HYDRO AND EOLIC PLANTS

ESF II project of the University of West Bohemia in Pilsen, reg. number: CZ.02.2.69/0.0/0.0/18_056/0013239



EUROPEAN UNION
European Structural and Investment Funds
Operational Programme Research,
Development and Education



Evolution of eolic power plants

Milan Bělík

Wind farms on canadian eastern coast

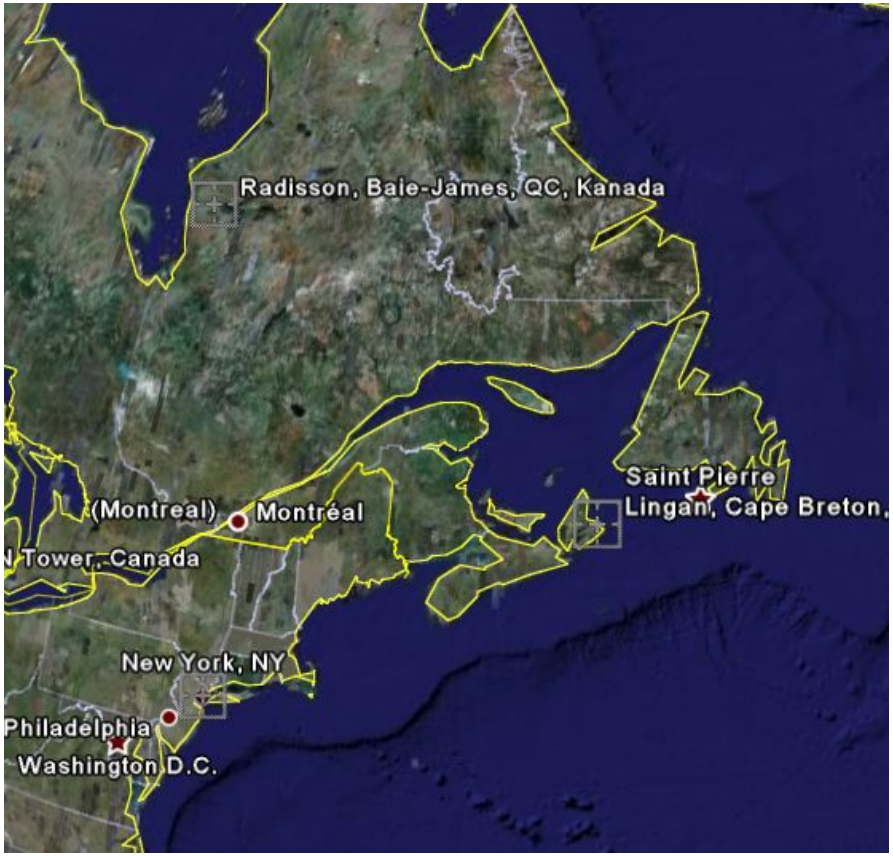
Nova Scotia

- Lingan (North Sydney) 14 MW
- Pubnico Point 30 MW

Quebec

- Mont Miller (Gaspesie) 54 MW
- Cap Chat 57 MW
- EOLE 4,2 MW

Average wind speed: 9,5 m/s



Lingan Wind Turbine Project

North Sydney, NS
Coast of Cabot Strait



project 17 MW (9 turbines)
supposed production 42 GWh/year
Cape Breton Power Ltd.

finished:
7 x Enercon E70s

06/2006 - 2 x 2 MW
12/2006 - 3 x 2 MW
06/2007 - 2 x 2 MW









Enercon E70s

- power 2 MW
- rotor 90 metres, windward
- number of blades 3
- height 105 metrů
- area 6.362 m2
- rpm 8,2 – 14,9 rpm
- start up wind speed 4 m/s
- nominal wind speed 15 m/s
- drop-out wind speed 25 m/s
- restart wind speed 23 – 20 m/s
- generator 2 MW, asynchronous
- voltage 690 VAC, freqvention 50/60 Hz
- planetary gear box
- material of blades: polyester/epoxid resin
- Blade length 44 m
- conic tower, tubed, steel, 5 parts
- diameter bottom / top 4,15 / 2,3 m
- basement plate: armored concrete 15,35 x 15,35 x 2 m
- weght 335,3 t (tower 231 t, machine room 68 t, rotor 36,3 t)
- costs cca 70 mil Kč
- ČR - Dukovany



Mont Miller Wind Farm

Gaspesie, QC



project 54 MW (30 turbines)
supposed production 195 GWh/year
Hydro Quebec Ltd.



finished:
30 x Vestas V80

2005 - 30 x 1,8 MW

34,5 kV switching stati











Cap Chat Wind Farm

Cap Chat, QC
coast of St. Lawrence gulf



project 57 MW
supposed production 195 GWh/year
Hydro Quebec Ltd.
finished:
76 x NEG-Micon NM750/48
2003 - 76 x 750 kW

largest north of CA








HALTE SANTÉ
CAPUCINS







EOLE VAWT

Cap Chat, QC
coast of St. Lawrence gulf

project 4,2 MW
Supposed production 15 GWh/rok
Axor Ltd.



finished:
1987 - 4,2 MW





EOLE 4,2 MW

vertical axis - type Darrieus
auxiliary start
height 110m
diameter 60m
basement 10m
rigging cables
DC generator
DC/AC inverter

1. multi MW
1. without gearbox
1. variable speed
1. with invereter









Wind farms in California

San Gorgonio Pass (San Bernardino) 359 MW
Tehachapi Pass (Bakersfield) 710 MW
Altamont Pass (Santa Clara) 576 MW

2004 - 4,26 GWh/year (1,5%)
13 000 turbines
11% of world prod.



San Gorgonio Pass

San Bernardino



San Bernardino Mnts.
San Jacinto Mnts.
I-10 - Los Angeles
Average wind speed: 9 m/s

Shell Wind Energy Inc.
1980 - 1300 turbines (61,5 MW)
research: bird kills



today 4000 turbines (359 MW)
893 GWh/year




Whitewater













Tehachapi Pass

Bakersfield

Average wind speed: 9,2 m/s

today 3400 turbines (710 MW)
1500 GWh/year





Altamont Pass

Santa Clara



Diablo Range Mnts.
San Joaquin Valley
I-580 – „Silicon Valley“
average wind speed: 9 m/s

established 1980s - 4900 turbines (567 MW)
small = high speed turbines
1300 raptors/year
4700 birds/year











Wind farms on Hawaii

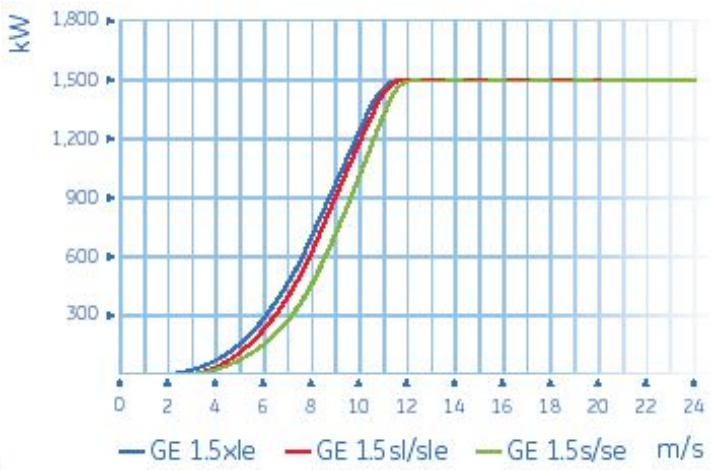
average wind speed: cca 9 m/s
Kamaoa Wind Farm – 9,3MW
South Point Wind Farm – 21MW

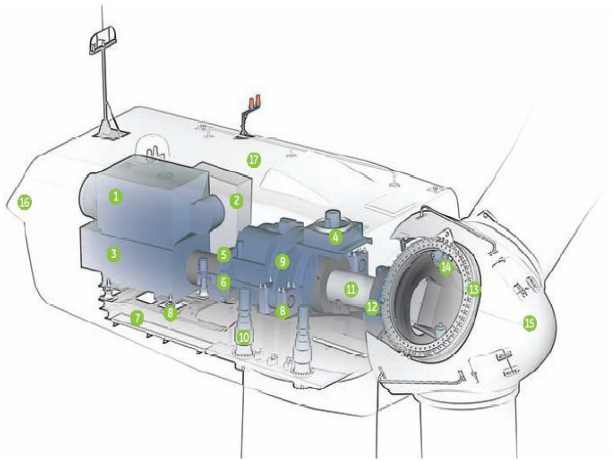


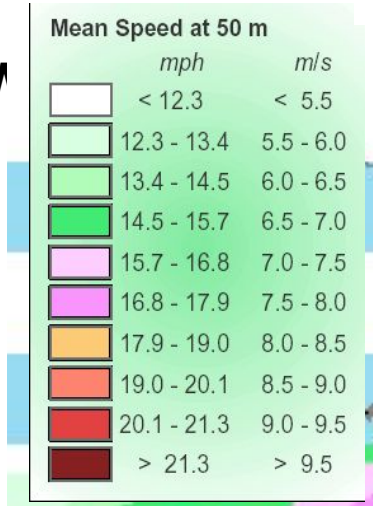
South Point Wind Farm

2006 – Apollo Energy Corp.
„reconstruction" of aged Kamaoa Wind Farm
21MW - 14x General Electrics 1,5MW

- **3 speed planetary gear box**
- **3f asysnchronous generator**
- **rotor 70,5m (3904m^2)**
- **12 – 22,2 rpm**
- **height 64,7m**
- **4 – 25m/s**
- **6,5% production (300MW**











Kamaoa Wind Farm



1986 – Kamaoa Wind Energy Partners Corp. – 100 acrea ra
1994 – sold to Apollo Energy Corp. – serving out
9,3 MW - 37x Mitsubishi MWT250 (250 kW)

- **planetary gear box**
- **3f asynchronous generator**
- **rotor 28m**
- **30 – 50 rpm**
- **height 30m**
- **5 – 24 m/s**
- **weight 85t**



















