: New Vehicles, Consumer and Private Sector Choices and Government Procurement

8.1: Encourage the Purchase of Vehicles with Low to Zero Emissions

In 2008, France introduced a [bonus-malus revenue neutral scheme for new car sales](#) to the effect that those who purchased the low and zero emission vehicles would get a rebate of €1000 (\$1420 CDN), while those who purchased high CO₂ emission vehicles would be subject to a surcharge of €2600 (\$3688 CDN). This system was found to be very effective, but since then the range and types of increments have changed.

As of 2015, France's bonus ranges from [€6300](#) to [€10000](#) (\$9625 to \$15278 CDN) for an electric vehicle and up to [€4000](#) (\$6111 CDN) for a plug-in hybrid. The surcharge for vehicles in the [malus categories currently ranges from €150 \(\\$229 CDN\) to €8000 \(\\$12222 CDN\)](#). All of these figures are based on the [full price of a given vehicle, including the Value Added Tax](#).

In reviewing the merits of the bonus-malus system in France and its applicability to Canada, the Government of Canada may wish to consider two models. One would be a bonus-surcharge system along the lines of France's model without any changes to the federal new vehicles sales tax schemes, while the other would build in the bonuses and penalties into the sales tax on vehicles.

However the disadvantage of integrating differentiation in the sales tax rates based on vehicle type is as follows. The range of the difference between a bonus (negative tax/rebate) on a fuel efficient vehicle versus a high sales tax rate on a high consuming expensive vehicle risks 1) being insufficient to significantly influence consumer choices of models and 2) not having any impact on the market for luxury vehicles.

Complementary options for consideration include:

- A more significant bonus/rebate for zero emission vehicles and hybrids for low income or all buyers;
- Federal-provincial support for interprovincial charging and hydrogen fueling stations (see sub-section 11.2);
- Federal-provincial collaboration, where applicable, on wiring and service panels to be in place to accommodate electric vehicle charging stations in new private and public buildings and parking lots (see sub-section 10.4);
- Support for integration technologies to network the batteries of parked electric vehicles for energy storage plus exploit combinations of clean energy sources, surplus clean energy from buildings and energy storage technologies to address peak demand for electric vehicle use (see sub-sections 10.3 and 10.4); and
- Transparency regulations for zero emission vehicle charging and refueling.

8.2: Clean Transportation, Government Procurement and Leadership by Example

The Government of Canada can position itself to be both an innovation leader, and set an example for all, by establishing a federal government fleet procurement program that sets clean transportation targets. These targets would be defined in terms of 1) the percentage of vehicle purchases that are low to zero emissions/low to zero fuel consumption vehicles beginning 2017 and 2) a government-wide and government organization-specific corporate/fleet average fuel economy standards for new vehicle purchases for each year beginning 2017. The CAFE standards for new vehicle purchases could either be equivalent to the CAFE standards that apply to the Canadian market at-large or be more stringent than the requirements for the auto makers outlined in sub-section 7.2. More stringent requirements for the government vehicle procurement, however, would send a stronger signal to Canadian consumers and the private sector.

In considering targets for eco-vehicle procurement, note that:

- China's national government has set a target to have electric vehicles represent at [least 30% of vehicle purchases beginning 2016](#) and several of China's regional governments [have a 30% target beginning 2016 for hybrids and electric vehicles](#); and
- California's state government procurement plans for light duty vehicles calls for [10% of purchases to be zero emission vehicles in 2015 and this would rise to 25% by 2020](#).

Backing up the clean transportation procurement action plan, appropriate charging infrastructures for government vehicles would be put in place to meet the requirements for zero emission and plug-in hybrid vehicles. In selected instances these charging stations would be accessible to the public.

Additional procurement-related support for the clean transportation industry in Canada could be extended to government participation in vehicle innovation demonstration projects, as per sub-sections 6.2; and 10.5.

Where appropriate, the above-mentioned demo projects could be part of holistic approaches combining clean energy integration, low carbon or net zero emission building, clean transportation vehicles and infrastructure, in collaboration with the support of The National Clean Technology Integration Centre. (see sub-sections 4.4; 6.2; 10.3; 10.4 and 10.5)

8.3: Pilot Cities for Zero Emission Vehicles

Canada's metropolitan centres will be invited to submit project proposals for migrating their respective taxi, transit, municipal, contractor rental/lease delivery and other fleets to zero emission vehicles under innovative programs conceived by the municipal and/or provincial governments.

8.4: Other Model Policy/Program Frameworks for Low Carbon and Zero Emission Vehicles: Learning from California and China

There are an **extraordinary array of complementary Zero Emissions Vehicle (ZEV) programs and policies in California and China**. Point form descriptions of the evolving models in California and China can be found in Annexes B and C respectively.

Part 9: 21st Century Rapid Intercity Passenger Rail and Starting with Pilot Projects

9.1: Getting Started: Developing the Partnerships for a Consortium of Investors and Suppliers

We all know what intercity passenger rail could be like. Most Canadians are very familiar with the impressive European model. In Europe, the high speed intercity rail service not only provides a more convenient, less tiring and less energy demanding alternative to the automobile for medium distances between communities, it is also competitive with the high energy consuming air travel mode for distances of 500km to 1000km.

We also know that the Canadian company Bombardier has participated in high-speed rail projects in Europe and China and that company recently sold shares of its land transportation division in order to finance investments required for the Bombardier C Series aircraft.

Finally, it is a given, that without dedicated tracks for high passenger speed rail in this country, high speed rail cannot happen in Canada.

Taking into account the three above-mentioned considerations, the Government of Canada could choose to explore working with the CPP Investment Board, the Caisse de dépôt et placement du Québec, private pension plans and investment organizations, public and private research institutions, private suppliers and/or provincial governments, to establish a consortium on high speed rail in Canada, to set the stage for a 21st Century version of a national dream.

9.2: Being Realistic, a Phased Approach to Pursuing a Bold New National Dream

Being realistic, that is, recognizing that we are more than a half century behind our international competitors, the start-up process will be lengthy and costly.

As a result, it is recommended that pursuing the national dream begin with tenders with two distinct steps:

- The first phase would be that of developing Made in Canada prototypes regarding a high speed rail train model and the infrastructure necessary to support such a train.
- A second phase pertaining to the manufacturing of train locomotives and wagons, the installation of dedicated passenger rail tracks and new construction/modifications for train stations, for two to three high speed demonstration projects for the most heavily travelled intercity corridors in Canada.

With regard to the choice corridors, factors like potential passenger volumes and provincial government and private sector participation, the interests of municipalities in intermodal connections between rail and local public transit, etc. could be among the considerations for selecting the best candidates.

**Part 10: Buildings, Existing, New, Commercial, Residential, and Government Financed --
Energy Efficiency and the Integration of Clean Energy and Clean Transportation**

10.1: From the Successful Canadian History regarding Building Audits and Retrofits To Today's Pressing Challenges for GHG Reductions Involving Multiple Sectors

Past Canadian free home energy audit programs, coupled with government support for energy efficiency improvements stemming from opportunities identified via these audits, have been reasonably successful. In certain areas of the country, the federal programs were combined with provincial ones.

But now, with the challenges of climate change being more pressing, together with the fact that Canada has much to do to catch up with its competitors, not only with respect to greenhouse gas reductions, but also by way of making great strides forward on green jobs and clean technologies, the efforts required are greater than they were during the eras of past programs.

10.2: Federal-Provincial/Territorial Collaboration

Capitalizing on past successful energy programs for buildings and extending them to make links with clean energy and clean transportation, the Government of Canada would enter into discussions with the provinces and territories on initiatives for existing and new buildings in the residential and commercial sectors. Based on the respective provincial/territorial interests, policy objectives and ability to pay, the Government of Canada would seek agreements around the following themes and options.

10.3: Existing Residential and Commercial Buildings and Federal-Provincial/Territorial Collaboration

Existing buildings would be eligible for energy audits plus grants, loans, leasing and/or tax credit incentive packages for energy efficiency, clean energy/clean transportation support infrastructure/energy storage/micro-grid components (see sub-sections 8.1 and 11.2), that would include payback arrangements and, if applicable, reflect financial savings.

Eligible projects would include packages for a group of buildings or households such as a group of industrial park buildings and a group of condominium buildings.

An additional option on financing could be government sponsored or approved third party leasing arrangements that could be the object of combinations of federal-provincial-utility-private sector agreements, as per provincial preferences, with an opting out formula for provinces that propose to achieve the same aims with different measures.

A further variation of the above-described potential components of an existing buildings program would be to include the Business Development Bank of Canada and Natural Resources Canada as the federal members of the federal-provincial/territorial financing partners responsible for program funding at the macro level and/or management at the project-specific level. (see sub-section 2.4)

10.4: New Residential and Commercial Buildings and Federal-Provincial/Territorial Collaboration

New buildings would be the object of federal-provincial/territorial discussions to reach a consensus on national and provincial/territorial building codes and financial support concerning energy efficiency, clean energy integration and micro-grids, clean transportation infrastructure, energy storage, water heating, heat pump, insulation, lighting and other considerations related to minimizing the environmental footprints of new buildings. Clean transportation support infrastructure could include new conduits to carry electric wiring and upgrades to service panels to accommodate the power requirements for charging stations.

With the above considerations in mind and with [California's buildings energy use reduction targets as a point of departure](#), national and provincial/territorial building codes would be updated with targets to the effect that all new buildings be zero net energy buildings beginning 2020 for residences and 2030 for commercial buildings, in provinces and territories where 70% or less of grid capacity is sourced from renewables.

A particular priority of the federal-provincial/territorial discussions would be that of supporting Canada's global leadership in buildings certified as Leadership in Environmental and Energy Design, or LEED.

This would reflect the fact that Canada is second to the US among nations for gross square metres of LEED buildings space. Moreover, given 1) Canada's population is roughly 10% of that of the US and 2) Canada's nearly 27M gross square meters of LEED certified space and 5,000 LEED-certified and registered projects amount to approximately 10% of the LEED numbers for the US, [-- Canada is, proportionately speaking, equal to the first place US in LEED buildings to-date.](#)

This being the case, the building code updates could be combined with LEED building targets, as a percentage of total new buildings space.

On Government of Canada support to assure that 1) energy efficiency, clean energy integration, zero net energy buildings, LEED etc. targets are met and 2) the Canadian eco-building industry sector flourishes in foreign as well as domestic markets, it could take the form of involving one or more of the following federal organizations by way of financial assistance, CMHC, BDC and/or EDC, to leverage private sector investments on a project-by-project basis. (see sub-sections 2.4; and 2.5)

Regarding government assistance for buildings-related innovation research projects and demonstrations, these activities would be included as eligible for support under the generic clean technology innovation program(s) as per the description in sub-section 4.2.

With respect to in-kind government cooperation on research projects, the National Clean Technology Integration Centre and select facilities of the National Network of Clean Technology Research Centres would partner with building project stakeholders, as appropriate. (see sub-sections 4.3; and 4.4)

More generally speaking, while a project may be eligible for two or more of the aforementioned types of support, the total value of public sector financial and in-kind support should **not exceed one third of a given project's cost.**

10.5: New and Existing Government and Government-Financed Buildings: Supported by Federal/Provincial/Territorial and/or Municipal Governments

Policies would be established for all new government buildings as well as new buildings funded by the federal provincial and/or municipal governments, such as public housing. These policies would be intended to assure consistency with the targets of the various levels of government, building codes, LEED objectives etc. for the non-government commercial and residential sectors, as per sub-section 10.4, and optimize:

- clean energy independence and storage;
- energy efficiency;
- clean transportation support infrastructure (see sub-section 8.2); and
- support for green economy demonstrations/innovations with possibilities for 1) co-funding under sustainable development, clean energy, clean transportation innovation and government procurement programs, plus 2) the participation of the National Clean Technology Integration Centre and select research facilities of the National Network of Clean Technology Research Centres, as appropriate, as per sub-sections 4.2; 4.3; 4.4; 6.2; 8.2; and 10.4 respectively of this Roadmap on a green economy.

For all existing government buildings, regardless of the level of government, internal energy audit programs could be set up to determine the potential concerning the first two items above and associated the payback periods. Subsequently existing government buildings would be prioritized according to the potentials for reducing their respective environmental footprints, as per government funds available.

As well, clean transportation infrastructure for existing government buildings would be a priority.

Part 11: Green Infrastructure, the Vision and the Scope

11.1: Setting Macro Priorities and Frameworks for Agreements with the Provinces and Territories

As alluded to in sub-section 1.1, with infrastructure being one of the largest budget items of the current Government of Canada, it is critical that infrastructure priorities take into account that 1) the clean tech sectors are among the largest growth and job creation sectors in the world -- with green economy returns on government investments for job creation being 6 to 8 times greater than similar investments in the traditional resource-economy; 2) the market for green solutions will continue to grow rapidly as a result of increasingly aggressive climate policies among Canada's competitors and the declining costs of clean technologies; 3) infrastructure investments which lead to increased dependency on personal vehicles are to be avoided; and 4) increasingly intensifying climate policies of the world's largest energy consuming nations are engendering a plateau/decline among the fossil fuel sectors.

Clearly all of the above considerations imply that **if the current government is serious about climate change, the goal should be that of reversing the current ratio of infrastructure investments in the old economy measured against that of the new green economy.** Such orientations could be a starting point for discussions with the provinces and territories, municipal, private and other stakeholders.

11.2: Among Eligible Projects (see Sub-sections 4.1; 4.2; 4.4; 5.5; 6.1; and 6.2)

Projects in the green infrastructure category could include, but not be limited to, the following:

- Substantive public transit investments consistent with needs of provincial and local governments and new opportunities, not only for subway and light rapid rail system expansions but also for the introduction and development of Made in Canada electric buses for medium to large communities across Canada; (see sub-sections 4.2; 4.3; 4.4; 6.1; 6.2 and 11.1)
- Local clean energy autonomy projects such as distributed generation, district heating, community energy management and clean energy micro grids;
- Large facilities to produce energy and products from waste (organic and human);
- Apart from public transit, innovative sustainable transportation infrastructure alternatives to highway expansion, urban sprawl and greater dependence on the automobile including:
 - Increases in high occupancy vehicles and bike lanes, car sharing services; etc.; and
 - Systems for traffic controls (e.g. tolls in London and Stockholm, reduction of parking available in downtown core);
- The creation of a new Natural Resources Canada (NRCan) Office of Inter-provincial Green Infrastructure to coordinate and collaborate with the provinces to support:
 - East-West/interprovincial clean electricity grids; and
 - Interprovincial infrastructures for clean transportation highways for electric vehicles (charging stations), hydrogen-powered vehicles (hydrogen fueling stations) , etc.;
- Innovative road construction materials/products that reduce community environmental footprints compared to conventional materials and techniques ;

- Green cluster development including projects that foster:
 - The creation of greater metropolitan and regional hubs, much like the auto sector hub in Southern Ontario and the aerospace hub in the Montreal area, plus clean tech industrial parks and other creative/innovative hub models; and
 - A variation of the preceding point by way of holistic hubs of multi-disciplinary eco-systems of complementary sets of stakeholders that could involve major manufacturers; small and medium size supply chain firms; innovation/R&D private and public organizations; technology integrators, including the National Clean Technology Integration Centre and others that can address the challenges associated with multiple sources of clean energy both a) feeding a transmission grid and b) linked to low carbon building and clean transportation; developers and financial institutions; and additional stakeholders that could contribute to turn-key solutions; and
- Low-cost building space for green economy incubators, which would allow green technology innovators to lay the foundations for new enterprises with minimal start-up costs, share common services and participate in the cross-fertilization of technological solutions.

Part 12: Offshore Clean Energy and Exploiting the Extraordinary Potential

12.1: Atlantic Canada's First Entries into the Offshore Wind Markets and the Canada-wide Potential

Atlantic Canada is about to enter in the rapidly expanding global offshore wind sector with two Newfoundland-based Beothuc Energy projects 1) a [\\$4B \(CDN\) 1GW offshore wind farm, the Can-Am link, 20km off the southern coast of Nova Scotia](#), to export power via a 200 nautical mile subsea cable to the Boston/US New England area and 2) [a \\$400M \(CDN\) 180 MW offshore wind farm in the St-George's Bay 20km to 30km off the west coast of Newfoundland](#).

For the NS project, there will be local manufacturing of some components that will have gravity-based foundations assembled at, or near, dockside.

The Nfld project will also use gravity-based structures with foundations manufactured in Corner Brook. For this project, Beothuk will make use of the existing workforce with experience in large structures for the oil industry and create 600 new jobs, many of which would be high paying construction. Additional jobs will be in the fields of monitoring, operation and maintenance. Potential buyers for electricity would include Atlantic Canada and Northeastern US stakeholders.

Located near the proposed Nfld offshore wind site, there is the existing subsea 500 MW Maritime Transmission Link that connects Nfld to Cape Breton, NS, from where terrestrial transmission lines in New Brunswick reach into Maine.

In short, Canada is poised to a significant player in offshore wind, which, in turn, will support economic development in Nova Scotia and New Brunswick. But since the Canadian potential for viable offshore wind projects includes 1) two coasts and 2) large waterways between these two coasts, the scope for Canadian participation in offshore wind could be considerable.

Manufacturing, docking and shipbuilding (for installation vessels) facilities in Ontario, Quebec and Nova Scotia could become key elements for the Canadian offshore wind supply chain and dockside launching requirements. And from such a base, there lies the potential for Canadian offshore wind stakeholders to enter into global export markets.

At the same time, it is important to recognize European and Chinese leadership in offshore wind as a backdrop for the challenges for Canada catching up and joining global leaders.

12.2: The Global Leadership of Europe and China

In 2015, the [28 leaders of the European Union signed on for a agreement that](#) would result in offshore wind energy production coming to the Old Continent via sea cables to achieve a minimum target of 10% of total EU electrical generation by 2020 and 15% by 2030. All told, there exists a EU potential for a super-grid drawing from the North Sea offshore wind farms to transport up to 65 GW by 2030, or 25% of Europe's electricity needs.

Among the plans for sea cable links connecting offshore wind farms to the Old Continent are 1) the \$1.65B (USD) 1.4 GW 950km North Sea Network to link Norway and the UK and which will be operational in 2021; 2) the 1.4 GW NordLink between Germany and Norway; 3) the Viking Line between Denmark and the UK; and 4) the Nemo Link between the UK and Belgium. These links are in addition to the existing interconnectors, 1) the 1 GW BritNed line between the Netherlands and the UK; 2) the NorNed 700 MW line connecting Norway and the Netherlands; and 3) the 2 GW IFA line connecting the UK and France.

Further on the UK, the rapid expansion of wind farms in that country has contributed to making the UK the EU hub for the manufacturing of offshore wind turbines. [Five GW of offshore wind farms are already in operation in the UK, the projection is for 10 GW of offshore capacity by 2020](#), or 8% to 10% of UK's electricity needs.

The [630 MW London Array](#) in the outer Thames Estuary, commissioned in 2013, is currently the world's largest offshore wind farm and the Caisse de dépôt et placement du Québec, which manages Québec's pension funds, has 25% of the shares in the entity. But the London Array will soon lose its largest offshore wind farm title to the first wind farm to exceed 1 GW, [the 1.2 GW Hornsea wind farm off the Yorkshire Coast](#), which will power 1 million homes.

Employment in the UK offshore sector stood at 18,000 jobs in 2015 and the projection is for 30,000 jobs by 2020.

UK offshore wind manufacturing includes projects such as that of [Siemens which plans to build new wind turbine production and installation facilities in Hull](#) spread over two sites. This \$437M investment will create more than 1,000 jobs and Siemens will manufacture [7 MW turbines for the Hornsea project](#) at the Hull facilities. On this latter point, an important thing to note with respect to Canada's struggling shipping sector is that the UK has considerable potential for the diversification of much of its shipbuilding and port facilities to accommodate offshore wind.

On par with the UK, [the projections are that China will also reach 10 GW](#) of installed offshore wind capacity by 2020, with roughly 1 GW and 1.2 GW to be installed in 2016 and 2017 respectively. Much of the technologies to be furnished by China's domestic manufacturers such as Goldwind , Ming Yang Envision and Dongfang.

Lastly, marine renewable energy turbines placed underwater may offer additional scope for offshore clean energy. However, these technologies are still in their infancy and much research needs to be done before these technologies are cost effective to serve a significant portion of the clean energy market.

12.3: The Creation of an Offshore Clean Energy Agency: The Rationale and the Mandate

To avoid the pitfalls associated with multiple provincial, interprovincial and international considerations and the incredible numbers of types of stakeholders that might have an interest in offshore clean energy development and its impacts -- from the private, academic, fishing and tourism sectors -- it may be best consider the US Bureau of Ocean Energy Management model of having a one-stop-shopping Offshore Clean Energy Agency to coordinate and plan projects in collaboration with the provinces and the vast array of stakeholders.

To this end, the Agency would:

- In collaboration with the provinces and the Dept. of Fisheries and Oceans, as appropriate, identify good wind and marine energy production areas that 1) do not conflict with marine life or community interests and 2) fall outside marine protected areas, (see sub-section 13.1);
- In collaboration with the provinces and Natural Resources Canada, oversee leasing and permitting via its coastal offices to assure one-stop-shopping services for stakeholders in areas identified for development;
- Offer financial support for the final project planning stages, including the planning of offshore transmission links, much like the UK Crown Estate (the owner of the UK seabed);
- Offer services in the capacity of being a facilitator or a partner -- related to the Agency's planning support -- for offshore clean energy initiatives that target:
 - national clean energy innovation funding programs for pre-commercialization demos, as per sub-section 4.2;
 - BDC and EDC venture capital and export support respectively, as per sub-sections 2.4 and 2.5;
 - federal regional development agencies -- particularly regarding their economic diversification mandates and concerning coastal industries such as the shipbuilding and port services sectors -- for the purposes of assuring a solid industrial base for offshore wind and other marine renewable energy technologies; and
- Collaborate with coastal countries with advanced offshore clean energy development such as Germany, the UK and China.

Part 13: Protecting Marine Environments

13.1: Marine Protected Areas: Establishing a Bases for New Policies on Protecting the Marine Environment

To make up for lost time, the Government of Canada would in its first year authorize a clear mandate to the Dept. of Fisheries and Oceans (DFO) to establish marine protected areas in collaboration with the Offshore Clean Energy Agency -(see sub-section 12.3) - along the lines of national parks. These protected areas would be safe havens for marine life to regenerate.

To support the enhanced mandates, DFO research centres would be re-habilitated to reach their pre-Harper reign strengths and capabilities.

More precisely, the DFO research centres would be assigned high priority tasks to monitor the protected areas with a view of formulating new policies on protecting marine habitats and marine life in general.

13.2: Updating Marine Legislation

At the request of the pipeline industry, under the Navigable Waters Protection Act, the Conservative government eliminated requirements for environmental impacts analyses regarding projects involving new infrastructures/obstacles in waterways such as bridges and pipelines.

In a similar vein, the former Conservative government gutted the Fisheries Act to the effect that the Act only protects the marine habitats of commercial and First Nations fish. Since multiple species of marine life share any given marine habitat, this legislation is now inapplicable.

As well, there is a need to update the Canada Shipping Act -- under Transport Canada's authority -- to reflect the rapidly growing phenomena of motorized high powered pleasure craft on Canada's smaller lakes and rivers, as well as other types of personal motor boats, that significantly exceed the environmental tolerances of the majority of Canada's waterways. Examples to this effect include 1) motor boats equipped with wave amplifiers and motors of up to 550HP and 2) jet propulsion boats on shallow salmon rivers.

The Canada Shipping Act requires updating because 1) it is primarily about safety and navigators' rights, 2) environmental issues are very rarely considered under the Act, and 3) Transport Canada encourages non-regulatory community-specific solutions concerning motor boats, in the form of voluntary codes of conduct.

The Transport Canada directives favouring voluntary codes of conduct have, in the vast majority of communities, produced non-resolvable debates from coast-to-coast. The result is such that the owners of the problematic boats reap the advantages of either a lowest common denominator consensus or an absence of a consensus allowing them to continue their practices by default, in absence of environmental considerations.

To respond to ill-effects of the aforementioned legislation that dates back to the days of Confederation, a pan-Canadian Coalition for Responsible and Sustainable Navigation has been created with the aim of presenting to the Government of Canada science-based legislation pertaining to pleasure craft. The research program and legislative expertise of the Coalition plus its Canada-wide representation of stakeholders, suggest that the federal government would welcome the legislative recommendations of this organization.

To complete the overhaul of the Canada Shipping Act, Members of Parliament would also be tasked to review the all matters concerning the regulation of tankers on Canada's coasts and major waterways.

Pulling this all together, to put its house in order, the Government of Canada would work in collaboration with the provinces, citizens groups, environmental organizations and other organizations to revamp Canada's marine legislation to be 1) science-based; 2) meet social acceptability criteria; and 3) focused on synergies pertaining to the various pieces of federal legislation applying to the same waters.

Part 14: Other Related Matters

14.1: Canadian Environmental Bill of Rights

During the Fortieth Parliament, Linda Duncan submitted a Private Members Bill, C-469, an Act to Establish a Canadian Environmental Bill of Rights. Seizing the opportunity associated with model already developed, the Government of Canada would finish what was already started, by way of re-introducing the Canadian Environmental Bill of Rights for adoption at the earliest possible date.

To complete the portrait of putting citizens and environmental organizations in the driver's seat to contest actions of the private sector and the various levels of government that are contrary to environmental interests, the Bill could be accompanied with support under the Court Challenges Program for the court and legal expenses of citizens and not-for profit organizations, as per new eligibility criteria in this regard.

In this way, the Government of Canada would offer Canadians participatory democracy such that one would no longer have to depend on, serendipitous just-in-time surveillance of government legislative enforcers and/or new legislation, to address unforeseen threats to the environment.

14.2: Packaging

Introduce product packaging legislation that gives manufacturers, distributors, importers and retailers up to 2 years to introduce 100%, or near 100%, recyclable packaging materials and include in the legislation, the responsibilities of manufacturers, distributors, importers and retailers regarding optimization of the amount of packaging material that gets recycled.

14.3: Banning Plastic Microbeads: Following the Lead of the US and California Governments

In December 2015, [President Obama signed a bill, unanimously approved by both the US Senate and House of Representatives and modeled after California Microbead-Free-Waters Act](#), that will see the phasing out of the manufacturing for the US-wide market the use of microbeads for face wash, toothpaste and shampoo by July 1, 2017 and for the sales of these beauty products by July 1, 2018. The California legislation ban includes so called bio-degradable plastics.

The Canadian Parliament has already approved a motion in this regard. With the US and California legislation in place, Canada must now act quickly if it is not to become a dumping ground for what cannot be used in the US.

The order of magnitude of the problem is enormous as exemplified by the fact that 2.9T microbeads enter US waterways annually. The related topic concerning plastic bags at-large follows in sub-section 14.4 and provides some additional statistical background information.

14.4: Plastic Bags and Federal-Provincial-Municipal Collaboration

It is estimated that something in the order [of 8M metric tonnes of plastic](#) enter into the world's oceans every year. Several years ago, the [United Nations Environmental Program estimated that there are 13000 pieces of plastic for every square kilometre of ocean](#). More recently, a US consortium indicated that there are [5 trillion pieces of plastic in our oceans and weighing 300,000 US tons](#).

And of course, discarded plastics contribute more to terrestrial pollution than marine pollution.

Accordingly, the City of Montreal should be congratulated for its [February 2016 announcement](#) on the banning of single use plastic bags, beginning July 1, 2018. Nevertheless, one should also take notice of the leadership of the State of California which has adopted measures that go beyond a ban on single use plastic bags.

On California's action on plastics, in September 2014, The California Senate approved a phased approach for a state-wide ban on single use plastic bags encompassing the elimination of single use plastic bags in grocery stores and pharmacies beginning July 2015; and a similar ban for convenience stores in 2016.

Concurrently, the legislation called for a mandatory 10 cents minimum charge for recycled paper and reusable and compostable bags.

Where [California goes further than Montreal](#) is in the following areas:

- re-usable bags would be required to have 20% recycled content in 2016 and 40% by 2020;
- support for the recycling of agriculture plastic film;
- requirements for grocery stores to take back used bags; and
- third party certification of reusable plastic bags and compliance with standards.

Annex A: Quebec's Electric Vehicle Sector

The principal stakeholders in Quebec's electric vehicle (ev) sector are as follows

- two manufacturers of **ev batteries**
 - **Phostech Lithium:** <http://www.phostechlithium.com/>
 - **Bolloré/Bathium:** <http://www.bathium.com/>
- a developer of an **electric motor wheel, TM4** (100% owned by Hydro-Québec), <http://tm4.com/>
 - the TM4 technology will be manufactured in China under license
- 2 manufacturers of **ev charging stations, 4**
 - ADDÉnergie: <http://addenergietechnologies.com/en/>
 - GRIDbot: <http://roulezelectrique.com/gridbot-canada-hydro-quebec-lui-octroie-un-contrat-pour-la-mise-au-point-dune-borne-bidirectionnelle/>
- an **electric bus** under development at **Nova Bus (Volvo):**
<http://www.novabus.com/transit-solutions/electro-mobility.html>
- an **electric school bus** stakeholder, **Lion:** <http://lionbuses.com/en/>
- **Téo (Transport écologique optimisé)Taxi:** electric Taxis for Montreal, lead investor Alexandre Taillefer
 - pilot project with 50 taxis leading to 100 taxis in 2016, and 1000 vehicles by 2017 and 2000 vehicles in 2019 with 4000 drivers
 - pilot with 40 Kia ev Souls and Leafs and subsequently 10 Teslas
 - will feature own network of fast-charging stations and GPS location of taxis in real time
 - project 35% to 40% reduction in operating costs compared with conventional taxis
 - Taxi drivers will be employees paid at \$15/hour with benefits for 40 hour work weeks
 - reduced rates for airport and low demand periods
 - investors XPND Capital of Alexandre Taillefer, Investissement Québec and Caisse de dépôt et placement, \$25M in total financing
 - <http://www.ledevoir.com/economie/actualites-economiques/455890/taxi-teo-le-petit-dernier-d-alexandre-taillefer>
 - <http://www.pressreader.com/canada/la-presse/20151119/281921656947766/TextView>
- **electric motorcycle, Sora:** <http://soraelectricsuperbike.com/>
- **electric boat** using TM4 technology, **LTS Marine:**
<https://www.youtube.com/watch?v=E5i2BriHbS8>

Annex A: Quebec's Electric Vehicle Sector, Continued

- **research centres:**
 - **Institut du véhicule innovant** (formerly Le Centre national du transport avancé):
<http://www.cnta.ca/>
 - **Centre des technologies avancées** (a consortium of Bombardier Recreational Products and Université de Sherbrooke): <http://www.cta-brp-udes.com/>
 - **L'École de technologie supérieure (UQAM):**
<http://www.etsmtl.ca/nouvelles/2015/Transport-durable>
 - **Université de Montréal:**
<http://www.aveq.ca/actualiteacutes/hydro-quebec-et-luniversite-de-montreal-signent-une-entente-avec-aleees-un-des-plus-importants-producteurs-de-materiaux-de-batterie-du-monde>
- **research, energy storage, Super Battery of l'Institut de recherche d'Hydro-Québec (IREQ) in Varennes**
http://quebec.huffingtonpost.ca/2014/11/28/une-super-batterie-developpee-par-hydro-quebec_n_6236030.html
<http://ici.radio-canada.ca/nouvelles/environnement/2015/11/30/004-superpile-batterie-hydro-quebec-electricite-energies-fossiles.shtml>
 - lithium ion super battery developed by Hydro-Quebec, twice as light as competitors' batteries at a fraction of the price
 - Esstalion technologies is working in partnership with Hydro-Québec et Sony
 - the joint venture company is located in the vast campus of IREQ at Varennes
 - super battery can generate 1.2 MW/hour
 - Esstalion is working on the next generation of the battery to achieve a life cycle of 20 years instead of 10 and fast charging-discharging in less than 15 minutes

Annex B: California Zero Emission Vehicles Initiatives

Goals

- Goal: 1.5M ZEVs on California roads by 2025 through a combination of consumer incentives, infrastructure improvements, and communications/awareness raising
- 15.4% of all vehicles sold by each manufacturer to be ZEVs by 2025
- ZEVs represented 10% of total State government light duty vehicle purchases in 2015, target 25% by 2025
- Create enough infrastructure to support 1M ZEVs on the road by 2020; and
- Beginning 2018 California and 7 other states will have incremental increasing requirements for each manufacturer concerning the percentage of low emission (hybrids) and zero emission vehicles sold in these states by 2025

<http://cleantechnica.com/2013/02/14/california-plans-for-1-5-million-zero-emission-vehicles-by-2025/>

Government Support for Businesses and Residents

- Support for manufacturing and innovation
- Loans for small business to install charging stations
- Complementing incentives for Californians to purchase ZEV, there is the Self-Generation Incentive Program to provide \$415 million over 5 years to install micro-grid components on the customer side of the grid, including wind turbines, waste-heat-to-power technologies and advanced energy storage systems. Energy storage technologies are critical to making electric vehicles an attractive option

<http://cleantechnica.com/2013/02/14/california-plans-for-1-5-million-zero-emission-vehicles-by-2025/>

<http://ensia.com/features/the-emerging-power-of-microgrids/>

Regulations

- Requirements for recent buildings and parking lots to have wiring and control panels in place to install charging stations
- Requirements for buses of large fleets to eventually be ZEVs (China's BYD built an e-bus manufacturing plant in California

http://cleantechnica.com/2014/09/29/new-housing-in-california-to-be-ev-capable/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+IM-cleantechnica+%28CleanTechnica%29

<http://www.arb.ca.gov/msprog/bus/bus.htm>

<http://www.presstelegram.com/environment-and-nature/20140428/byd-motors-delivers-its-first-two-california-built-electric-buses-to-antelope-valley-transit>

Key Electric Vehicle Enterprises

- Tesla: Electric vehicles https://www.teslamotors.com/en_CA/factory
- BYD electric buses: <http://cleantechnica.com/2015/10/21/look-hood-byd-electric-bus-factory/>
- Proterra electric buses: <http://www.proterra.com/>

Annex C: China's Aggressive Strategy on New Energy Vehicles

Goals

China's Overall "New Energy Vehicle targets include:

- [Increasing domestic production of eco-cars to 2M/year by 2020](#)
- [5M in accumulated new energy vehicle sales by 2020](#)

Key Accomplishments

- For the first nine months of 2015, the combined electric and plug-in hybrid vehicles production and sales stood at 144,200 and 136,700 units respectively
http://cleantechnica.com/2015/12/15/china-track-lead-global-ev-sales-2015/?utm_source=Cleantechica+News&utm_medium=email&utm_campaign=940b0ec147-RSS_EMAIL_CAMPAIGN&utm_term=0_b9b83ee7eb-940b0ec147-332083729

Policies

Policies in support of the above-mentioned targets include:

- A [\\$16B program under review to fund ev charging stations](#) with an objective of reaching a 1:1 ratio for ev's and charging stations in the country;
- Central government subsidies for the purchase of "new energy vehicles."
- A central government requirement that electric vehicles represent 30% of the government's procurement of new vehicles beginning 2016; http://cleantechnica.com/2014/08/28/china-considering-16-billion-government-funding-new-ev-charging-infrastructure/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+IM-cleantechica+%28CleanTechnica%29
- Electric or hybrid technology vehicles to make up at least 15% of all 2015 new vehicles procurement by government bodies in Beijing-Tianjin-Hebei region, the Yangtze River Delta, and the Pearl River Delta and 30% by 2016; http://cleantechnica.com/2014/08/27/chinas-electric-and-hybrid-vehicles-production-up-280/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+IM-cleantechica+%28CleanTechnica%29
- The announcement of 21 provinces and cities about 70 subsidy programs to promote eco-friendly vehicles, typically up to 120,000 Yuan/vehicle. (\$24000(CAD)/vehicle), in many instances, to favour local manufacturing; <http://asia.nikkei.com/Business/Trends/Green-cars-still-far-from-taking-off-in-China>

- A Shenzhen target to have more than 3,000 electric taxis, 5,000 hybrid and 1,000 electric urban transit buses on the road by the end of 2015; <http://www.scmp.com/article/995267/half-shenzhens-buses-be-electric-or-hybrid>
- Shenzhen earmarked 5B yuan (\$1B CAD) in its 2015 budget for eco-car subsidies (\$11000CAD)/vehicle and set an annual sales target of 15,000 units; http://www.greencarreports.com/news/1096094_china-extends-electric-car-incentives-as-shenzhen-caps-registrations
- In 2015, Shenzhen banned all vehicles that fail to meet in advanced emission standards; <http://www.scmp.com/article/995267/half-shenzhens-buses-be-electric-or-hybrid>
- Shenzhen is the home of BYD headquarters -- BYD manufactures electric buses and cars and has foreign e-bus manufacturing plants in California and Bulgaria; and <http://www.presstelegram.com/environment-and-nature/20140428/byd-motors-delivers-its-first-two-california-built-electric-buses-to-antelope-valley-transit>
<http://www.byd.com/news/news-131.html>
- All new apartment and condo buildings in Shenzhen must now include ev charging stations for each parking space. http://cleantechnica.com/2014/09/06/byd-electric-car-sales-2014/?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+IM-cleantechnica+%28CleanTechnica%29

Annex D: The Revamping of the German Renewable Energy Act, A Work in Progress

Once again Germany is breaking new ground with a tendering process which will be designed to replace its FIT program and better reflect the rapidly declining costs of renewables technologies. In this regard, a reform of the German Renewable Energy Act will be ready in 2016, with full implementation to begin in 2017.

In the interim, Germany is experimenting with pilot tenders for solar and wind projects whereby the government sets a ceiling for the total number of megawatts to be approved for any given round of solar or wind tenders. This system favours the cheapest proposals to win until the overall capacity limit is attained for the tender round in question.

However, the German government has recognized that this model should not be applied across the board to include small installations since doing so would rule out projects from small communities, co-operatives, farmers, individuals and others. This is significant because the stunning success of the German FIT model is in part attributable to the fact that 50% of renewable energy production capacity in Germany is owned by such groups. The attraction has been guaranteed the high Feed-in-Tariff prices and priority access to the grid to sell their surpluses. For rural communities in particular, the old formula meant new local jobs and an increase in tax revenues. <http://energytransition.de/2012/10/key-findings/>

To address these matters, Germany plans to exempt projects, such as rooftop solar initiatives, that are 1 megawatt or less.

Other matters that the German government must consider is that the proposed tender model, as formulated thus far, has the potential to limit the number of stakeholders who are capable of participating. Only those with sufficient financial strength can afford to invest in an expensive bidding process for which they might not be among the winners. The German Green Party worries that the result may translate into higher costs and tendering round-specific ceilings not being met.