Economic Development Alliance of Southeast Alberta

Opportunity Identification Based On Wind Energy Development

Report

The Economic Development Alliance of Southeast Alberta (EDA) is interested in helping to build on the region's anticipated success associated with plans for local wind farm development, by ensuring that local companies benefit directly from the construction of transmission lines and wind turbines. Specifically, through the identification of job requirements and construction components to be tendered, the EDA will work with communities and companies to plan for, and to respond to the human resource and procurement requirements of the regional projects.

Background

The average 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 up to $2.8 million USD per installed megawatt of generating capacity, with the wind turbine consisting of up to 70% to 75% of the cost, and engineering, site service and construction making up the balance. About 70% of the total cost of the turbine comes from four main components: the turbine blades, the turbine tower, gearbox, and the pitch and yaw control systems. Canadian wind projects depend almost exclusively on European and American suppliers for turbines and key components. The five largest wind turbine manufacturers are: Denmark's Vestas Wind Systems; Spain's Gamesa; Germany's Enercon; USA's GE Energy; and Germany's Siemens.

The turbines are in excess of 100m tall and are too large to transport to the wind farm and erect in one piece. Instead, they are field installed from manageable sized sub-assemblies 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.

Five organizations that are part of the value chain in the wind energy development projects in southeast Alberta were interviewed:

1. **ALTALINK** (transmission provider)
   AltaLink is a fully independent transmission company. It is responsible for 11,800 km of transmission lines and 270 substations. AltaLink owns more than half the transmission in Alberta and serves 85% of the population. AltaLink is currently owned by SNC-Lavalin (76.92%) and Macquarie Essential Assets Partnership. This is changing as SNC-Lavalin is in the process of acquiring the remaining interest.

2. **SNC-LAVALIN** (engineering, procurement and construction)
   SNC-Lavalin is a leader in project management and global engineering, procurement and construction. The company has offices across Canada and in over 35 other countries around the world, and is currently working in some 100 countries. SNC-Lavalin is involved in the engineering and construction of transmission lines and provides operations and maintenance services. SNC-Lavalin holds 76.92% ownership in AltaLink and is in the process of acquiring the remaining interest.

3. **RENOVALIA** (Wind Farm Developer)

Renovalia Energy is a Madrid-based company that produces electric power by means of renewable energy sources (wind, solar, photovoltaic, solar thermoelectric and mini-hydraulic). The company is present in eight countries: USA, Canada, Mexico, Italy, Romania, Hungary, Turkey and Spain. Renovalia Energy is one of the leading companies in the sector in Spain and owns and operates ten wind farms, four solar photovoltaic plants, a mini-hydraulic power plant and a thermo-solar plant. The company provides technical, consultancy, construction and maintenance services through its engineering division.

The Peace Butte wind development project, located 22 km south of Medicine Hat, is Renovalia's first in Canada and forms part of the company's international expansion strategy.

4. **NATURENER** (Wind Farm Developer)

NaturEner Renewable Energy develops, owns and operates wind energy farms. Since 1999, NaturEner has developed fourteen wind farms in Spain and with the acquisition of Great Plains Wind & Energy, Energy Logics and West WindEau, the company is now developing more than 1,000 MW of wind power in the United States and Canada.

NaturEner has two projects in southeast Alberta: Wild Rose 1 and Wild Rose 2.

- Wild Rose 1 is located 45 km southeast of Medicine Hat and 20 km south of Irvine. The project is located on the north and south sides of Highway 515 north of the Cypress Hills Park. The project study area contains 12,500 acres of private agricultural and grazing lands while the actual land area occupied by the project facilities including turbine sites, new access roads, transformer station site and the collector lines will be about 50 acres.
- Wild Rose 2 is located 30 km south of Medicine Hat in the vicinity of intersection of the Eagle Butte Road and Township Road 100. The project study area contains 28,500 acres of privately owned agricultural land, including 30 local landowners. The actual land area occupied by the project facilities will be 50 to 100 acres.

5. **IWEA - International Wind Energy Academy (Lethbridge College)**

The vision of the International Wind Energy Academy (IWEA) at Lethbridge College is to build capacity of individuals, communities, organizations and institutions to take advantage of the emerging opportunities associated with the development and operation of large and small wind and solar energy projects. IWEA offers a Wind Turbine Technician Training Program, which is a dual-stream program that allows graduates the choice of working in the wind turbine industry and/or continuing on to complete their journeyman electrician certification with inter-provincial Red Seal certification.

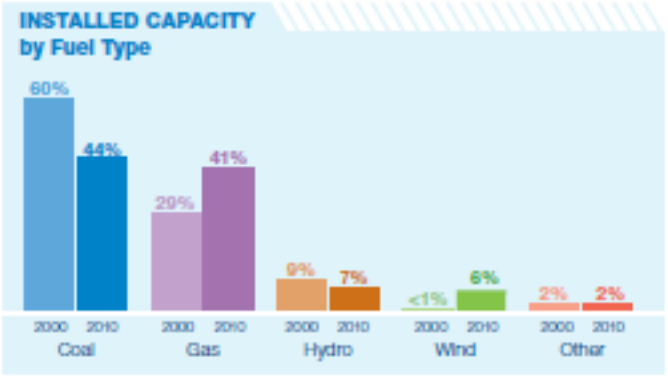
The 32-week certificate program combines technical training with hands-on lab practice on training turbines, teaching students to diagnose and maintain both mechanical and electrical wind turbine equipment. The program has partnered with BZEE, provider of the European training standard for wind turbine technicians, and recognized by most major wind turbine manufacturers in Europe and North America. The program takes in 16 students (each) in September, January and May and costs just over $7,700. Upon completion, students will have an understanding of wind turbine electrical, mechanical and hydraulic systems. They will also be able to inspect and repair blades. Graduates who successfully complete the BZEE qualification examinations receive temporary BZEE certification.

To date, IWEA has graduated 20 cohorts of 16 students each, with 75 percent of these being employed. Many students complete the program but are not interested in pursuing employment opportunities in the wind energy industry. IWEA administrators are aware of all wind energy developments in the province and have key contacts in each company in order to match graduates to potential employment opportunities.

Alberta Power Sources, Infrastructure and Players

There are various **generation sources of power**:

- **Natural gas-fired generation** – Air is compressed and then heated by burning natural gas. The hot air speeds the turbine, which causes a generator to turn and create electricity.
- **Coal-fired generation** – Coal is burned in furnaces to heat water which when boiling creates steam that travels through pipes into a turbine. When the turbine spins the generator, it creates electricity.
- **Wind power** – When the wind blows, turbine blades spin which turns a shaft attached to the blades. As the shaft turns, it spins a generator and makes electricity.
- **Hydroelectric power** – The force of falling water that dams create or that is caused by rushing river water is pushed against turbine blades that spin the turbine. The turbine causes the generator to spin and produce electricity.
- **Solar power** – Solar cells in panels collect sunlight during the daylight hours and convert it into electricity.
- **Biomass power** – Fuels from animal manure, plants, garbage and landfill fumes are used to boil water and create steam. The pressure from the steam spins a turbine attached to a generator and creates electricity.



While coal has long been Alberta's primary electricity source, electricity generated from natural gas and wind power is increasing. This can be attributed to both aging coal-fired generation plants retiring and new, diverse sources of power coming online.

Source: Alberta Electric System Operator. "Powering Albertans". Volume 5, Issue 1.

Alberta Existing Generation Capacity

Alberta Generating Capacity [MW]		
Coal	6,119	48%
Gas	4,903	38%
Hydro	900	7%
Wind	777	6%
Biomass	178	
Fuel Oil	8	
Subtotal	***12,885***	

Source: John Grove. AltaLink. "2011 Lethbridge Ag Expo Presentation". March, 2011

The **electricity infrastructure** consists of many components:

- **Power Generation** (coal, gas, hydro, wind, etc.) – Power is generated and turned into electricity.
- **Transmission Substation** – A set of large transformers increases the voltage of power coming from the generating plant for a long journey through the transmission grid to customers.
- **Transmission Line** – Transmission is the backbone of the electrical system, moving power from where it is generated to where it is needed in homes, farms, businesses and industries.
- **Intertie** – Connections with neighboring electric systems allow power to move in or out of the province, enabling a stable and reliable supply of electricity.
- **Distribution Substation** – Power lines enter a substation where a transformer reduces voltage to a level that can be safely carried on the lines that deliver electricity to homes, farms and businesses.
- **Distribution Line** – Low voltage power lines are best for transporting electricity over short distances. These distribution lines carry electricity from a substation to homes, farms, and businesses.
- **Power Meter** – Power meters measure the amount of electricity delivered to a home, farm or business.

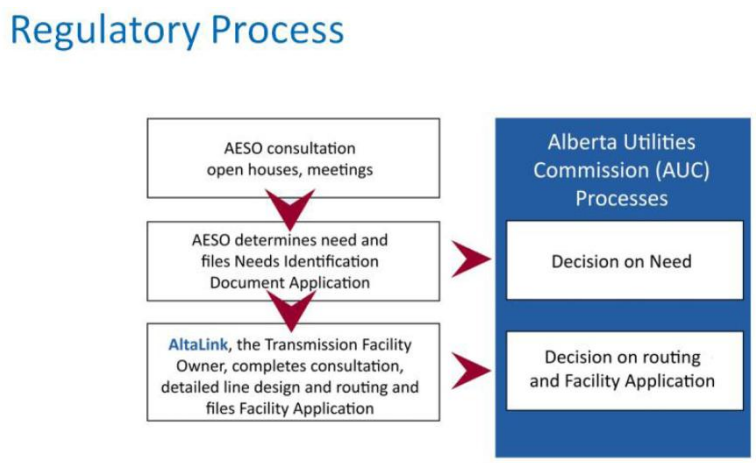
The various components of the infrastructure require the presence of **key stakeholders**:

- ***Alberta Utilities Commission (AUC)*** - The AUC is an independent agency responsible for ensuring that the delivery of Alberta's utility service takes place in a manner that is fair, responsible and in the public interest.

- ***Alberta Electric System Operator (AESO)*** - AESO is an independent, not-for-profit organization that develops and operates Alberta's real-time wholesale energy market to facilitate fair, efficient and open competition. AESO also plans and develops the transmission system to ensure continued reliability and facilitates the competitive market and investment in new supply. AESO provides transmission system access for both generation and load customers. In sum, AESO operates the provincial transmission system, ensuring safe and reliable electricity for Albertans. AESO does not own or operate any power facilities. It just plans, develops and manages the power system.

- ***AltaLink*** - AltaLink is a regulated utility, which owns, operates and maintains and constructs electrical transmission facilities. AltaLink invests in new transmission lines and substations to replace aging infrastructure and to connect new sources of electricity to consumers. A challenge that AltaLink faces is that the existing 240 kV system is on average 38 years old. The system needs to be reinforced in order to ensure it is running at North American reliability standards.

These three stakeholders work together to ensure that Alberta's power needs can be met and that infrastructure can keep pace with growing demand.



Source: John Grove. AltaLink. "2011 Lethbridge Ag Expo Presentation". March, 2011

Wind Related Activity in Southeast Alberta

Both on the transmission and generation side, there is wind related development activity in southern Alberta and in particular southeast Alberta. AESO needs to integrate incremental 2,700 MW of wind generation from southern Alberta. Forty-one projects have applied for 5,383 MW. There is also a gas project for 175 MW and 1 coal project for 1,050 MW in two phases.

On the transmission side, the following projects have been identified and needs identification documents (NIDs) have been detailed by AESO for the south:

	Central	Calgary	South	Total
System Projects	4	7	5	16
Connection Projects				
- Generation Wind	14	0	41	55
- Generation Other	2 [1]	3	2	7
- Load	15	21	3	39
TOTAL Projects	35	31	51	117
NIDs 2010	9	6	9	24
NIDs 2011	13	9	18	40

Notes:

1. Includes 255 MW of generation in the Cold Lake Area

On the wind development side, the following projects are known of in southeast Alberta:

PROJECT	Installed Capacity	Annual Production	Number of Turbines	Number of Substations	Number of Acres involved	Timeframe
Peace Butte (Renovalia) (22 km south of Medicine Hat) – transmission lines are not an issue.	120 MW	380,000 MW/hr	60 (2 MW turbines)	1	9,000 under lease	Foundation Summer 2011; Turbines 2012
Wild Rose 1 (NaturEner) (45 km southeast of Medicine Hat and 20 km south of Irvine) – dependent on East Palliser Transmission Line	204 MW	750,000 MW/hr	136 (1.5 MW turbines)	1	15,000	Foundation Summer 2012; Turbines 2013
Wild Rose 2 (NaturEner) (located 30 km south of Medicine Hat)	162 MW	675,000 MW/hr	108 (1.5 MW turbines)	1	29,000	Foundation 2013; Turbines 2014
Wild Steer Butte (Shell Energy) – Near Bow Island	775 MW	TBD	250 turbines	3	TBD	TBD
TOTAL	1,261 MW	1,805,000 MW/hr*	554 turbines	6	53,000*	

* Not including Wild Steer Butte, which is to be determined.

Local Opportunities Associated with Transmission

Based on research and interviews, the following chart details the Regulatory Process and the challenges that stakeholders may face at each level, the impact (if any) at the local level and possible role for the EDA of Southeast Alberta.

Steps in the Regulatory Process	Challenges for Stakeholders	Impact at Local Level	Potential Role for EDA
AESO identifies need for transmission development	AESO has to plan by load forecasting, developing scenarios for size, type, timing and location of future generator additions, ensuring reliability and operating standards are met and ensuring a long-term transmission system plan. Scenarios are assessed based on social/landowner concerns, environmental, land use, technical performance including reliability and future flexibility and cost. The demand for power has increased by 31 percent since 2000. Peak demand growth is forecasted to average 3.2 percent for the period 2010 to 2029. Currently, there is 12,885 MW generating capacity. The forecast is to increase by additional 11,500 MW by 2030. 2,000 MW of existing capacity will be retired in the next 20 years.	AESO has identified the need to reinforce the transmission system in southern Alberta. AESO also identified the need to integrate 2,700 MW of wind generation in southern Alberta and meet growing demand in outlying communities. Also, there are south area system projects to meet demand, replace aging infrastructure and improve system reliability.	Support. Understand the need for transmission and be able to answer questions from within the region.
AESO submits a Needs Identification Document to AUC	AESO submits a Needs Identification Document to the Alberta Utilities Commission (AUC) which includes a recommendation for transmission reinforcement in the area.	Nearly 800 MW of wind power is currently connected to the provincial grid and the AESO has received 45 requests to interconnect approximately 7,000 MW more, mainly in southern and central Alberta. Right now, Alberta's grid is too congested to fully accommodate these additional	None.

Steps in the Regulatory Process	Challenges for Stakeholders	Impact at Local Level	Potential Role for EDA
		connection requests so transmission system reinforcements are needed to meet the challenge.	
AUC makes a decision on need			
Transmission Facility Owner (AltaLink) submits a Facilities Application	The Transmission Facility Owner (AltaLink) has to provide detailed routing and specific siting, detailed engineering, complete a separate consultation process and submit to the AUC a Facilities Application which includes a specific route proposal. AltaLink identifies a preferred and alternate route for transmission lines and substations with the lowest overall impact on landowners and communities. Seven aspects that need to be taken into consideration: - Areas with high residential densities - Agricultural impacts - Environmental areas - Costs - Visual impact and areas of cultural significance - Existing infrastructure such as oil and gas facilities, airports, telecommunications sites - Sites to follow such as highways, railways, existing transmission lines, quarter lines or section lines.	Many aspects need to be considered in selecting a route. Public has the opportunity to be involved in planning.	Support. Understand the routing criteria and be able to answer questions in the region.
Public Consultation Process	During the consultation process, open houses are held, and newspaper and radio ads are used to inform the public.	Communities have an opportunity to learn more about the project.	EDA can facilitate the exchange of information about process, benefits, etc.

Steps in the Regulatory Process	Challenges for Stakeholders	Impact at Local Level	Potential Role for EDA
	Government representatives (municipal and provincial), area First Nations and Industry stakeholders are consulted. Process can take 1 to 3 years.		
AUC makes a decision on routing and Facility Application	Based on the AUC review of the Facility Application and the level of public concern a Public Hearing may take place. The AUC has three options which are to: 1. approve the application 2. approve the application with amendments 3. disapprove the application		
Transmission Lines are built, reinforced, etc.	AltaLink hires an Engineering, Procurement, and Construction (EPC) company, often SNC Lavalin. The EPC company will sub-contract the work through the RFP process, whereby experts are utilized along with local labour and materials where it is cost-effective.	Some interviewees estimate that 15 to 20 percent of the labour needs will be local, while 80 to 85 percent will consist of specialized labour sourced elsewhere, but imported in temporarily. EPC firms may require the following locally: - Excavation and earthmoving - Concrete making, concrete, gravel - Truck drivers - Water haulers - Road builders - Heavy Equipment Operators Any expert labour that is imported into the area will require lodging and food.	Facilitate the matching of local companies and contractors with the EPC firms' needs at the bid stage. EPC companies typically have 4 to 6 weeks to cost out project and assemble bids. EDA's role in matching local/regional supply of labour and materials to project needs is important. Keep track of the economic impact associated with building transmission lines. Gather data for case study which can be used at the end of project to prove economic impact.

Local Opportunities Associated with Wind Farm Development

Based on research and interviews, the following chart details the steps in planning and building a wind farm and the challenges that developers may face at each step, the impact (if any) at the local level and possible role for the EDA of Southeast Alberta.

Steps in Planning and Building a Wind Farm	Challenges for Wind Farm Developers	Impact at Local Level	Potential Role for EDA
Municipal Consultations	Wind Farm Developers have to engage municipalities in the planning process and talk to people that may be impacted directly or indirectly. They must keep an open dialogue throughout the process. Private investors decide where and when to build a new power generation plant and bear all the associated costs and risks.	**Opportunity is present.** The naturally remote locations of wind farms result in an added benefit to rural municipalities and land owners in the form of local tax revenue, land lease income for private landowners, and employment opportunities to areas that have traditionally faced economic challenges. Community is engaged early on in the process.	Educate community about the process, the potential investment and the potential economic impact.
Wind Assessment	Developers have to assess the wind resources and identify how much energy the wind farm will produce. Assessments are costly and can be between $50,000 to $150,000 (as quoted during interview).	**Opportunity is present.** Early in the process, developers usually approach landowners to negotiate "option" agreements to use their land.	Be available to answer general process questions that land owners may have.
Wind Farm Design	Wind data is combined with topographical information to design the wind farm. Engineers use the data to model wind flow, turbine performance, sound levels and other parameters to optimize the location of the wind turbines. They also design access roads, turbine foundations and the local electric network, as well as connection to the electricity grid. Developers will need to identify the turbine	**None.** Wind Farm Developers have experts that they will use for the studies and therefore may not rely on local expertise or labour.	Work with the municipality to understand potential impact on roads and other local infrastructure.

Steps in Planning and Building a Wind Farm	Challenges for Wind Farm Developers	Impact at Local Level	Potential Role for EDA
	that will be used in order to identify performance levels, etc. Wind Farm Developer may have to enter into a supply agreement and place some monies as a down payment/deposit. All design studies require an investment of funds.		
Environmental Study	Environmental assessments are conducted to identify any impacts on landscape, plants and wildlife, soil and water, land use or other activities such as aviation or telecommunications. If negative impacts are identified, the wind farm design is adjusted to avoid or mitigate them. This can be a lengthy and costly process.	**Education Opportunity** - Land owners are involved in and interested in identifying potential impacts.	Stay informed and help others to be informed.
Land Acquisition	As the project progresses, the developer will seek to convert the options into firm land lease agreements.	**Financial Opportunities** - Landowners lease their land to energy companies who build and run the farm. Landowners have the opportunity to earn money without having to expend a lot of time, energy or capital themselves. Royalties generally pay in the thousands of dollars annually for each turbine, providing a great source of income for landowners.	Keep track of the economic impact associated with the land acquisition and the location of the turbines. Gather data for case study which can be used at the end of project to prove economic impact.

Steps in Planning and Building a Wind Farm	Challenges for Wind Farm Developers	Impact at Local Level	Potential Role for EDA
		Wind farms provide a new tax revenue stream for local municipalities (which can be used for community centers, roads, park maintenance, and other local infrastructure).	
Permitting and Public Consultation	As with any other power project, developers must seek municipal, provincial, and federal permits before the project can go ahead. They also meet the local communities to present the project, solicit their feedback and seek community support.	**Education Opportunity** - Communities have an opportunity to learn more about the project.	EDA can facilitate the exchange of information about process, benefits, etc.
Economic and Financial Analysis	Developers must demonstrate the economic viability of their project to raise the funds to build the wind farm. On the one hand, they work to estimate the cost of turbines and their installation, as well as roads, electrical system, operation and maintenance, etc. On the other hand, they estimate the income they will get from the energy production of the wind farm over the lifetime of the project.	**None**. Typically experts that the company is familiar with conduct the studies.	
Manufacturing	The wind turbine parts are manufactured and pre-assembled into the main components at the factory, then shipped to the wind farm site where the final assembly will take place.	**Logistics.** Typically, the wind turbine components come from United States or Europe. Therefore, there may be local opportunities for logistics (transporting the components within regional boundaries).	Facilitate the matching of logistics companies (trucking, etc.) with the Wind Farm Developers' needs for transportation.

Steps in Planning and Building a Wind Farm	Challenges for Wind Farm Developers	Impact at Local Level	Potential Role for EDA
Site Preparation	Wind Farm Developers utilize Engineering, Procurement and Construction (EPC) firms to bid on the project. Wind Farm Developers issue Request for Proposals for the project. EPC firms bid on the project and use their own experts combined with some local capacity. Crews prepare the site. They build access roads and clear the areas where turbines are erected. They then prepare the foundations; do the excavating, followed by installing the formworks and pouring concrete. Weather can be a challenge. Typically site preparation is completed in the summer.	**Site Preparation.** EPC firms may require the following locally: - Excavation and earthmoving - Concrete making, concrete, gravel - Truck drivers - Water haulers - Road builders - Heavy Equipment Operators - Millwrights Any expert labour that is imported into the area will require lodging and food. Once site preparation is complete and the components have been delivered, access road repairs, etc. take place that local labour and materials can be used for.	Facilitate the matching of local companies and contractors with the EPC firms' needs at the bid stage. EPC companies typically have 4 to 6 weeks to cost out project and assemble bids. EDA's role in matching local/regional supply of labour and materials to project needs is important. Keep track of the economic impact associated with site preparation. Gather data for case study which can be used at the end of project to prove economic impact.
Construction	Once all components have been received, the assembly can take place. A crane is used to erect the tower and install the nacelle and rotor with its hub and blades. On the ground the electrical collection network is installed and connected to the grid through the substation. Weather can be a challenge. Typically construction can be completed in the spring.	**Construction.** EPC firms may require the following locally: - Cranes and Crane operators - Helicopter	Keep track of the economic impact associated with construction. Gather data for case study which can be used at the end of project to prove economic impact.

Steps in Planning and Building a Wind Farm	Challenges for Wind Farm Developers	Impact at Local Level	Potential Role for EDA
Commissioning	Finally, the wind farm is tested before becoming fully operational.		Develop case study showing economic impact of project.
Operation and Maintenance	Regular activities include: - Monitoring and analyzing performance - Conducting environmental surveys - Performing preventative maintenance and repairs to the turbines and other components. Much of the equipment can be remotely accessed from the Head Office for monitoring purposes.	**Operation.** On an ongoing basis, depending on the size of the wind farm, there may be a need for a wind technician or a field manager. According to Lethbridge College typically, one operations/ maintenance person is required for every 10 MW installed capacity. However, the minimum number of technicians on site is two as they never work alone.	

Economic Impact to Southeast Alberta

The economic impact of the wind-related activity is significant to the area. On the transmission side, a study of economic impacts has not been developed. However, some interviewees estimate that 15 to 20 percent of the labour needs will be local, while 80 to 85 percent will consist of specialized labour sourced elsewhere, but imported in temporarily.

On the wind farm development side, in 2006, the Canadian Tourism Research Alliance (CTRI) was contracted by the Economic Development Alliance of Southeast Alberta (EDA) to assess the potential economic impact of the construction and operation of wind farms in southeast Alberta. This study, *Economic Impact Analysis of Proposed Wind Development Projects in Southeast Alberta – CTRI,* concluded:

Economic Impact Generated By Capital Costs of Wind Farms	Based on 1,650 MW	Per MW
Increased direct employment	1,757 FTE jobs for local residents	1.06 FTE jobs for local residents
Including indirect and induced effects	4,950 FTE jobs for local residents	3 FTE jobs for local residents
Payroll	$302.0 million	$183,030
Municipal taxes and charges	$16.5 million	$10,000
Gross domestic (regional) product	$526.7 million	$319,212

Economic Impact Generated By Annual Operating and Maintenance Costs of Wind Farms	Based on 1,650 MW (Annual)	Per MW (Annual)
Increased direct employment	132 full year jobs for local residents	0.08 full year jobs for local residents (or 1 for 10 MW as quoted by IWEA)
Including indirect and induced effects	518 full year jobs for local residents	0.314 full year jobs for local residents
Payroll	$35.5 million	$21,515
Municipal taxes and charges	$10.8 million	$6,545
Lease payments to land owners	$7.9 million	$4,788
Gross domestic (regional) product	$69.9 million	$42,364

The 2006 study was based on a projected total of 1,650 MW being introduced in the area. In order to calculate the economic impact of the more recent anticipated projects totaling 1,261 MW, the per MW impact is outlined in the right hand column of the two tables above. These per MW statistics are used to estimate the total economic impact of the 1,261 MW anticipated in the region.

Therefore, based on these statistics, the economic impact of the projects in southeast Alberta is projected to be:

PROJECT	Installed Capacity	Timeframe	Employment	Payroll	Taxes and Charges	Gross Domestic Product
Peace Butte (Renovalia) (22 km south of Medicine Hat) – transmission lines are not an issue.	120 MW	Foundation Summer 2011; Turbines 2012	Direct Employment from development and construction of wind farms: 128 Employment including indirect and induced effects from development and construction of wind farms: 360 Direct Employment from annual operating and maintenance of wind farms: 10 Employment including indirect and induced effects from operating and maintenance of wind farms: 38	Payroll from development and construction of wind farms: $22 million Payroll from operating and maintenance of wind farms: $2.6 million	Municipal taxes and charges from development and construction of wind farms: $1.2M Municipal taxes and charges from operating and maintenance of wind farms: $785,400 Lease payments to land owners per year: $574,560	Gross Domestic (regional) product from the development and construction of wind farms:$38.3 M Gross Domestic (regional) product from the operation and maintenance of wind farms: $5.1M

PROJECT	Installed Capacity	Timeframe	Employment	Payroll	Taxes and Charges	Gross Domestic Product
Wild Rose 1 (NaturEner) (45 km southeast of Medicine Hat and 20 km south of Irvine) – dependent on East Palliser Transmission Line	204 MW	Foundation Summer 2012; Turbines 2013	Direct Employment from development and construction of wind farms: 217 Employment including indirect and induced effects from development and construction of wind farms: 612 Direct Employment from annual operating and maintenance of wind farms:16 Employment including indirect and induced effects from operating and maintenance of wind farms: 64	Payroll from development and construction of wind farms: $37.3 M Payroll from operating and maintenance of wind farms: $4.4 M	Municipal taxes and charges from development and construction of wind farms: $2.0 M Municipal taxes and charges from operating and maintenance of wind farms: $1.3 M Lease payments to land owners per year: $976,752	Gross Domestic (regional) product from the development and construction of wind farms: $65.1M Gross Domestic (regional) product from the operation and maintenance of wind farms: $8.6 M

PROJECT	Installed Capacity	Timeframe	Employment	Payroll	Taxes and Charges	Gross Domestic Product
Wild Rose 2 (NaturEner) (located 30 km south of Medicine Hat)	162 MW	Foundation 2013; Turbines 2014	Direct Employment from development and construction of wind farms: 172 Employment including indirect and induced effects from development and construction of wind farms: 486 Direct Employment from annual operating and maintenance of wind farms: 13 Employment including indirect and induced effects from operating and maintenance of wind farms: 51	Payroll from development and construction of wind farms: $29.7M Payroll from operating and maintenance of wind farms: $3.5M	Municipal taxes and charges from development and construction of wind farms: $1.6M Municipal taxes and charges from operating and maintenance of wind farms:$1.1M Lease payments to land owners per year: $775,656	Gross Domestic (regional) product from the development and construction of wind farms:$51.7M Gross Domestic (regional) product from the operation and maintenance of wind farms: $6.9M

PROJECT	Installed Capacity	Timeframe	Employment	Payroll	Taxes and Charges	Gross Domestic Product
Wild Steer Butte (Shell Energy) – Near Bow Island	775 MW		Direct Employment from development and construction of wind farms: 825 Employment including indirect and induced effects from development and construction of wind farms: 2,325 Direct Employment from annual operating and maintenance of wind farms: 62 Employment including indirect and induced effects from operating and maintenance of wind farms: 243	Payroll from development and construction of wind farms: $141.8 M Payroll from operating and maintenance of wind farms: $16.7M	Municipal taxes and charges from development and construction of wind farms: $7.8M Municipal taxes and charges from operating and maintenance of wind farms: $5.1M Lease payments to land owners per year: $3.7M	Gross Domestic (regional) product from the development and construction of wind farms: $247.4M Gross Domestic (regional) product from the operation and maintenance of wind farms: $32.8M

Conclusions and Recommendations

Based on the interviews and research, the following conclusions and recommendations are made:

1. The average 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 up to $2.8 million USD per installed megawatt of generating capacity, with the wind turbine consisting of up to 70% to 75% of the cost, and engineering, site service and construction making up the balance. About 70% of the total cost of the turbine comes from four main components: the turbine blades, the turbine tower, gearbox, and the pitch and yaw control systems. Canadian wind projects depend almost exclusively on European and American suppliers for turbines and key components. The five largest wind turbine manufacturers are: Denmark's Vestas Wind Systems; Spain's Gamesa; Germany's Enercon; USA's GE Energy; and Germany's Siemens.

2. The turbines are in excess of 100m tall and are too large to transport to the wind farm and erect in one piece. Instead, they are field installed from manageable sized sub-assemblies 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. Therefore, logistics and on-site assembly is important.

3. Both on the transmission and the wind farm development end, Engineering, Procurement and Construction (EPC) companies as well as companies they sub-contract are utilized throughout the site preparation and construction process. In general, job opportunities in wind energy offer something for every skill set:
    - Project development
    - Turbine technology, testing and certification
    - Construction of wind turbines
    - Production of turbines – blades, turbines, gearboxes
    - Manufacturing of wind turbine components
    - Turbine operation
    - Wind turbine maintenance
    - Wind data manager
    - Wind energy analysis and assessment
    - Manufacturing engineers
    - Quality assurance people
    - Environmental assessment (effect of wind turbines on the environment)
    - Field technicians
    - Legal services required by wind plants
    - Marketing services for commercial and residential wind turbines
    - Site Managers
    - Consultants who conduct all the necessary assessments needed for project approval
    - Right of way planners
    - Power linesmen, power system engineers, power system electricians
    - Telecom engineers
    - Stakeholder engagement managers
    - Transmission line managers
    - Journeyman transmission linesmen

While there are many different job opportunities, many of these are very specialized and EPC companies and sub-contractors will only rely on local labour for non-specialized needs where it makes good business sense. ***Some interviewees estimate that 15 to 20 percent of the labour needs will be local, while 80 to 85 percent will consist of specialized labour sourced elsewhere, but imported in temporarily***. Local opportunities include:

- Project manager
- Yard manager
- Excavation and earthmoving
- Concrete making, concrete, gravel
- Truck drivers
- Water haulers
- Road builders
- Crane pad builders
- Trenchers
- Heavy equipment operators
- Cranes and crane operators
- Wind turbine assembly
- Helicopters

In 2006, The Conference Board of Canada released "Economic Impact Analysis of the Proposed Wind Development Projects in Southeast Alberta". When the statistics presented in this paper are extrapolated to the five projects in southeast Alberta, the employment impact in the region total 1,337 FTE direct employment through development and construction and 101 FTE direct employment through operations and maintenance.

4. Local materials that may be utilized during the site preparation and construction phase include:
   - Gravel
   - Cement
   - Water
   - Rebar/steel

5. The EPC companies release Request for Proposals (RFP) to pre-qualified sub-contracting companies. These pre-qualified sub-contracting companies are not known to the public. Therefore, EDA of Southeast Alberta may be able to play a role in liaising with the EPC companies to ensure these companies are well-versed in local labour and materials available as well as to ensure that local companies are aware of the timing and the need for specific skills and materials. This liaison work would benefit the EPC companies and their potential contractors as well since responding to a RFP for a major wind project entails thousands of hours of work. EDA may be able to make the process easier by helping to match potential needs to the supply in the region. These efforts may result in a directory or database of pre-qualified suppliers and contractors.

6. Once the capital work to develop a wind farm is complete, the wind farm is in operation and the warranty period for the turbine expires (typically two years after commissioning), there is an opportunity for the formation of an operation and maintenance service industry to support the wind farms. This can involve monitoring and analyzing performance as well as conducting environmental surveys and performing preventative maintenance and repairs on turbines. Lethbridge College estimates that for every 10MW of installed capacity, one job in maintenance and operations is required.

   Lethbridge College's International Wind Energy Academy offers a Wind Turbine Technician Training Program. The 32-week certificate program combines technical training with hands-on lab practice on training turbines, teaching students to diagnose and maintain both mechanical and electrical wind turbine equipment. The program has partnered with BZEE,

provider of the European training standard for wind turbine technicians, and recognized by most major wind turbine manufacturers in Europe and North America. Graduates who successfully complete the BZEE qualification examinations receive temporary BZEE certification. The IWEA program is well-established and fills the training niche, therefore, there does not seem to be an opportunity for Medicine Hat College to provide a similar program.

Likewise, on the transmission end, much of the training is on the job or available through NAIT and SAIT.

7. There are many direct benefits as a result of employment and materials procurement. These should be documented in terms of economic impact to the area. The EDA of Southeast Alberta may want to consider the merits of updating "Economic Impact Analysis of the Proposed Wind Development Projects in Southeast Alberta" conducted in November 2006. Additionally, the EDA should consider the merits of working with AltaLink to conduct a similar study on the transmission side (which may be of benefit provincially).

8. Beyond the jobs and materials at the local level, wind related activity brings many benefits to the region:
    - Wind farms provide a new source of tax revenues that can be used for roads, recreations centers and other facilities, which benefit the whole community. For example, according to CANWEA, in Pincher Creek, local wind farms contributed almost $3 million to the municipal district's tax revenues.
    - Wind farm operators pay royalties to local land owners who host wind turbines on their property. These payments are negotiated early in the development stage for a wind project and extend up to 20 years. Royalty rates vary from project to project, but a conservative estimate is that they average $3,000 per MW per year. This provides an additional revenue stream to farmers, ranchers and home owners in rural Alberta.
    - Wind farms attract tourists and have the possibility of providing additional spin off business opportunities.
    - Wind farm workers' (especially if they are imported into the region) use local lodging, transportation, restaurant and other services.
    - Access roads often need to be built which improves ease of use in the region.
    - Wind energy has stronger job creation impacts compared to gas and coal. According to the Global Wind Energy Council in Wind Energy Outlook 2006, an American study that compared the employment impacts associated with the construction and operations and maintenance of similar coal, natural gas and wind powered electricity generation facilities concluded that wind energy the produced the most jobs:

TABLE 5 COMPARATIVE JOB CREATION IMPACTS

Technology	Coal	Gas	Wind
Construction, direct	465	322	866
Construction, indirect and induced	391	271	751
Operations, direct	72	138	152
Operations, indirect and induced	48	231	107

Source: Canadian Wind Energy Association. "Wind Vision 2025. Powering Canada's Future. Backgrounders on Wind Energy".

These benefits provide incentive for the EDA of Southeast Alberta to work with municipalities to consider all the benefits of transmission line and wind farm development. Some interviewees suggested that EDA could:

- Work with municipalities to facilitate a positive business environment, perhaps including some financial incentives for companies developing wind farms.
- Work with municipalities to smooth the permitting and other processes that are within their control (e.g. improvement requirements for roads, etc.)
- Encourage the provincial government to adopt a policy statement for renewable energy so that renewable energy has a prominent place in the market place.

9. Related to the economic impact, even after construction is completed, interviewees suggest that it would be beneficial for the EDA to develop marketing oriented case studies that "prove" the positive impact of wind related activities.