Wind Energy: challenges for the lifting industry

Scott Sanders
Manitowoc Cranes

Aviad Shapira
Technion – Israel Institute of Technology

Agenda
Introduction
Wind Industry
Wind Turbines
Wind Industry Challenges
Crawler Cranes
Wheel Mounted Cranes
Case Study: Manitowoc 16000 WA
Case Study: Manitowoc GTK1100
Conclusion

Introduction

Wind energy poses new challenges for the lift equipment
- Growth rate of wind industry is rapid
- Growth is global with differing country requirements
- Growth in variety of challenging windfarm locations
- Growth in tower heights and windmill sizes (weights)

Crane types, configurations and capacities are a result of customer needs

Crane manufacturers have responded to the wind industry with variants of traditional cranes and some new offerings to satisfy the customer needs.
Wind Industry

Push for “green” energy has caused the wind energy industry to experience staggering growth.

The Global Wind Energy Council predicts 409 GW by 2014 (158 GW at the end of 2009). Nearly a 160% increase in five years!

Regionally, 90% of installed wind energy is in three main areas:

- **United States**: Over 35 GW of wind power. To achieve 20% wind power by 2030, over 300 GW would be required.
- **Europe**: Over 76 GW of wind power. To achieve 20% wind power by 2020 (2009 Renewable Energy Directive), 230 GW would be required.
- **China**: China was the largest market in 2009. Over 25 GW of wind power. To achieve renewable energy goal for 2020, 80-100 GW would be required.

Wind Turbines

Wind turbines (interchangeably called windmills) have evolved to become more efficient and more productive.

Focus on larger windmills (from ~650 kW to 3.0 MW).
**Wind Industry Challenges**

**Challenges in wind energy:**

**Site:**
- Geographic location – accessibility, country regulations, weather, land/sea
- Terrain – flat, sloped or mountainous; desert, agriculture or forestation
- Layout – large or small windfarm; distance between windmills
- Wind Velocity – sustained winds average 6 to 8 m/s

**Turbine Technology:**
- Size and weight of nacelle, rotor hub and blades (60-100 t)
- Height of the tower – typically 80-100 m (and growing!)

---

**Crawler Cranes**

**Strengths**
- Can travel with boom and rigging erected (generally)
- Low ground bearing pressure
- Good gradeability

**Weaknesses**
- Wider footprints can increase site road costs
- Large build-up/lay-down areas can damage local vegetation
- Often require multiple truckloads to transport
Crawler Cranes

Wheel Mounted Cranes

Strengths

- Easily transported. Designed to meet local road laws
- Mobility on site with narrow width
- Increased speed of setup/teardown (telescopic)

Weaknesses

- Narrow width often means more teardown for on-site travel
- Difficult to make "global" machine due to various road laws
Case Study: Manitowoc 16000 WA

Design Challenges:
Luffing and fixed jibs are a traditional approach to windmill erection BUT
- Difficult to travel with jib erected
- Jibs generally not as strong as main boom
- Time consuming to rig/unrig

Solution:
Developed an Extended Upper Boom Point (EUBP)
- Allows travel without unrigging
- Allows higher in-service wind speed (than luffing jib)
- Faster and easier to rig

Case Study: Manitowoc GTK1100

Design Challenges:
- Transport of cranes can require ten or more trucks
- Standard crawler width adds site development costs
- Erection/teardown of luffing and fixed jibs is time consuming
- Erection of lattice booms requires a large lay-down area
Case Study: Manitowoc GTK1100

Solution:
New concept for cranes. A cross between a self erecting tower crane and a wheel mounted hydraulic crane.

Three main parts:
- Luffing telescopic boom
- Vertical telescoping mast
- Multi axle wheeled carrier

Case Study: Manitowoc GTK1100

Transport
- Four or five trailer transport configuration
- All transports meet 12 t maximum axle-load regulation
- Shipping volume allows lower overseas shipping cost

Case Study: Manitowoc GTK1100

Site Requirements
- Approximately 34 m x 20 m space required when rigged
- No stock / lay-down area for boom systems required
  (conventional cranes need at least 120 m x 15 m for rigging main boom + luffing / fixed jib)
- Roads need only accommodate 3 m width
- Spot preparation for the outrigger mats possible
- Vertical lifting allows compact area / reduces damages to environment
Conclusion

Crane designers are continuously challenged by the growth in both wind turbine size and the height at which they are erected.

In many cases, modifications to traditional crawler and mobile cranes provide a tailored solution for windmill erection and maintenance.

The GTK1100 was designed specifically for windmill erection and maintenance and has modifications that allow it to operate in other traditional industries.

Regardless of the design method chosen, the wind energy industry will keep crane designers and construction managers quite busy addressing new challenges.