AUTO LIFT PRECAST CONCRETE WIND TOWER: MAXIMUM OPTIMIZATION IN LARGE HEIGHTS

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1. INTRODUCTION

Concrete towers, for the intrinsic advantages of its best performances when supporting higher power turbines to higher hub heights, are now a complete reality in the global wind power market. These structures develop all its competitive advantages over steel towers as the height grows and their potential is enormous as engineering doesn't represent a challenge to reach heights of 120, 140, 160m or even higher.

However, currently there is a limitation to increase the tower height: the scarcity of cranes able to lift the turbines.

To design a tower avoiding large cranes is a revolution that the wind market may experience in the short term, allowing a lower energy cost and providing access to heights which currently are prohibitive. This is nowadays a reality with the new technology developed, in design and **also prototype**, by the authors of this abstract, through their experience of over 400 concrete towers currently designed and built, being part of a leading company worldwide.

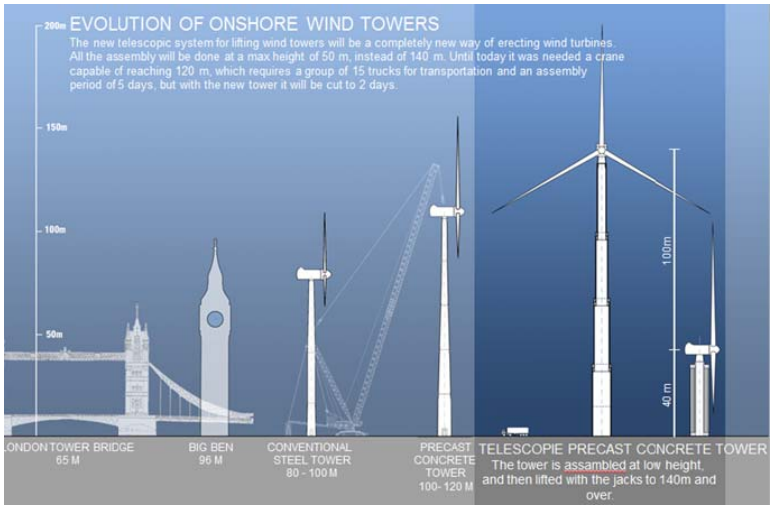

Figure 1. Heights Market Evolution of the Onshore towers.

2. APPROACH

Searching for the solution of the on-shore telescopic tower, comes from the clear tendency of the onshore market towards higher towers with more power; and the geometrical advantage that telescoping provides when allowing flotation stability of the offshore tower.

High capacity and efficiency of heavy-lift jacks for large heights allow a lower price than a conventional crane. The system, with no limitations, is based on a proven technology in multiple industries, with a track record of over 30 years, reusing hydraulic jacks easily transportable from one tower to another.

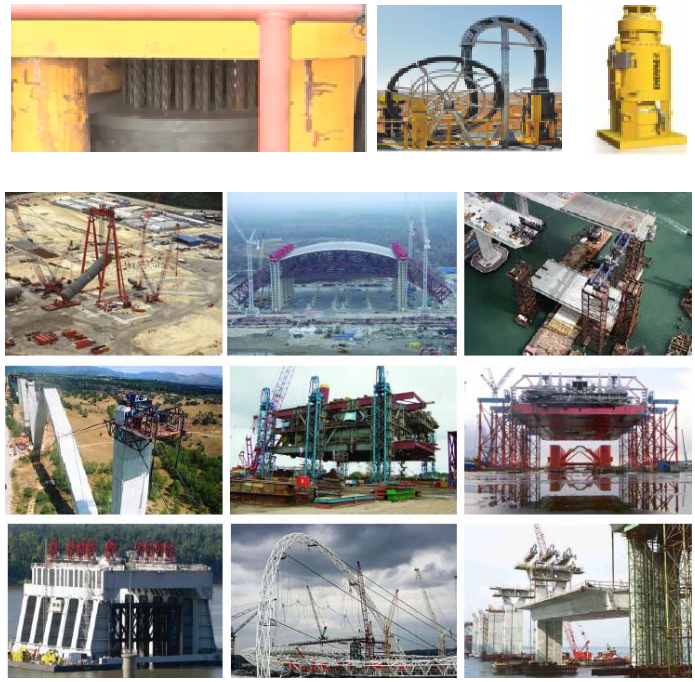

Figure 2. Heavy-lifting tecnology usually employed for Civil Works constructions.

The weight of the tower is not a limiting factor, providing better structural capacity at a lower cost with respect to the steel one. Fatigue resistance, increased durability and reduced maintenance of concrete are additional main attributes and saving factors.

As an additional advantage, emphasize that the new system can be aimed while two closely related but distinct markets: the on-shore and offshore wind markets, where even their advantages can be amplified due to the increased dependence of these infrastructures to lifts.

In the field of onshore wind energy, the solution presented will provide new capabilities to effectively achieve increased hub height with larger turbines, overcoming the limitations currently generated by the capacity, cost and availability of mobile large tonnage cranes, as well as by the structural limitations of conventional tubular steel towers.

3. MAIN BODY OF ABSTRACT

The auto lift system consists on a precast tubular tower sections that are assembled in a concentric layout involving at these stage economic and highly-available cranes.

Precast sections are formed by segments with a simple cylindrical shape, thus saving substantial costs of labor.

Figure 3. Precast concrete panels

Panels' preassembly process takes place from inside to outside. The first preassembly corresponds to the upper section of the tower. Later on, every section corresponding to the lower levels will be preassembled and positioned. The execution of the vertical joints, can be done from outside, minimizing working time.

The manufacture is planned to be taken both by close stationary or modular mobile factories, providing significant savings from logistical point of view.

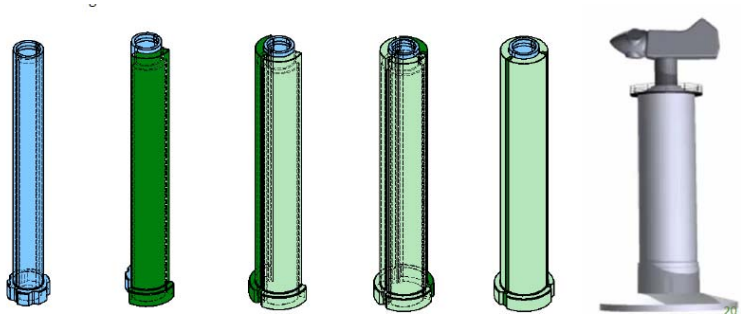

Figure 4. Pre-assembly process “by layers”.

Once the preassembly is completed, the tower can be lifted to their final position by heavy-lift jacks, which may be reused for lifting a section after another.

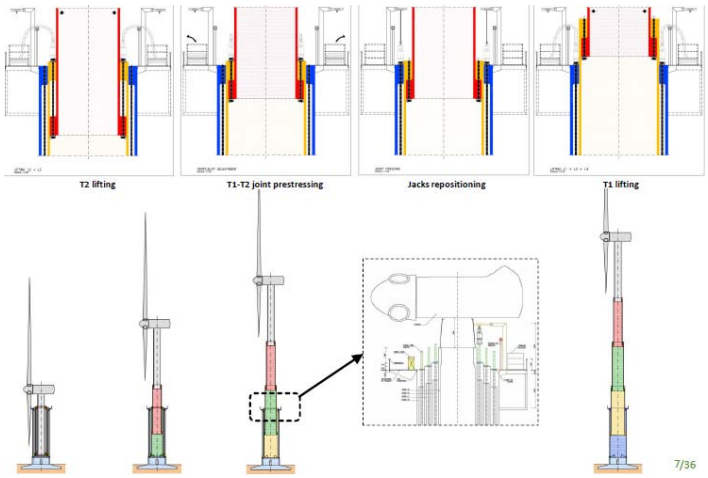

Figure 5. Telescopic Tower lift.

The whole assembly takes place at a maximum height of 40 m.

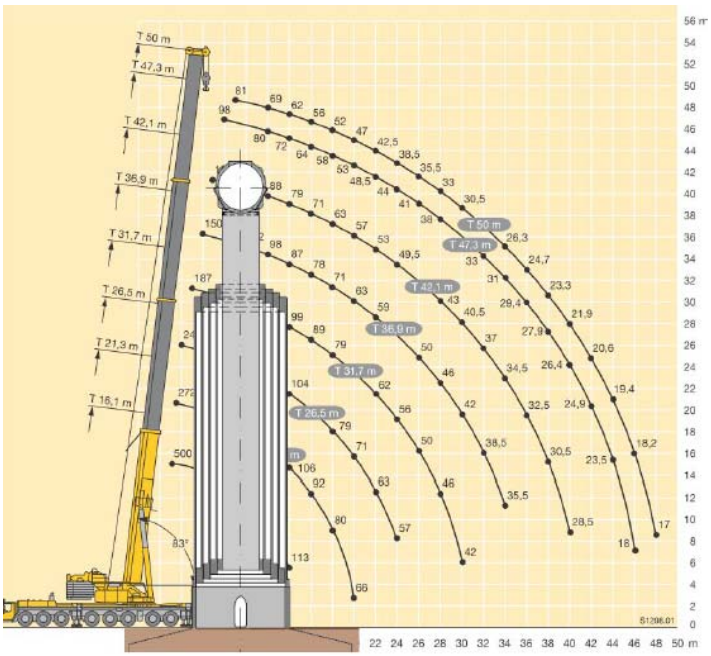

Figure 6. Capacity curve of conventional telescopic wheeler crane.

4. CONCLUSIONS

The telescopic system proposed, already designed and with prototype, provides a solution to the current height limitations in wind towers, as the lifting capacity can be achieved without major problems through proper disposal of conventional jacks.

Thus, the tower-turbine assembly requires only conventional half capacity hydraulic cranes

This main advantage, to which is possible to add some secondary ones, which have been previously mentioned, together with some others, allow us to think that the development of this type of precast concrete tower can ensure a promising future, with a clear niche business objective: higher hub heights, locations with difficult access and movement for large conventional cranes and large power turbine.

5. LEARNING OBJECTIVES

Upon completion, participant will be able to understand the current limitation of the market when it comes to higher hub heights tower erection.

Upon completion, participant will be able to distinguish the different technical challenges and costs between the innovative solution presented and the traditional one.

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