

**Case study 2. SALKHIT WIND FARM IN  
MONGOLIA**



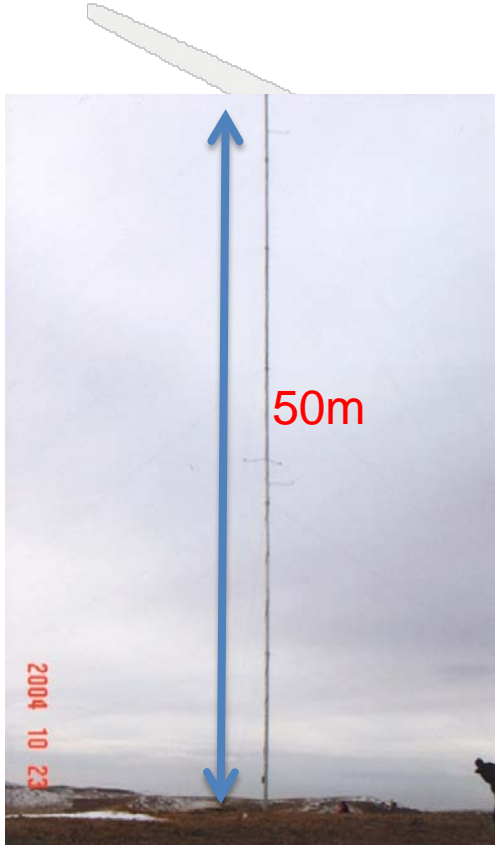
**Third ADB Quantum Leap in Wind Workshop, June 4-5, 2012**

- Background of the project
- Planning Phase: Estimated timeline, budget
- Development, Construction, Commissioning and Operation phases
- Actual timeline of project
- Ownership and organization structure

- 1. Policy support (Parliament, Government)**
  - **Law, Programs (Renewable Energy Law, National Renewable Energy Program)**
- 2. Selection of the site with sufficient wind resources (Salkhit mountain)**
- 3. Electricity demand (Consumers of Central Regional Energy System)**
- 4. Relevant electrical infrastructure (Nalaikh 110kV substation)**
- 5. Other infrastructure (Road, Railway, Telecom etc.)**

- **Land permits**
- **Wind resource assessments**
  - Measurement with meteorological station with international standard
  - Wind power assessment software (Wind Pro, WASP)
- **Public awareness and introduction about the Wind farm**
  - Citizens, Parliament, Government
- **Complete bankable FS (Sgurr Energy)**
- **To select Investors (Newcom, EBRD, FMO, GE)**
- **“Power Purchase Agreement”- negotiations with Investors and Purchaser**

- Required 50-100 m tower height
- 3-5 Stations
- More than 3 years measurement
- Cooperation with local citizens



**GE was established by Thomas Edison, the father of the lamp, in 1890 and its first name was Edison General Electric Co.,Ltd.**

## Energy infrastructure



- Power
- Oil, gas
- Water supply

## Technological infrastructure



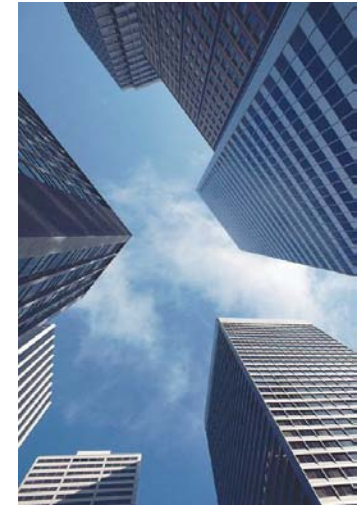
- Civil aviation
- Technological solution for entities
- Health
- Transportation

## NBC Media



- Cable TV
- Movie channel
- International TV
- Broadband
- Sport and Olympic TV

## Finance

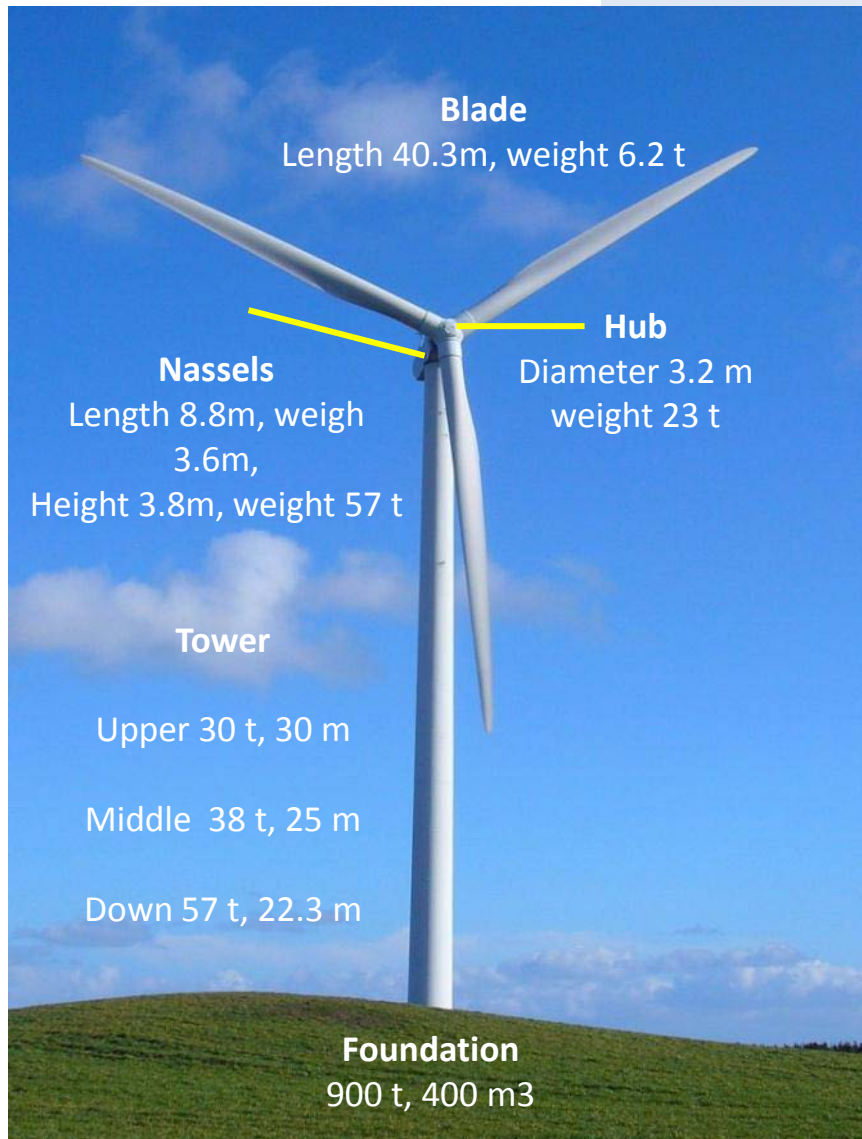


- Financial service for civil aviation
- Advertisement, commercial service
- Financial service for power sector
- GE money

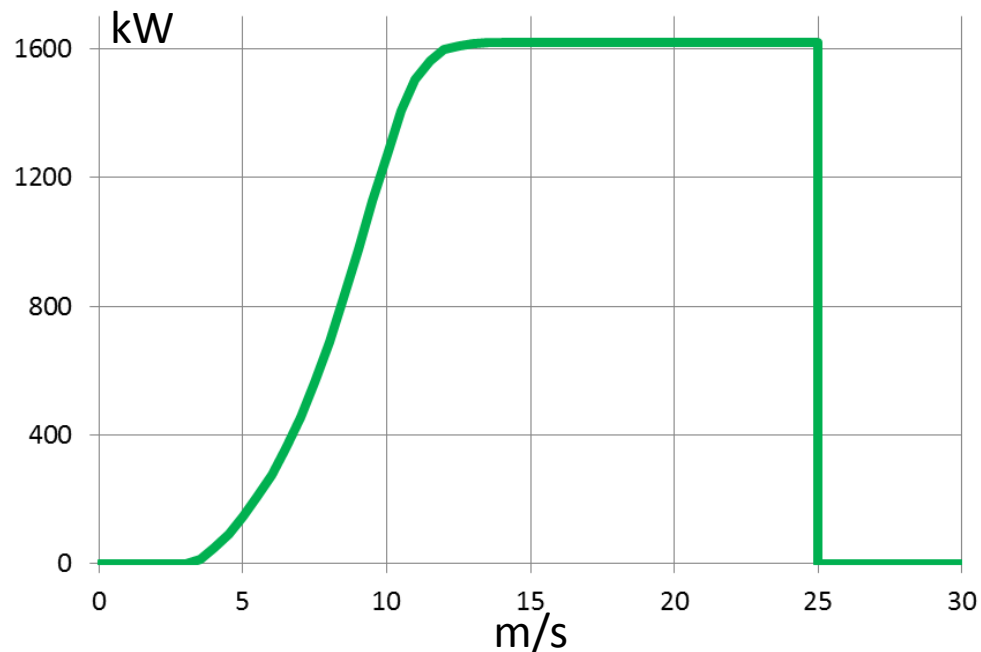
### 3B. WIND TURBINE GENERATOR



#### WTG – GE 1.6-82.5



#### Power Curve – GE 1.6-82.5



Rotor swept area	<b>5'346 m<sup>2</sup></b>
Rotor speed	<b>9-18 r/min</b>
Survival wind speed*	<b>77.2 m/s</b>
Operation temperature	<b>-40°C ... +50°C</b>

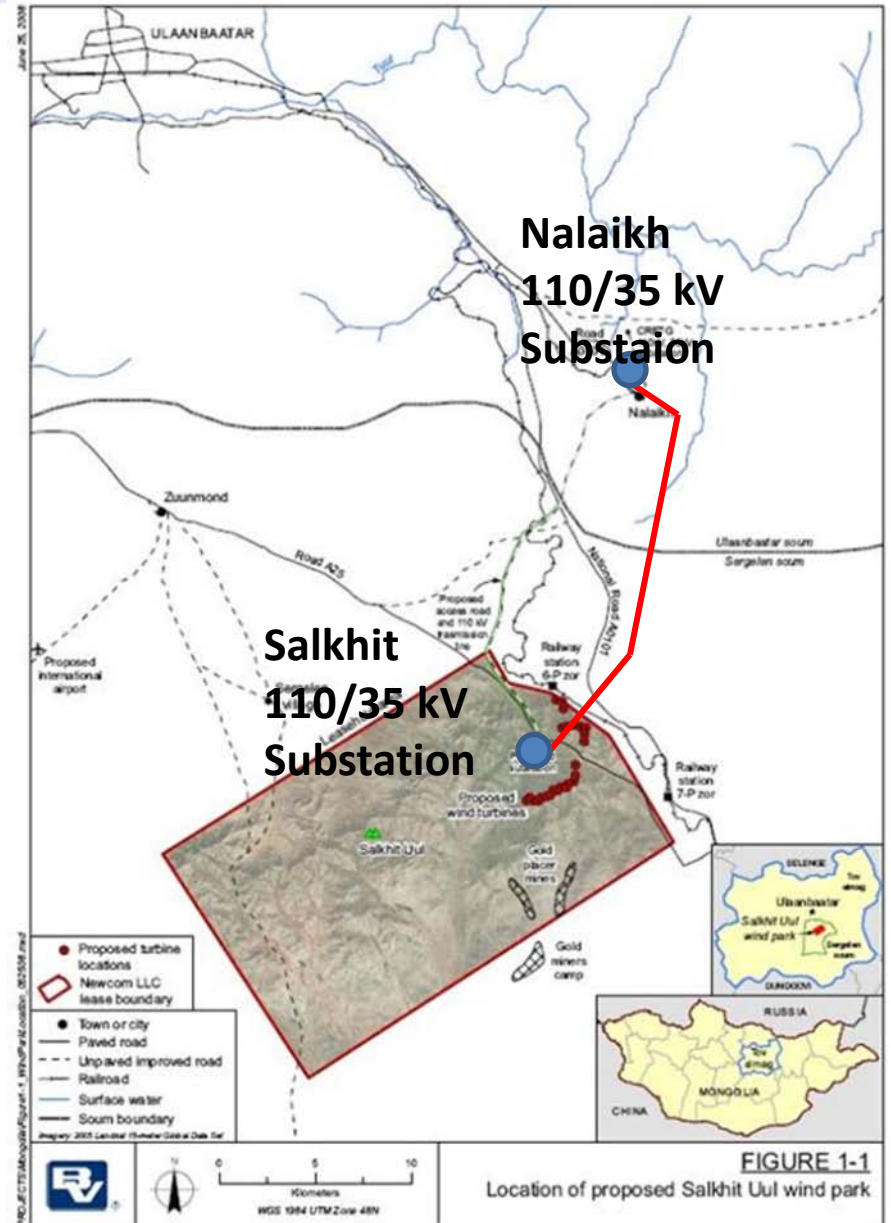
\* the rotor

## 4A. ABOUT THE WIND FARM



Developer: Clean Energy LLC

- **Commencement:** 2012
- **Investment** about 100 Mio USD
- **Average wind speed:** 8.2 m/s
- **WTG** GE 1.6-82.5
- **Total WTGs:** 31
- **Unit capacity:** 1'600 kW
- **Wind Farm Capacity:** 50 MW
- **Annual electricity generation:** 168.5 Mio kWh
- **110 kV Transmission** 28 km, double
- **35 kV cables** 30 km
- **Connected Central Energy System.**





- **Comprehensive environment study, evaluation**
  - Birds
  - Archeology
- **Tozoographical Map**
- **Geology, geotechnical study**
- **Road and transport condition study**
  
- **2.2 km Branch Road construction between and Railway cross**
- **Construction railway branch road and temporary railway cross by Tsagaan khyar Railway station**
- **Construction 28 km, 110 kV double circuit high voltage transmission line between Nalaikh and Salkhit**
  
- **Extension and Reconstruction Nalaikh 110 kV substation**
- **Installation of fiber optic cable between Ulaanbaatar 220 kV substation and Nalaikh 110 kV substation, SCADA**

# 5A. ARCHEOLOGICAL STUDY





## Implementation of soil survey

# 5A. ROAD CONSTRUCTION



# 5A. CONSTRUCTION RAILWAY BRANCH ROAD AND TEMPORARY RAILWAY CROSS



# 5A. CONSTRUCTION OF 110 KV – HIGH VOLTAGE TRANSMISSION LINE



## TARGET

- Limited tender
- EPC
  - Supply
  - Transport
  - Construction
  - Commencement
- O&M

## ACTUAL

- Limited tender
- EPC
  - Supply (GE, Siemens)
  - Transport (Leighton)
  - Construction (Leighton)
  - Commencement (GE)
- O&M (GE, CRETN)

## About LEIGHTON GROUP

- Australia's largest project development and contracting organisation
- The world's largest contract miner
- Established in Australia in 1949
- Listed on Australian Stock Exchange since 1962
- Over 50,000 employees
- Turnover is over US\$20 billion
- We offer a broad range of project development and contracting services and skills to public and private sector clients across a wide range of industries and geographic locations



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## Geographic footprint LEIGHTON ASIA



### ➔ Wind Farm Projects



Lake Bonney Wind Farm – SA

- The development comprises 46 wind turbine generators, each capable of generating 1.75MW of power, giving the wind farm a total capacity of 80MW
- Design and construction of all of the civil works and the electrical works for the project



Canunda Wind Farm – SA

- The wind farm comprises 23 Vestas V80 wind turbine generators, each capable of generating 2MW of power, giving the wind farm a total capacity of 46MW
- Design and construction of all of the civil works and the electrical works for the project



Waubra Wind Farm – VIC

- The development comprises 128 wind turbine generators, each capable of generating 1.5MW of power, giving the wind farm a total capacity of 192MW
- Design and construction of all of the civil works for the project

Local knowledge

International experience

Focused on success



# 5B. TRANSPORT



### No negative impact to environment and public



- Footprint of installed WTG is small – no impact to pasture
- No fences – no impact to pasture and public movement
- Slow rotation of rotor – less noise impact.
- The nacelle located 80m from ground – no impact to nearby ground wind



**General environmental  
impact assessment**

**2006**

**Ministry of Nature**

**Detailed environmental  
and social impact  
assessment**

**2008**

**Black & Veatch  
international company**

**Salkhit wind farm will annually:**

- **Save 150 thousand tons of coal**
- **Avoid emission of 180 thousand tons or 130 billion litre of CO2**
- **Save 1.6 million tons of potable water**



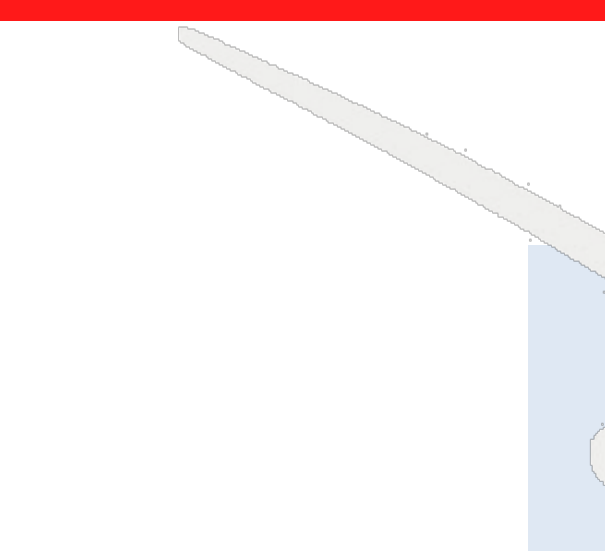
Lifting Crane is vital  
Zoomlion



6A. CONSTRUCTION SITE, ROAD



## 6A. FOUNDATION MOUNTING RING



## 6A. UNLOADING OF TRANSFORMER



- **A major difficulty to developing a bankable power project in Mongolia is creating a strong power purchase agreement that takes into account changes in prices over time**
- **Difficulty in introducing private sector participation and investment in what has traditionally been solely a state-owned and run sector**
- **Lesson learned: need to actively work with SOEs and regulators to provide a clear understanding of private sector expectations and requirements, and the requirements of international finance providers**
- **Includes both the legal framework and the financial requirements**





Prepared by:

Sukhbaatar Ts.

**Thank you for your attention**

**Contact:**

Phone: +976-11-313183

Fax: +976-11-318521

Web: [www.newcom.mn](http://www.newcom.mn)