CanWEA / CME Wind Industry Supply Chain Opportunities for Canadian Manufacturers

Canadian Manufacturers & Exporters

Manufacturiers et Exportateurs du Canada

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CANADIAN WIND ENERGY ASSOCIATION | ASSOCIATION CANADIENNE DE L'ÉNERGIE ÉOLIENNE

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About Canadian Wind Energy Association

CanWEA is the voice of Canada's wind energy industry, actively promoting the responsible and sustainable growth of wind energy on behalf of its more than 450 members. A national non-profit association, CanWEA serves as Canada's leading source of credible information about wind energy and its social, economic and environmental benefits. To join other global leaders in the wind energy industry, CanWEA believes Canada can and must reach its target of producing 20 per cent or more of the country's electricity from wind by 2025. The document Wind Vision 2025 – Powering Canada's Future is available at www.canwea.ca.

About Canadian Manufacturers & Exporters

Canadian Manufacturers & Exporters (CME) is Canada's leading trade and industry association and the voice of manufacturing and global business in Canada. The association represents more than 10,000 leading companies nationwide. More than 85% of CME's members are small and medium-sized enterprises. As Canada's leading business network, CME, through various initiatives including icosmo.ca and the establishment of the Canadian Manufacturing Coalition, touches more than 100,000 companies from coast to coast, engaged in manufacturing, global business and service-related industries. CME's membership network accounts for an estimated 82% of total manufacturing production and 90% of Canada's exports. Visit www.cme-mec.ca.

Executive Summary

One of the most significant opportunities for Canada's industrial supply base over the next decade lies in providing products and services to the North American wind energy industry.

The industrial landscape in Canada is undergoing significant changes. Traditional manufacturing and service sectors continue to feel the strain of a North American market still searching to find its place in the wake of the 2008-09 global recession. The long-term demand for high-volume, low-mix manufactured goods continues a shift towards low-cost regions around the world. Canadian companies must find new ways to leverage existing capabilities and transform operations in order to meet the needs of new customers and emerging markets.

Over the past 10 years, global wind energy capacity has continued to grow at an average annual rate of more than 25 per cent. Global investment in wind energy is projected to total more than $1 trillion (US) by 2020, bringing global installed capacity to more than 600,000 MW.

The rapid pace of wind energy market development in North America is leading wind turbine OEM's to seek capable and experienced business partners and suppliers in North America to meet customer demands. The added costs associated with transportation, lead time, duties and taxes for products coming from Europe, combined with government and industry preference for the establishment of a domestic North American supply chain has created an opportunity for manufacturers and service providers to enter the wind energy industry.

The North American wind industry is developing well behind the birthplace of commercial wind energy, Western Europe. The Canadian market is still relatively small in comparison to the U.S. This situation presents both challenges and opportunities for the Canadian supply chain.

Innovative Canadian companies that are successful in the North American market will be able to access global supply opportunities in regions that are expected to outpace North America over the long term – Asia, for example – by exporting products and services, transferring technology, entering into licensing agreements with local suppliers, and by setting up operations in regions of growth.

There is a need for key local, regional and national stakeholders in the wind energy supply chain to coordinate their efforts with a common purpose of ensuring a strong, globally competitive Canadian industry while balancing the need for healthy regional competitiveness as the industry matures.

As a first step, CanWEA and CME have formed a strategic partnership to share information, promote opportunities in the wind industry and coordinate efforts among the numerous industry stakeholders.

CanWEA and CME are committed to bringing together the key jurisdictions and stakeholders with an interest in this area to establish strategic priorities for communication and coordination of supply chain development activities in support of an integrated national strategy for the wind industry.

Key initiatives that should be pursued are covered in greater detail in this report:

A. Communication
B. Partnership Facilitation
C. Capability Development
D. Policy to Develop a Sustainable Canadian Supply Chain

There is a race for the establishment of a North American wind energy supply chain. Canada must act now in order to successfully compete for its share of this growing market. This will require concerted efforts on the part of wind farm developers, turbine OEMs, industry associations, economic development agencies and federal and provincial governments.

1.0 Global Wind Energy Development

Worldwide wind energy production capacity has increased at an average annual rate of 25% over the past ten years. Investment is projected to total more than $1 trillion US by 2020, bringing installed capacity to more than 600,000 MW.

The total global installed wind energy production capacity at the close of 2009 was 157,899 MW, an increase of 37,466 MW from 2008. Growth in 2009 was led by the United States and China, with approximately 40% and 100% year over year growth in 2009 respectively.

1.1 North American Wind Energy Development

Wind energy development in North America is being led by strong activity in the United States, which has installed more new wind energy capacity than any other country in four of the last five years. Canada is also a rapidly growing wind energy market, with total installed capacity increasing by a factor of 10 between 2003 and 2009. At the present time, wind energy development remains limited in Mexico.

However, North America lags behind other regions such as Europe, the birthplace for the commercial wind energy market and global hub for wind energy development and wind turbine manufacture. Nations such as Denmark, Spain and Germany currently meet between 7% and 20% of their overall domestic electricity demand through wind energy, and the wind turbine manufacturing supply chain has been historically concentrated in these nations. It is clear, however, that new wind turbine manufacturing supply chain opportunities are rapidly expanding in strong new markets like North American and China.

1.2 United States Wind Energy Development

In 2008, the United States installed 8,545 MW of wind power – 42% of all new generating capacity added to its electricity system – accounting for more than 30% of the wind turbines installed in the world that year, to become the world's largest producer of wind power. The US added almost as much new capacity in 2009, and had 35,159 MW of installed capacity by the end of the year. Wind power represents almost 2% of the electricity mix and provides sufficient electricity to meet the needs of more than 7 million households in America.

The wind industry in the US has grown at an average rate of more than 30% for the past five years to become a mainstream energy source and significant new green industry. The industry employed about 85,000 people in 2008, primarily in the manufacturing sector, up from 50,000 one year earlier. There are now over 70 manufacturing facilities in operation or under development to support the demand for new wind farms. As a result, about 50% of the components of a wind turbine are produced in the US today, up from under 30% in 2005.

A supportive federal administration under President Obama has put in place more favourable policies that will continue to help the US wind industry to flourish. In February, 2009, the US Congress passed an economic stimulus bill that included several provisions that will positively impact the development of the wind energy industry in the short-term. The Administration is also pursuing a range of long-term energy policies that will help to provide a stable market for development, such as a national renewable electricity standard, climate change legislation and regulatory changes to drive the development of a national clean energy transmission network.

The US Department of Energy has concluded that the United States could move to meet 20% of its electricity demand from wind energy by 2030, creating 250,000 jobs and $ 944 billion in economic opportunity. Meeting this objective would require the installation of 70,000 turbines in the US.

1.3 Canadian Wind Energy Development

Canada is the sixth largest electricity producer in the world, producing 600 TWh annually and is the fourth largest exporter of power, with all of its exports going to the US, the world's largest market for electricity. Canada's electricity generation capacity in 2009 is 125,485 MW, with 60% derived from renewable resources – mainly hydro, 20% nuclear, 15% coal and 5% natural gas. Wind power currently supplies about 1 % of Canada's electricity demand with enough power to meet the needs of almost 1,000,000 homes.

Canada currently ranks 18th in the world for the contribution of wind to meeting its domestic electricity demand. Since 2003, wind power generation capacity in Canada has increased ten-fold, thrusting wind power into the mainstream as a significant future energy source and emerging green industry. For the first time, in 2009, every province now has wind farms contributing power to the grid. By the end of the year, Canada added 950 MW of new wind generating capacity for a total of over 3,300 MW. If provincial governments meet their stated targets and objectives for new wind energy development, Canada will have a minimum of 12,000 MW of installed capacity by 2015. Already, there are almost 5,000 MW of new wind energy projects that have signed power purchase agreements and are scheduled to be constructed over the next few years.

2.0 Energy Price Benefit of Wind

Electricity prices for residential consumers in Canada increased by 48% between 1990 and 2005 according to the National Energy Board of Canada and are expected to continue to grow by another 50% between 2005 and 2025 as the demand for electricity in Canada grows by 36 % while over the same period, 15 % of the current generation capacity is slated for retirement.

The major contribution to the increases in electricity prices Canadians face in the future come from the costs for sourcing fuel for power generation plants, either in the form of coal, petroleum products or uranium, and the added costs to treat, capture, store and dispose of waste by-products and streams. The cost of delivering energy derived from non-renewable sources of energy, primarily fossil fuels have, and will continue to increase over time, relative to renewable sources of energy such as wind. This is primarily due to increased costs of raw material extraction and refinement, stricter environmental compliance regulations and future carbon pricing.

A major benefit from having a significant proportion of wind power generation in Canada's energy mix is the stabilizing effect of wind on long-term electricity prices. Once a wind farm is in operation, the cost of generating power remains unchanged over the life of the project because, in effect, the fuel for operating a turbine – wind – is absolutely free, and there is no waste produced from the electricity generation. In addition, as the costs of electricity generation from all sources increases, wind energy becomes even more cost-competitive and is likely to be able to compete with all forms of power generation before the end of this decade.

3.0 Aging Infrastructure, Market Growth and Greenhouse Gas (GHG) Reduction Commitments Equal a Perfect Storm for the Canadian Wind Industry

Between today and 2025, 15% of Canada's energy mix – approximately 19,000 MW of generating capacity – will be phased out and will need replacement. Over the same period, 45,000 MW of additional generating capacity are expected to be required to meet the growing needs of the Canadian market. To keep pace with the market's demands, an investment of approximately $ 185 billion (US) is required – $ 95 billion in generating capacity, $ 27 billion in transmission and $ 63 billion in distribution – by 2030. While these estimates have been impacted by the global recession, there is no doubt that significant investments in new infrastructure will be required.

The federal government has also committed to seeing 90% of Canada's electricity produced from non-emitting sources by 2020, and reducing the country's greenhouse gas (GHG) emissions to 17% below 2005 levels by 2020 and 60% – 70% below 2006 levels by 2050. Achieving this set of goals will require a coordinated effort on all fronts, and the wind power industry has a unique opportunity to play a major and positive role.

There is an excellent opportunity for the federal and provincial governments to elevate Canada as a global leader in renewable energy generation and environmental responsibility by encouraging the replacement Canada's aging, GHG intensive sources of power generation and to meet the future needs of the Canadian people with clean sources of energy such as wind power.

3.1 Wind Power is an Economic Opportunity for *all Canadians*

While wind power makes up about 1.5% of the electricity mix in Canada today, a progressive, stable and long-term federal and provincial regulatory framework will help to create a stable wind development market, strong demand for wind turbines and their components, and far reaching economic benefits.

CanWEA's Wind Vision 2025 offers a strategic roadmap for increasing wind power generation capacity to world class standards, by setting a target of 20% of Canada's total electricity demand being met by wind by 2025. The objective is for wind to supply 50% of new electricity produced in Canada to serve the electricity market's needs between now and 2025.

To meet the strategy of Wind Vision 2025, 55,000 MW in new wind generating capacity will need to be installed – equivalent to some 22,000 wind turbines spread over approximately 450 locations across Canada. Most of the prime locations for wind farm development are far from urban centres. The naturally remote locations of wind farms result in an added benefit to rural municipalities and land owners in the form of a new, stable form of local tax revenue, land lease income for private landowners, and employment opportunities to areas that have traditionally faced economic challenges.

CanWEA and CME estimate that the strategy set in Wind Vision 2025 will result in $ 80 Billion (CDN) in direct investment, a minimum of 50,000 new full-time jobs and new revenues for rural municipal governments across Canada of $ 165 million a year.

For every 1,000 MW of new installed wind generation capacity today, there is approximately $ 2.75 billion in private sector investment, 1,000 jobs and enough electricity to power 300,000 Canadian homes. It also provides $ 3 million in annual lease payments for rural landowners as well as a similar amount in new taxes for rural municipalities.

Once the capital work to develop a wind farm is complete, there remains a substantial opportunity for the formation of an operations and maintenance service industry to support the wind farms. Based on Wind Vision 2025, CME estimates there is a $ 3 billion direct opportunity for operations and maintenance services over the life of the wind farms.

Two major elements are required to maximize the value of the economic opportunity for Canadians: a stable and predictable market for wind farm development must be developed across the country; and a Canadian supply chain to support the market opportunities needs to be established quickly before the US market and supply chain become too large and have too great a competitive advantage over Canada's and dominates the North American market.

4.0 Provincial Wind Development Opportunities

The provincial jurisdictions that are positioned to be the largest domestic markets for wind power development in the short-term are Ontario, Quebec, and Alberta. Quebec has already installed or contracted 3,500 MW of wind energy as part of its objective to have 4,000 MW in place by 2016. Ontario had originally planned to have 4,600 MW of wind energy on-line by 2020, but has now put in place a Green Energy and Green Economy Act that represents the most comprehensive policy package to support renewable energy development in North America, making it likely that it will significantly exceed this original objective. Since the Act passed into law in the fall of 2009, approximately 8,000 MW of wind energy projects have submitted applications for contracts, although the current transmission grid will only allow for 2,500 MW at this time. Alberta is planning to build new transmission infrastructure in the south of the province specifically to allow up to 3,200 MW of new wind energy to connect to the grid – which is only a portion of the 12,000 MW of wind energy projects seeking to connect at this time.

While other provinces have smaller ambitions in absolute terms, the sum total of their aspirations is significant. For example, the Maritime Provinces are seeking 1,700 MW by 2015. Prince Edward Island alone plans to develop 500 MW of wind in that timeframe to provide 30% of the province's electricity needs and to export surplus power to the US.

Table 1 provides a summary of wind power capacity in Canada's Provinces as of February 2010 (see **http://canwea.com/farms/index_e.php** for updated figures). Many provinces and territories have now publicised strategies and targets for new wind energy development over the short-term. Table 2 provides a summary of the current status of each jurisdiction's wind development strategy.

Table 1 – Installed Wind Capacity in Canada, February 2010

Province	Installed Capacity
British Columbia	102 MW
Alberta	590 MW
Saskatchewan	171 MW
Manitoba	104 MW
Ontario	1,208 MW
Quebec	659 MW
New Brunswick	195 MW
Nova Scotia	110 MW
Prince Edward Island	164 MW
Newfoundland and Labrador	54 MW
Yukon Territory	0.81 MW
Total	**3,359 MW**

Table 2 – Summary of Wind Development Strategies in Canada – February 2010

Jurisdiction	Development Initiative	Status
Federal	Announced the ecoEnergy Renewable Power program in January 2007 to support the deployment of 4,000 MW of renewable energy between 2007 and 2011. Government also has target for 90% of electricity to be generated from clean sources by 2020.	The program has been extremely successful and all funding was fully allocated by early 2010 – one year ahead of schedule. The government did not extend the program as part of its 2010 Budget.
British Columbia	Government aims to achieve energy self-sufficiency by 2016. 50% of new generation to come from clean energy sources (no specific wind energy target).	BC's first wind farm was commissioned in 2009. In 2009, BC Hydro issued a Clean Power Call for 3,000 – 5,000 GWh/yr – winners are expected to be announced in Spring of 2010. In February 2010, the BC Government announced the development of a Clean Energy Act which is supposed to include a new procurement process and streamlined regulatory and approvals process. No target for wind energy was identified.
Alberta	No provincial target. Note that Alberta operates Canada's only fully deregulated electricity market.	Alberta Electric System Operator (AESO) has applied to build new transmission infrastructure to accommodate more than 3,000 MW of wind generation in Southern Alberta. AESO has also undertaken a new interconnection process designed to bring more certainty to the process.
Saskatchewan	Provincial energy strategy seeks to have 300 MW of wind energy in Saskatchewan by 2011.	171 MW currently in place and an additional 25 MW are contracted. SaskPower has indicated it will issue a call for 175 MW of new wind energy in 2010.
Manitoba	Manitoba Government seeking 1000 MW of wind energy by 2016.	Currently 104 MW in place. In 2007, Manitoba Hydro launched a RFP process for an additional 300 MW of wind – the resulting contracts have yet to be finalized. No announcements have been made on the timing of subsequent procurement processes.
Ontario	The Ontario Power Authority's Integrated Power System Plan had called for 4,600 MW of wind energy by 2020. However, in 2009, Ontario's new Green Energy Act came into force with a feed-in-tariff and new transmission investments that make it likely that this target will be exceeded. The government has not provided a wind-specific target.	In January 2009, OPA announced contracts for six new wind energy projects in Ontario totalling 492 MW. The first contracts to be signed under the new Feed-in-Tariff (FIT) will likely be signed in Spring 2010. Approximately 8,000 MW of wind energy projects have submitted applications for FIT contracts. At this time, 2,500 MW of capacity will be able to connect to the grid, but transmission upgrades are planned to allow the connection of significantly more capacity over the next few years.
Quebec	Quebec Energy Strategy set target for 4,000 MW of wind energy by 2015, with an addition of 100 MW of wind for every 1,000 MW of new hydro.	Nearly 3,500 MW of wind energy has been contracted. A Request for Proposals for 500 MW of First Nations & Municipal wind projects was issued April 2009 and will be awarded in 2010. No subsequent procurements are planned at this time.
New Brunswick	The New Brunswick government's commitment is to increase the amount of electricity from new renewable sources in New Brunswick to 10% of total use by 2016 (roughly 500 MW, 400 MW of which will be wind)	200 MW of wind contracts were announced in 2008 and a new RFP for 100 MW of wind was announced in June 2009. In February 2010, a new Community energy policy was announced; this 75 MW initiative can be met with all forms of renewable energy.
Nova Scotia	The Renewable Energy Standard (RES) put in place by the Government of Nova Scotia requires that 25% of the total Nova Scotia electricity requirement be supplied by new (post 2001) renewable energy sources by 2015.	In 2008, Nova Scotia Power Inc. contracted for 246 MW from 7 projects. No new procurement processes have been announced.
Prince Edward Island	Government target of installing 500 MW of wind power by 2013.	Plans to issue a new RFP for wind energy projects in 2010.
Newfoundland and Labrador	Target of 80 MW of wind energy on the island of Newfoundland and exploring wind development potential in Labrador.	No new procurement processes have been announced.

5.0 Wind Development Opportunities for the Canadian Supply Chain

5.1 Anatomy of a Commercial Scale Wind Farm

A typical commercial wind farm in Canada today, ranges in size from a few MW to 200 MW. It is expected that almost all of the wind developments in Canada in the medium term will be on-shore and the turbines will be in the range of 1.5 and 3.0 MW in size.

The total cost of a large scale wind farm ranges from $ 2.2 million to $ 2.8 million (USD) per installed megawatt of generating capacity, with the wind turbine making up 70% to 75% of the cost, and engineering, site service and construction making up the balance.

The installed cost of a wind turbine on a typical commercial wind development is affected by a number of factors including the rated power, type of generating technology selected, the size of the wind farm and quantity of turbines required, general location and proximity to manufacturing expertise and capacity, land and soil conditions, quality of site access, and cost of labour. Approximately 70% of the total cost of a turbine comes from four main components: the turbine blades, the turbine tower, gearbox, and the pitch and yaw control systems.

The turbines used on a commercial wind farm are very large, reaching heights in excess of 100 m tall, and are constructed from over 8,000 parts. These turbines are too large to transport to the wind farm and erect in one piece, instead they are field installed from manageable sized sub-assembles and sections to complete the manufacture of the turbine. The main field installed sub-assemblies and sections include the turbine foundation, tower sections, nacelle assembly, rotor hub assembly and cover, blades, and the power converter and transformer.

The most complex section of the wind turbine is the nacelle assembly. It contains the major mechanical and electrical components including, the nacelle frame, yaw drives, pitch control mechanisms, rotor shaft and drive train, power generator and gearbox (if applicable), braking systems, oil circulation and cooling system, controls system and insulation.

Original Equipment Manufacturers (OEM's) employ a variety of manufacturing strategies from primarily in-house to nearly 100% outsourced.

5.2 Opportunities for the Canadian Supply Chain

The rapid pace of wind energy market development in North America is leading wind turbine OEM's to seek capable and experienced business partners and suppliers in North America to meet customer demands. The added costs associated with transportation, lead time, duties and taxes for products coming from Europe, combined with government and industry preference for the establishment of a domestic North American supply chain, has created an opportunity for manufacturers and service providers to enter the wind energy industry.

The development of a strong wind turbine supply chain takes a predictable path once a sustainable market for wind farm development is established. In the early stages a wind turbine OEM will set up operations in a location that provides both access to the regions that will be undergoing wind farm development and that are close to good manufacturing capability and capacity, and a skilled workforce. Tier 1 suppliers, including tower, blade and nacelle assembly manufacturers follow, and finally, sub-component suppliers including nacelle components, control systems, metal fabricators, precision machine shops, enter the supply chain to support the requirements of the tier 1's.

The North American wind industry is developing well behind the birthplace of commercial wind energy, Western Europe, and other jurisdictions of the world, and the Canadian market is still relatively small compared to the US. This situation presents both challenges and opportunities for the development of a Canadian supply chain.

First, the presence of wind turbine OEM's in Canada will require stable, consistent and predictable long-term opportunities in regional markets that are located relatively close to one another, have access to a capable supply chain, and are also within striking distance of the much larger US marketplace. If the market opportunity in Canada is not large enough to justify wind turbine OEM's establishing Canadian operations, or is not centralized enough to allow access to multiple wind farm developments and also provide a business case for penetration into the US market, there is a risk that wind farm development opportunities in Canada will be able to be served by OEM's that are in the US market and a potential US supply chain that has already begun to be established.

The Canadian supply chain must also rely heavily on innovation, both in design and manufacturing techniques in order to be competitive with a US supply chain that is larger in size and more experienced. Canadian suppliers will have to develop and manufacture stronger, lighter, longer lasting components and assemblies that are of lower cost, shorter lead time and higher quality than their US competitors to ensure they are competitive at home and also achieve significant US market penetration.

North American Competitive Situation

Turbine Vendor and Component Supply Relationship

In-house / Outsource	Rotor/Blade	Gearbox	Controls	Generator	Castings	Tower
Mitsubishi Power Systems	Mitsubishi/TPI (Vientek)	Ishibashi	Mitsubishi	Mitsubishi	Various local firms	Mitsubishi, Local firms
Nordex	Nordex, LM, NCI, Baoding HT	Winergy, Bosch Rexroth, Eickhoff	Nordex, Mita	Loher/Winergy, Elin	Siempelkamp	Nordex, Omnical, Local firms
Siemens	Siemens Wind Power, LM	Winergy, Hansen	KK Electronic	Loher/ Winergy, ABB	Sakana, Metso, Local firms	KGW, Roug, Coiper, Local firms
Suzlon	Suzlon, LM	Hansen, Winergy	Suzlon	Suzlon, Elin	Patel Alloy	Suzlon, Local firms
Repower Systems	LM, A&R	Winergy, Eickhoff, RENK	Mita Teknik	Winergy, VEM	Siempelkamp	Klotz, Reuther, Local firms
Vestas	Vestas, LM	Hansen, Winergy, Moventas, Fellar, Jahnel-Kestermann	Vestas	Vestas, ABB, Leroy Somer, Elin (VAT Tech)	Vestas, Patel Alloy, Metso	Vestas, Local firms
AAER Wind Energy	AAER (EUROS)	Jahnel-Kestermann	American Superconductor	IEC Holden, Elin	Local firms	Local firms
Acciona Windpower	LM Glasfiber Tecsis	Moventas, Winergy	Ingeteam	Ingeteam	Sakana, Felguera, Local firms	Acciona, Local firms
Clipper	Tecsis	Clipper	Clipper	Grupo Potencia	Local firms	Local firms
Gamesa	Gamesa, LM	Echesa (Gamesa), Ingoteam	Ingeteam	Ingeteam	Fundicion Nodular del Norte, ATL, Sakana, Felguera, Hodge	Gamesa, Local firms
GE Wind Energy	LM, TPI, MFG, A&R, Tecsis	GE Rail, Rexroth, Eickhoff, Moventas, Winergy, Etc.*	GE	ABB, Hitachi, VEM, Winergy	Buderus, Felguera, Hodge, Thyssen, other	Trinity, DMI, SIAG, Marmen, Titan, Local firms

Source: Emerging Energy Research

* For complete listing and latest data, visit EER's website: www.emerging-energy.com

Innovative Canadian companies that are successful in the North American market will be able to access global supply opportunities in regions that are expected to outpace North America over the long term – Asia, for example – by exporting products and services, transferring technology, entering into licensing agreements with local suppliers and by setting up operations in the regions of growth.

In the United States presently, about 50 % of the value of a wind turbine is sourced from outside the continent, with Canadian wind farms seeing an even higher percentage coming from outside Canada. This subjects equipment vendors to added cost and risk due to foreign exchange fluctuations. There are several opportunities for the Canadian supply chain to take advantage of the supply chain gaps, both as they exist in the young Canadian market and the more mature US market. These gaps in the global supply chain for wind turbine components have been well identified and established by market studies, for example the 2007 report entitled Opportunities for Canadian Stakeholders, prepared by The Delphi Group and Garrad Hassan Canada Inc., for Industry Canada.

The most promising and immediate opportunity for Canadian manufacturers with respect to large components are supply opportunities for those large components of a wind turbine that are costly to transport over long distances – the tower sections, rotor blades, nacelle assemblies and covers, casting and forgings. The high cost to transport these components due to their large size and often irregular shape provides some incentive for manufacturing facilities to be relatively close to wind farm developments and to have access to good quality transportation routes that can accommodate the products. More importantly, there must be several wind farm developments over the long term that are within reasonable access to the large component supply chain, so that it can remain competitive in the marketplace once the initial wind farm development is complete. As tier 1 suppliers set up operations to supply the large sized components, opportunities for sub-component and sub-assembly supply will spur the development of the sub-tier levels. The presence of nacelle assemblers in particular, provide an added opportunity for the lower tier levels of the supply chain due to the variety and quantity of sub-components required to complete their assembly.

A second immediate and significant opportunity for the supply chain in Canada comes from the need for engineering procurement and construction services, logistics, craning, transformers, and geotechnical and site preparation services at the wind farms.

Gears and generators also offer a good supply opportunity for Canadian manufacturers. The technology and manufacturing standards can be easily transferred from experience in applications other than wind turbines. Canadian industry does have a significant number of companies with suitable capabilities and manufacturing capacity, so the level of competition within the supply chain will be high.

Components that are longest lead time in the wind turbine assembly are the gear boxes, castings for rotor hubs and main frames, forgings for main shafts, and large bearings, due to limited global capacity. The gear boxes and bearings in particular, are tied together because the long lead components for the gearboxes are the bearings. These components offer an opportunity to a limited group of manufacturers because they are considered critical components in the wind turbine and have very high quality standards that must be adhered to. Generally, the turbine OEMs are unwilling to make substitutions and rely on a very small group of suppliers to provide these components.

Once the capital work to develop a wind farm is complete, the wind farm is in operation and the warranty period for the turbines expires – typically two years after commissioning – there remains a substantive opportunity for the formation of an operations and maintenance service industry to support the wind farms. Based on Wind Vision 2025, CME estimates there is a $ 3 billion direct opportunity for operations and maintenance services over the life of the upcoming generation of Canada's wind developments.

6.0 Recommended Actions to Encourage a Globally Competitive Canadian Wind Supply Industry

A coordinated strategy to ensure the development to a focused and unified national wind energy supply chain is crucial. There is a need for key local, regional and national stakeholders in the wind energy supply chain to coordinate their efforts with a common purpose of ensuring a strong, globally competitive Canadian industry while balancing the need for healthy regional competitiveness while the industry matures.

It will require concerted efforts on the part of wind farm developers, turbine OEMs, industry associations, economic development agencies and federal and provincial governments to maximise the wind power market's economic benefit for manufacturers and service providers arising from the growth of the wind power industry in Canada. To that end, CanWEA and CME have formed a strategic partnership to share information, promote the opportunities in the wind development industry and coordinate efforts more effectively to the benefit of Canadian manufacturers.

An important first step in the development of a national wind industry strategy is to bring together the key jurisdictions and stakeholders and establish a framework for communication and coordination of supply chain development activities and develop a unified national strategy for the wind industry.

CanWEA and CME have identified 4 additional types of interrelated initiatives that should be pursued to maximize business benefits in Canada and to develop a strong wind energy supply chain that can be competitive within Canada, in the US and around the world.

A. Communication

CanWEA and other stakeholders have begun to raise awareness of the opportunities in the wind power industry across Canada to business. These efforts should continue and be expanded to further research, characterize and communicate to the potential supply chain about:

- The details of wind power generation markets that are developing in Canada;
- Timing of wind farm developments
- Local and regional economic benefits of an operating wind farm – both during construction and operations;
- Detailed information regarding the supply opportunities for manufacturers and service providers in the wind industry;
- Long-term operations and maintenance opportunities;
- Quality, business operations and technical requirements to supply OEM's; and
- How and where to direct marketing and business development activities.

B. Partnership Facilitation

A number of stakeholders have undertaken activities to facilitate one-on-one communications around potential business partnerships between turbine OEMs and the potential supply chain across Canada. These activities, undertaken by all levels of government as well as industry associations, should be strengthened by:

- Increased communication and coordination of such activities among different stakeholders
- Actively engaging wind farm developers and wind turbine OEM's to identify specific outsourcing and partnership opportunities in Canada;
- Retaining the services of consultants or agents to directly connect qualified suppliers with partnership opportunities;

- Study and develop a national online portal for the supply chain to market their capabilities and experience to the wind farm developers and OEM's, that includes a certification process that helps to identify the best qualified suppliers; and
- Organization of mini supply chain clusters by regional government stakeholders, that will demonstrate capabilities and strengths, and connect them with the wind farm developers and OEM's through trade missions, plant tours and trade shows that focus on specific wind farm developments.

C. Capability Development

Partnership facilitation activities should be reinforced by workshops, programs and services aimed at enhancing the operations management and technical capacity of companies across Canada to enable them to take maximum advantage of partnership opportunities. Among the Canadian supply chain, there is a need to build and improve upon:

- Strategic planning – the incorporation of the wind industry as a strategic business priority;
- Development of marketing and business development strategies to reach out to the wind industry;
- Understanding the technical and reliability challenges of the wind power developments and translating them into innovative product and service solutions to resolve them; and
- Product development and tooling requirements to meet the demand for small to medium volumes of medium to large scale products.

D. Policy

A priority should be placed on accelerating the development of a Canadian supply chain for the wind power industry to ensure maximum economic benefit for Canadian business. Special consideration should be given to policy development activities that will help advance the development of a Canadian supply chain given the advanced state of the US wind industry. Policy initiatives that will help the development of Canadian supply chain while ensuring a competitive marketplace include:

- Development of a Canadian wind industry brand to be marketed globally, that demonstrates a strong commitment to the industry from both the public and private sectors;
- Establishment of regional zones where clusters of wind turbine supply chain members can set up business operations and also include centres of excellence for the development and demonstration of innovation and new technologies in the Canadian wind industry;
- Development of an attraction strategy to encourage wind turbine OEM's and major Tier 1 suppliers such as nacelle assemblers to set up operations in Canada;
- Offering tax incentives on research and development capital for wind capability development in the supply chain;
- Development of partnerships between colleges and universities and wind turbine OEM's to research and develop new technologies for next generation wind turbines;
- Development of curriculum at colleges and universities to support the technical and skills requirements of the wind industry;
- Standardizing and streamlining the permitting and approvals process to maximize the efficiency of regulatory approval for new wind farm developments;
- Removing internal regulatory barriers to interprovincial trade in products and services; and
- Removing constraints on interprovincial transportation infrastructure and logistics services.

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