Quality Wind Project

WIND TURBINE GENERATORS

Capturing the Wind

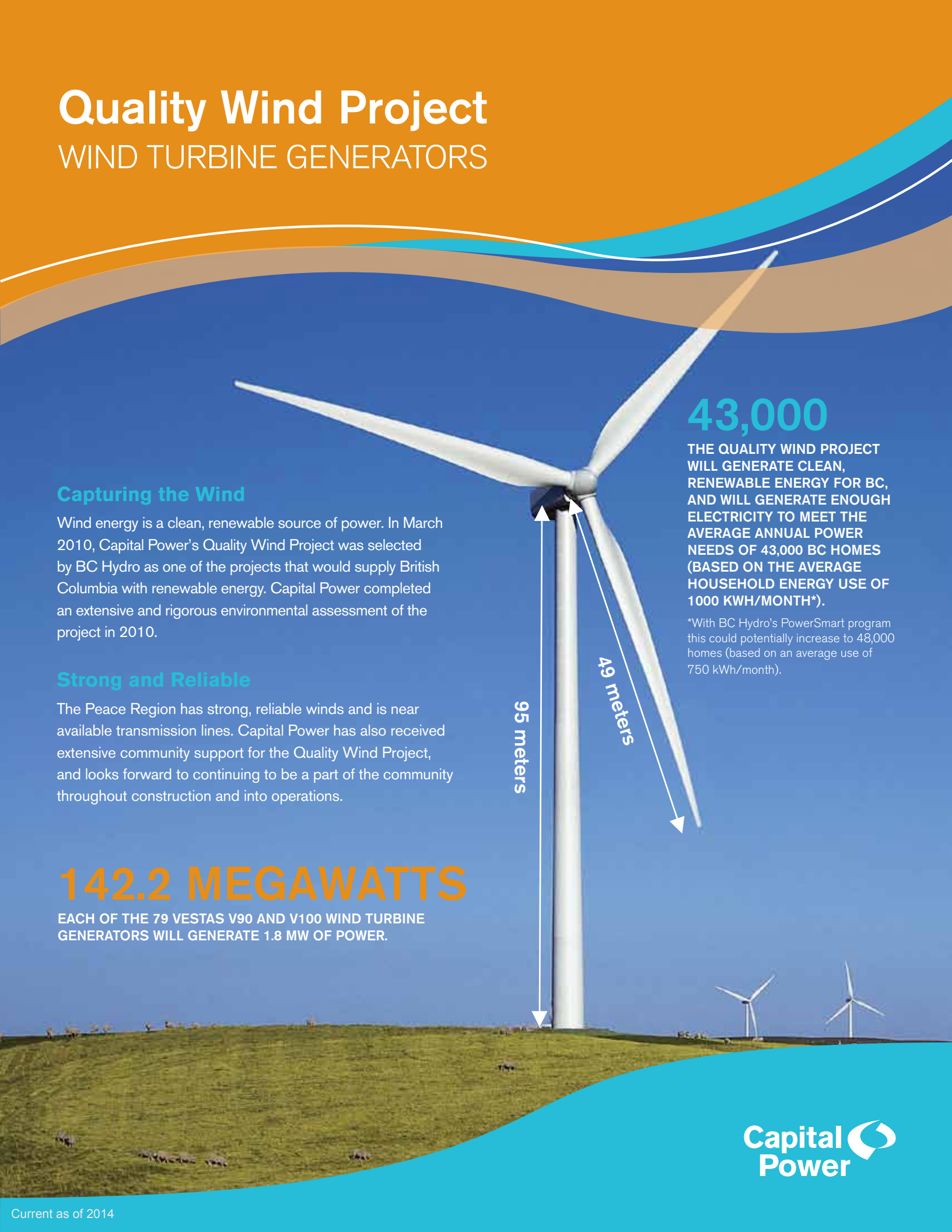
Wind energy is a clean, renewable source of power. In March 2010, Capital Power's Quality Wind Project was selected by BC Hydro as one of the projects that would supply British Columbia with renewable energy. Capital Power completed an extensive and rigorous environmental assessment of the project in 2010.

Strong and Reliable

The Peace Region has strong, reliable winds and is near available transmission lines. Capital Power has also received extensive community support for the Quality Wind Project, and looks forward to continuing to be a part of the community throughout construction and into operations.

142.2 MEGAWATTS

EACH OF THE 79 VESTAS V90 AND V100 WIND TURBINE GENERATORS WILL GENERATE 1.8 MW OF POWER.



43,000

THE QUALITY WIND PROJECT WILL GENERATE CLEAN, RENEWABLE ENERGY FOR BC, AND WILL GENERATE ENOUGH ELECTRICITY TO MEET THE AVERAGE ANNUAL POWER NEEDS OF 43,000 BC HOMES (BASED ON THE AVERAGE HOUSEHOLD ENERGY USE OF 1000 KWH/MONTH*).

*With BC Hydro's PowerSmart program this could potentially increase to 48,000 homes (based on an average use of 750 kWh/month).

Capital Power

Current as of 2014

POWER GENERATION

CAPITAL POWER (CPX: TSX) IS A GROWTH-ORIENTED NORTH AMERICAN POWER PRODUCER HEADQUARTERED IN EDMONTON, ALBERTA. THE COMPANY DEVELOPS, ACQUIRES, OPERATES AND OPTIMIZES POWER GENERATION FROM A VARIETY OF ENERGY SOURCES.

How does wind turn into power?

- Each turbine has a wind sensor located on the top of the nacelle that reads wind speed and direction. As the wind changes direction, each nacelle turns accordingly.
- Three large blades, are used to catch the wind as efficiently as possible. The blades bolted to the hub are called the rotor, which rotates at 14.5 revolutions per minute (RPM). The rotor is connected by a drive shaft to a gearbox that converts the revolution speed for the generator.
- The three-phase generator inside the nacelle produces electricity, which is then converted by a transformer.

60 KM/HOUR

THE OPTIMUM WIND SPEED FOR POWER PRODUCTION OF QUALITY WIND TURBINES.

- Cables transport the power inside the tower and underground to roadside collector lines leading to the project substation, then to the Tumbler Ridge Substation, and finally on to the provincial grid – to help meet the power needs of British Columbians.
- Each tower is connected to a Supervisory Control and Data Acquisition (SCADA) system at a remote operations center, which is fully automated.
- Interestingly, wind turbines components such as the blade pitching system, yaw motor, cooling fans and lights all require electricity to operate. As a result, wind turbines cannot produce power during a local outage or blackout.

NACELLE

THE 10.5 METRE LONG NACELLE – THE MAIN OPERATION CENTER OF THE TURBINE – CONTAINS THE COMPONENTS REQUIRED TO CREATE ENERGY INCLUDING A GENERATOR, GEARBOX, COOLING SYSTEM, ELECTRONICS AND TRANSFORMER. IT WEIGHS APPROXIMATELY 70 METRIC TONNES AND IS COMPARATIVE IN SIZE TO A SCHOOL BUS.

HOW ARE TURBINE LOCATIONS SELECTED? TURBINE PLACEMENT TAKES INTO ACCOUNT:

- Wind patterns
- Environmental features, wildlife, water bodies, woodlots, birds & bats and other elements
- Setback requirements from buildings, roads and inhabited areas
- Noise levels
- Proximity to transmission lines
- Provincial regulation
- Turbine technology

Wind sensor and speeds

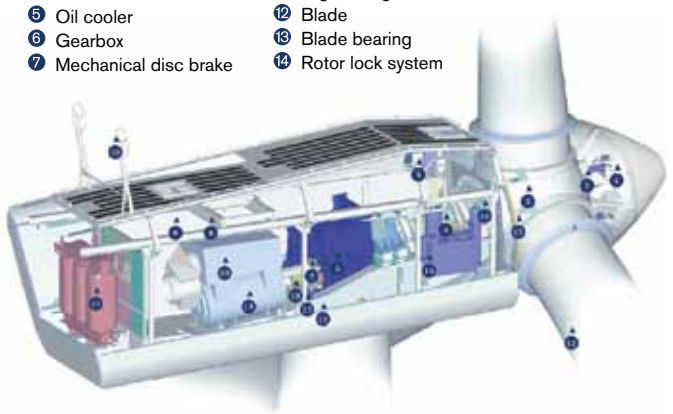
An automatic wind sensor, located on the top of each nacelle, sends wind data (including speed and direction) to the yaw motors. Based on this, the turbine will change its nacelle direction, to capture more wind on calm days, or allow excess winds to pass the blades on exceptionally windy days.

Quality Wind turbines need a minimum wind speed of 11 km/hour to produce power. When winds are 90 km/hour or greater, sensors signal the main computer to shut the turbine down as a safety measure. The optimum wind speed for power production is 60 km/hr.

YAW

TO TWIST OR OSCILLATE ON A VERTICAL AXIS.

1. Hub controller
2. Pitch cylinders
3. Blade hub
4. Main shaft
5. Oil cooler
6. Gearbox
7. Mechanical disc brake
9. Service crane
11. VMP-Top controller with converter
10. Ultrasonic sensors
11. High voltage transformer (6-33 kW)
12. Blade
13. Blade bearing
14. Rotor lock system

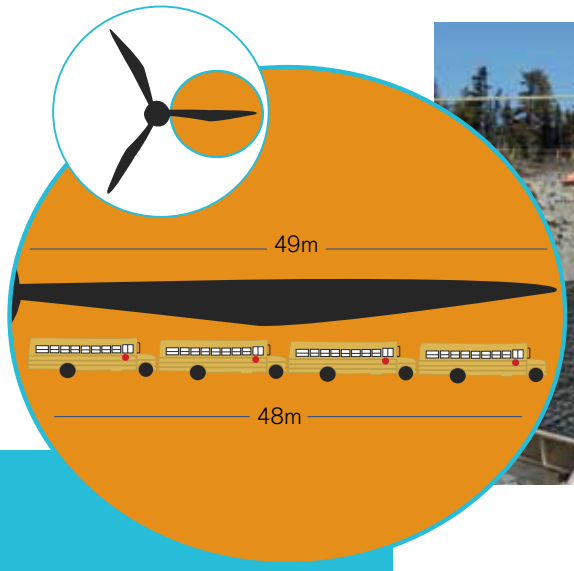


15. Hydraulic unit
16. Machine foundation
17. Yaw gears
18. Composite disk coupling
19. OptiSplip® generator
20. Air cooler for generator

Current as of 2014

44/49m

THE LENGTH OF ONE BLADE IS THE SAME AS APPROXIMATELY 4–48 PASSENGER SCHOOL BUSES



Foundation Construction.

BLADES

THREE 44/49M (V90/100) LONG HOLLOW BLADES, MADE OF A CARBON-REINFORCED FIBREGLASS, ARE CONNECTED TO A CENTRAL HUB ON THE NACELLE. TOGETHER, THE BLADE AND HUB WEIGH ABOUT 42 METRIC TONNES AND HAVE AN 100-METRE DIAMETER. THE AREA SWEPT BY THE BLADES IS 6,362 M^2 AND 7850 M^2 (RESPECTIVELY).

330

LADDER RUNGS TO THE TOP OF A QUALTY WIND TOWER.

Tower Base.

Tower

The nacelle and generator are mounted on top of a high tower to allow the blades to take advantage of the best winds.

Each Quality Wind tower is made up of four separate steel sections bolted together, creating a tower with a combined height of 95 metres and weight of about 210 metric tonnes. The tapered towers have a diameter of four metres at the base and roughly two metres at the top.

An internal steel ladder takes wind farm operators up to the nacelle. Four resting platforms, where each section is bolted together, are inside the tower. A small elevator makes the trip easier, but assembly crews must climb their way to the top.

Stages of Foundation Installation

- Excavation
- Mud mat installation (*to provide a level surface for the rebar)
- Base rebar installation
- Anchor bolt cage installation
- Rebar cage installation
- Pour base concrete
- Pour pedestal concrete
- Backfill

Transportation

For the Quality Wind Project, the equipment will be transported via rail and road from the U.S. manufacturing locations, through Alberta, en route to the project site. Because of logistics associated with the rail transport, some components will be delivered via a specialized transport vehicle known as a “schnabel trailer”.

1+1+3+4=9 HAULS

ONE TURBINE CAN REQUIRE UP TO NINE HAULS: ONE NACELLE, ONE HUB, THREE BLADES AND FOUR TOWER SECTIONS.

Turbine assembly.

ONE-BY-ONE

ONCE THE TURBINE COMPONENTS ARRIVE ON SITE, THE PIECES ARE STACKED ONE-BY-ONE ON THE FOUNDATIONS. SITE MANAGERS AND THEIR TECHNICIANS WORK WITH OPERATORS OF GIANT CRANES TO HOIST THE MASSIVE COMPONENTS INTO POSITION.

Assembly

Throughout the summer, the project's 79 wind turbine generators will be assembled by Eagle West, an experienced crane operator in the Peace Region.

Even though the crane may stretch more than 150m into the air, a skilled operator can lower a tower section to sit perfectly on top of the tower below – like giant LEGO – or they can place a blade gently into the hub.

Technicians will ensure everything is in working order before the turbine is commissioned and sending electricity to the BC grid.

Skilled Eagle West operators delicately position equipment into place.

3,300

CAPITAL POWER OWNS MORE THAN 3,300 MEGAWATTS OF POWER GENERATION CAPACITY AT 16 FACILITIES ACROSS NORTH AMERICA. AN ADDITIONAL 487 MEGAWATTS OF OWNED WIND GENERATION CAPACITY IS UNDER CONSTRUCTION OR IN ADVANCED DEVELOPMENT IN BRITISH COLUMBIA, ALBERTA, AND ONTARIO.

A REAL HEAD-TURNER

SITE VISITORS ARE ENCOURAGED TO REPORT IN AT THE CONSTRUCTION OFFICE (ENTRANCE OFF OF HIGHWAY 52).

EQUIPMENT THIS SIZE ALWAYS DRAWS ATTENTION. IF YOU'RE DRIVING AND WANT TO VIEW THE SITE ACTIVITY, WE ENCOURAGE YOU TO PULL OVER WHEN SAFE TO DO SO (I.E. PAST THE HIGHWAY SECTIONS MARKED FOR CONSTRUCTION ACTIVITIES). ALWAYS BE ATTENTIVE TO ROAD SIGNAGE AND THOSE INVOLVED IN TRAFFIC MANAGEMENT.

www.capitalpower.com/qualitywind

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