



Craneless Installation of the 160m-height Nabralift tower prototype

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AGENDA

1. Nabralift® Self-Erecting Tower

2. Craneless Installation of 160m-Height Prototype

3. Conclusions and Next Steps



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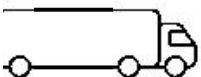
Nabralift® Self-Erecting Tower XXL Towers Challenges



Cost Increase

Exponential Cost

Most Expensive Component HH>120



Logistics

Roads / Bridges Limiting Concepts

High Logistic Cost



Assembly Cranes

Lack of Availability

Large Mobilization and Rental Costs



Installation Rates

Slow Wind Farm Installation Rates

Inefficiency Time Increase



WTG Integration

Control Challenges in Soft-Soft Towers

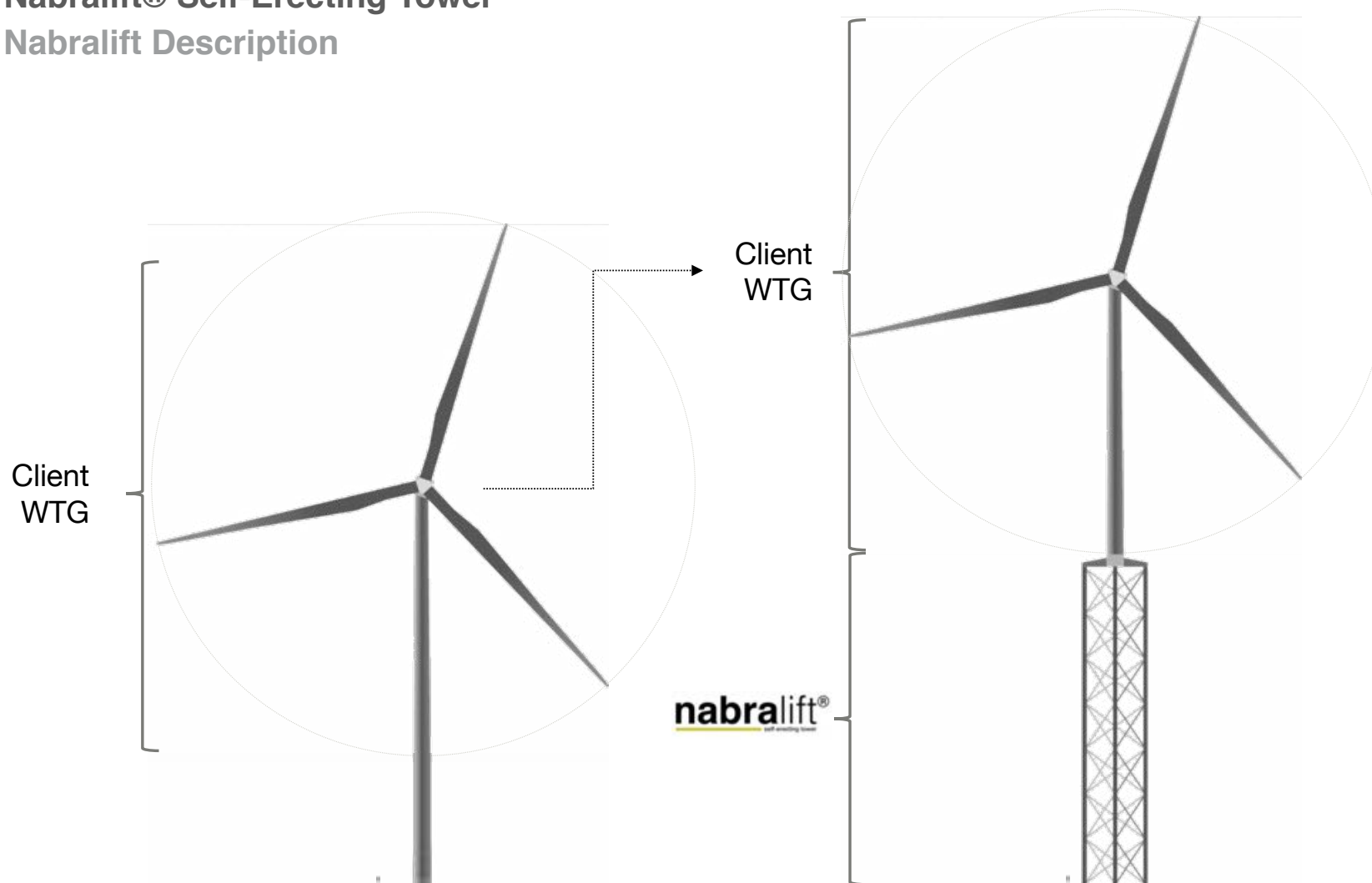
Soft-Stiff Unfeasible for XXL Steel Tow.





1

Nabralift® Self-Erecting Tower Nabralift Description

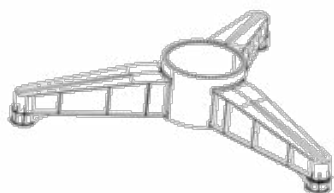




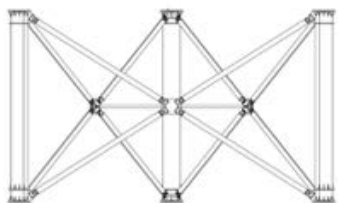
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Nabralift® Self-Erecting Tower Nabralift Description

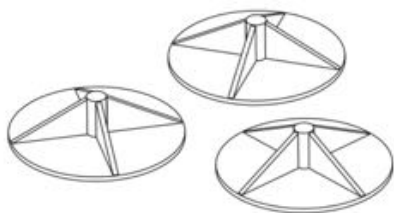
Tower Transition



Framed Structure



Foundation





1

Nabralift® Self-Erecting Tower Nabralift Description



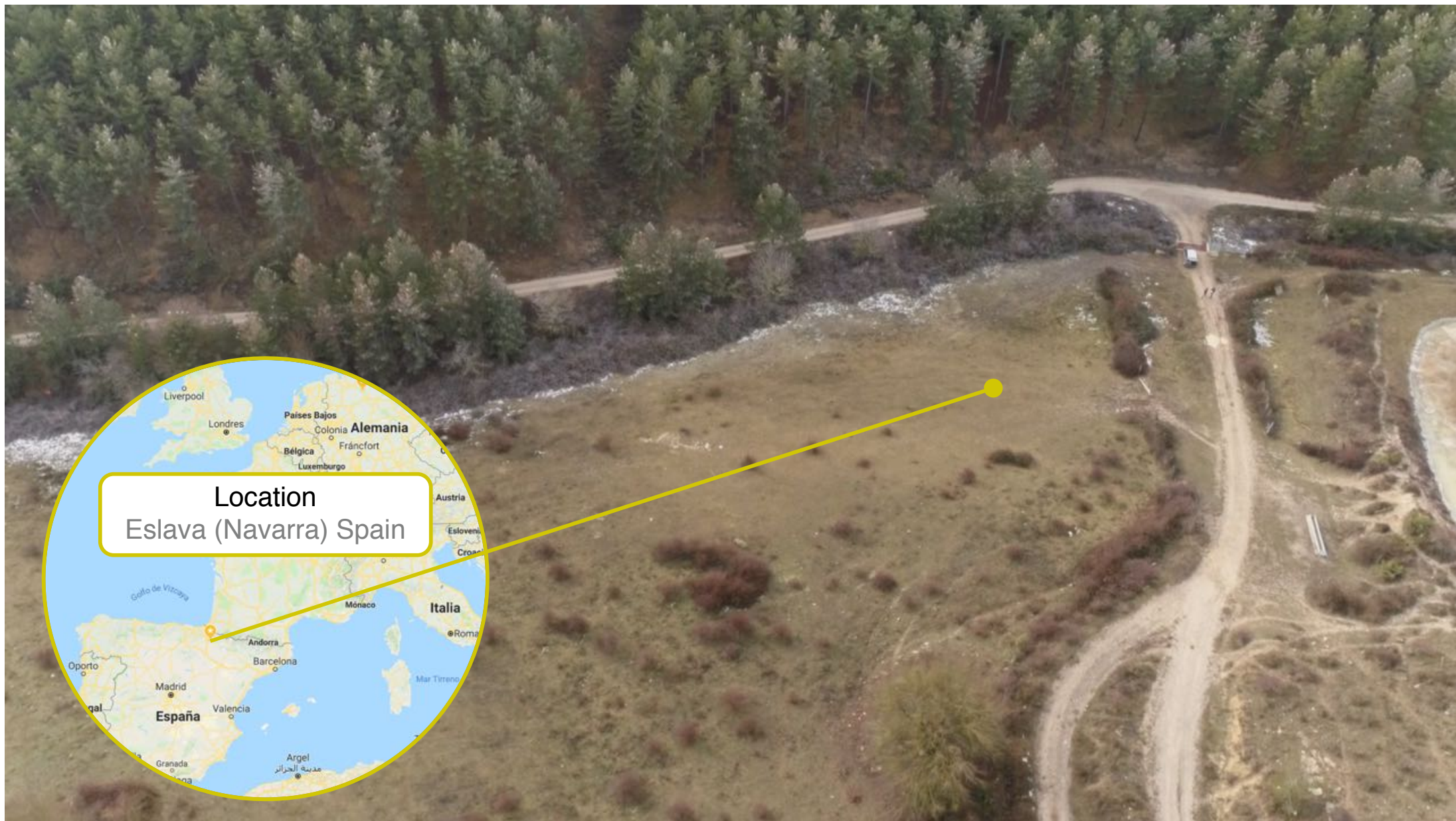


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Location
Eslava (Navarra) Spain



Minimum Assembly Platform
1200m² for 160m tower

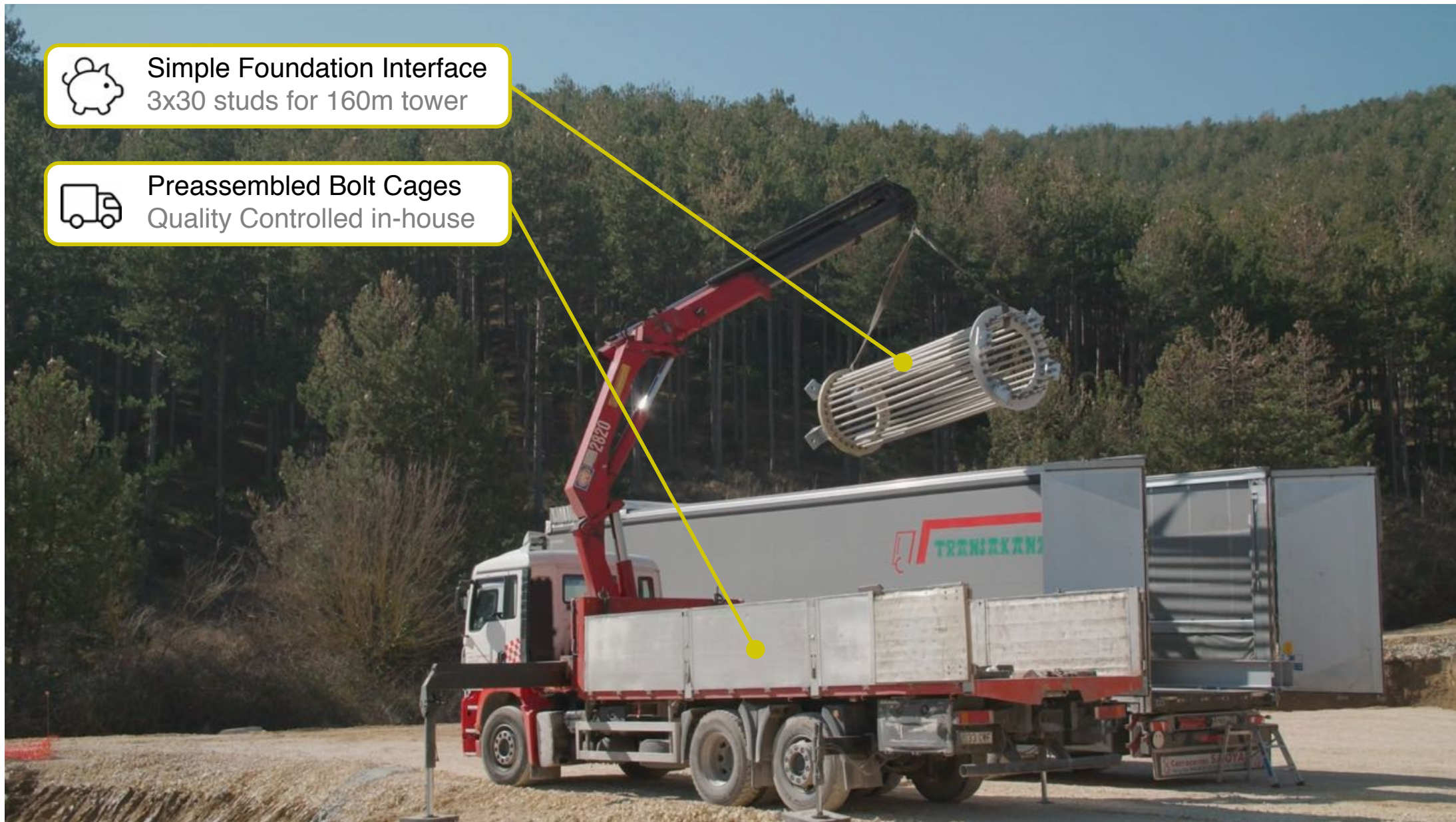


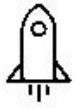


Simple Foundation Interface
3x30 studs for 160m tower



Preassembled Bolt Cages
Quality Controlled in-house



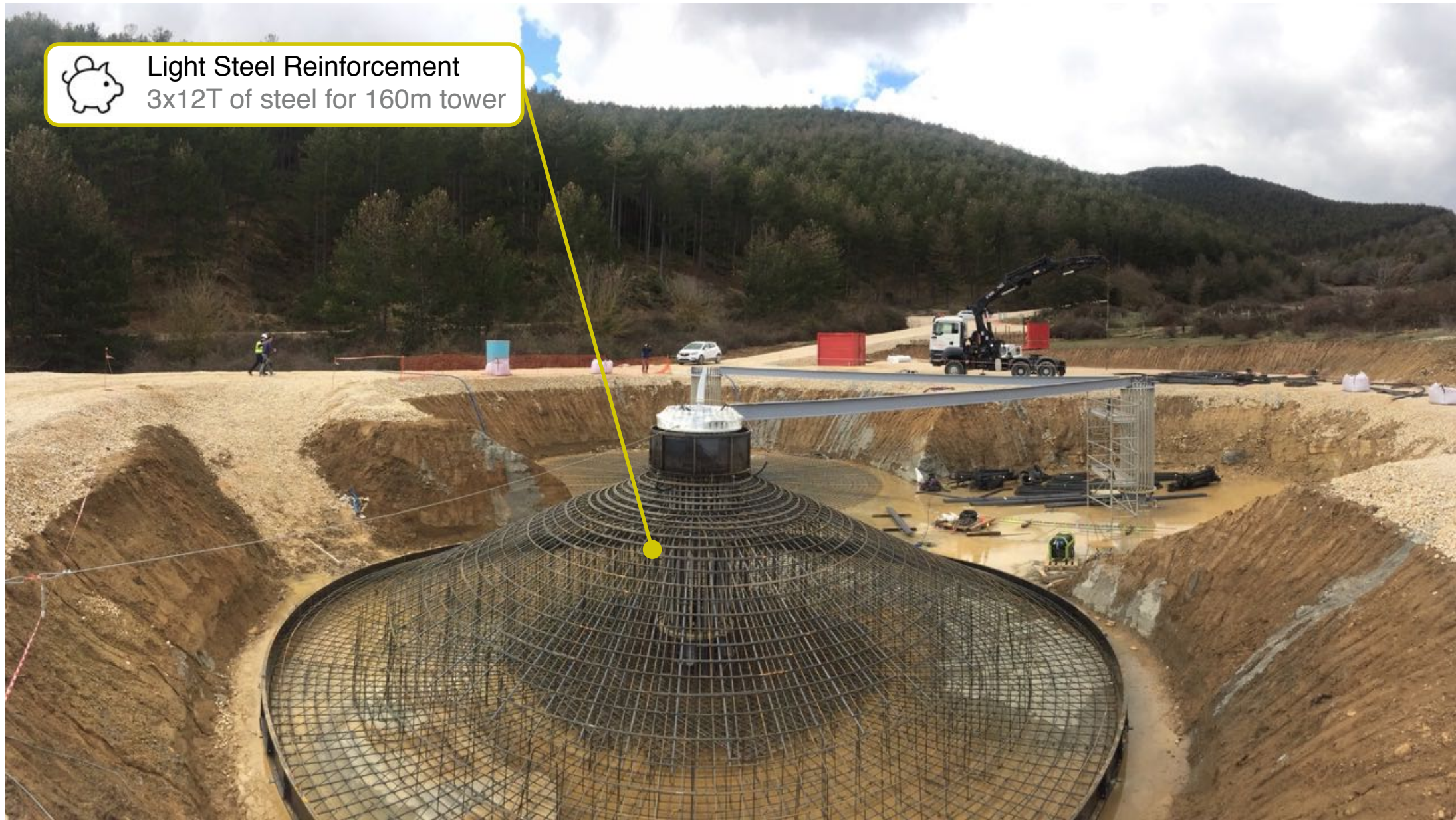


Preassembled Bolt Cages
Fast Installation on Site





Light Steel Reinforcement
3x12T of steel for 160m tower





Low Concrete Volume
30% reduction





4 – Casted Components
Cost-Effective – No welds



Simple Tower Interface
Conventional Tower Flange

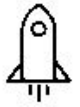




Transition Designed for Logistics

HxWxL as per 40' container



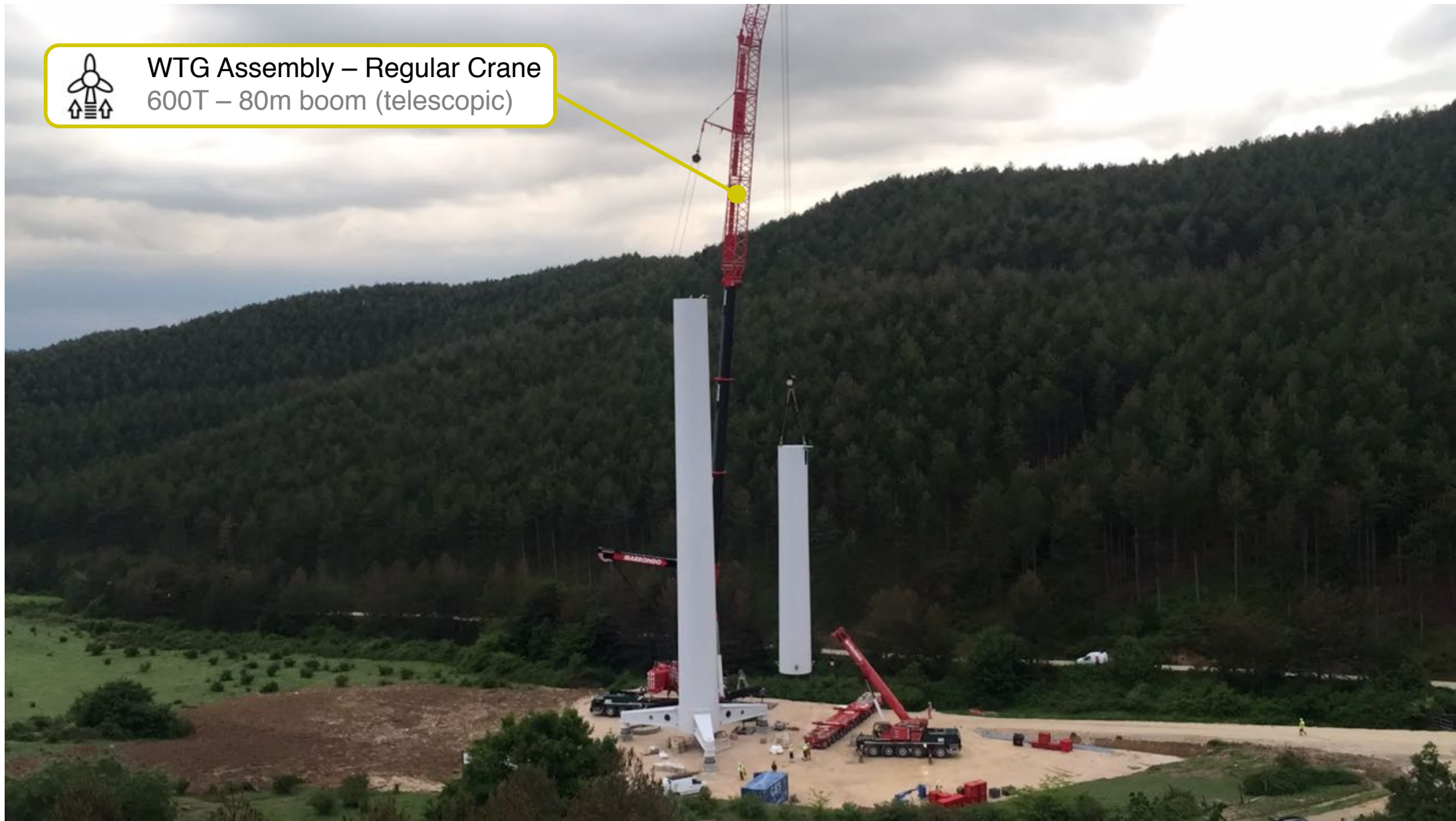


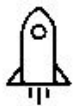
Transition Bolted Assembly 1-Day Installation





WTG Assembly – Regular Crane
600T – 80m boom (telescopic)





Quick WTG Installation
1WTG every 3-4 days





Self Erection System

Independent from final Hub Height



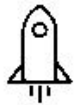


Frame Designed for Logistics
HxWxL as per 40' container





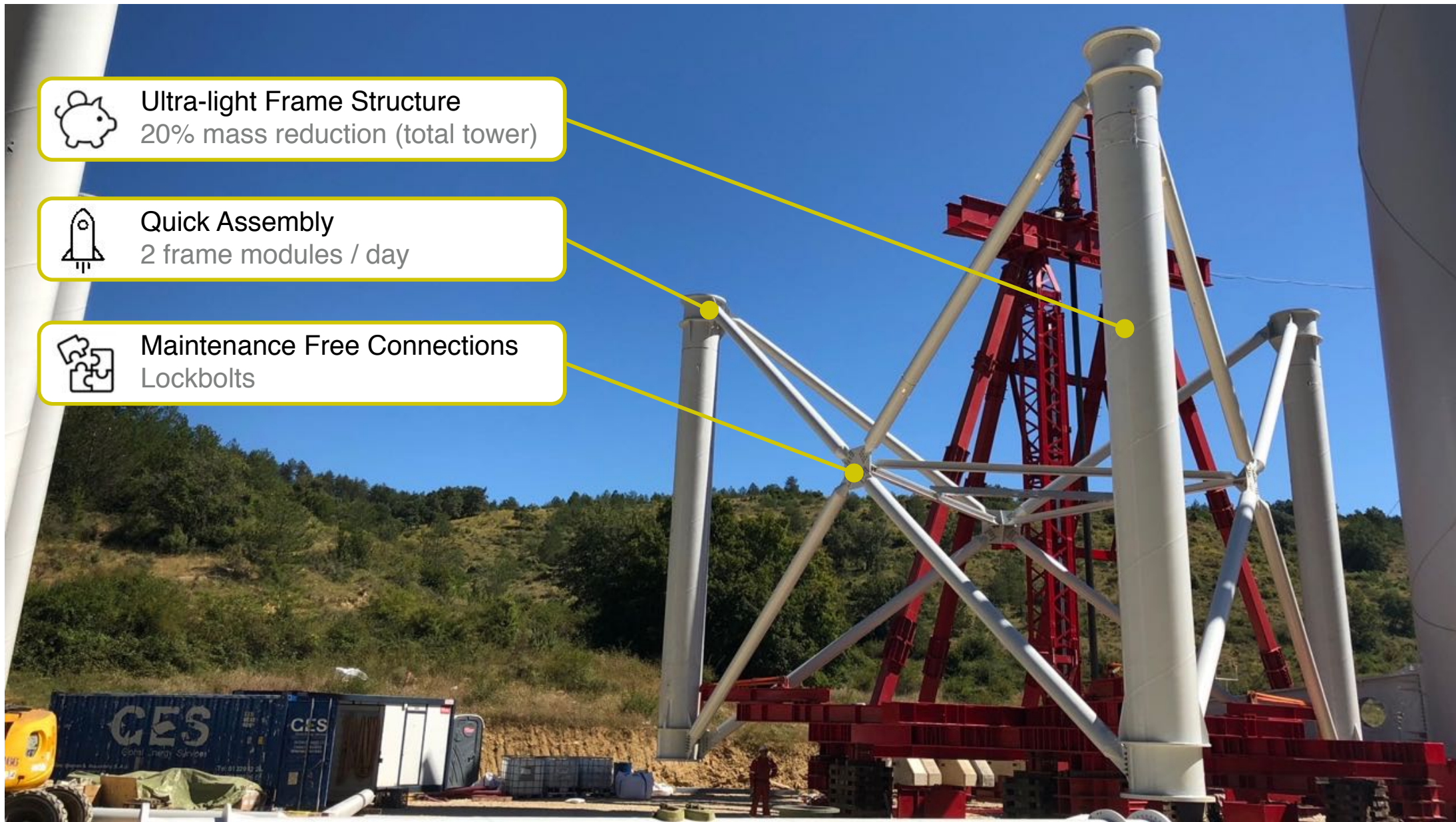
Ultra-light Frame Structure
20% mass reduction (total tower)



Quick Assembly
2 frame modules / day



Maintenance Free Connections
Lockbolts





Self Erection System
Compact Layout





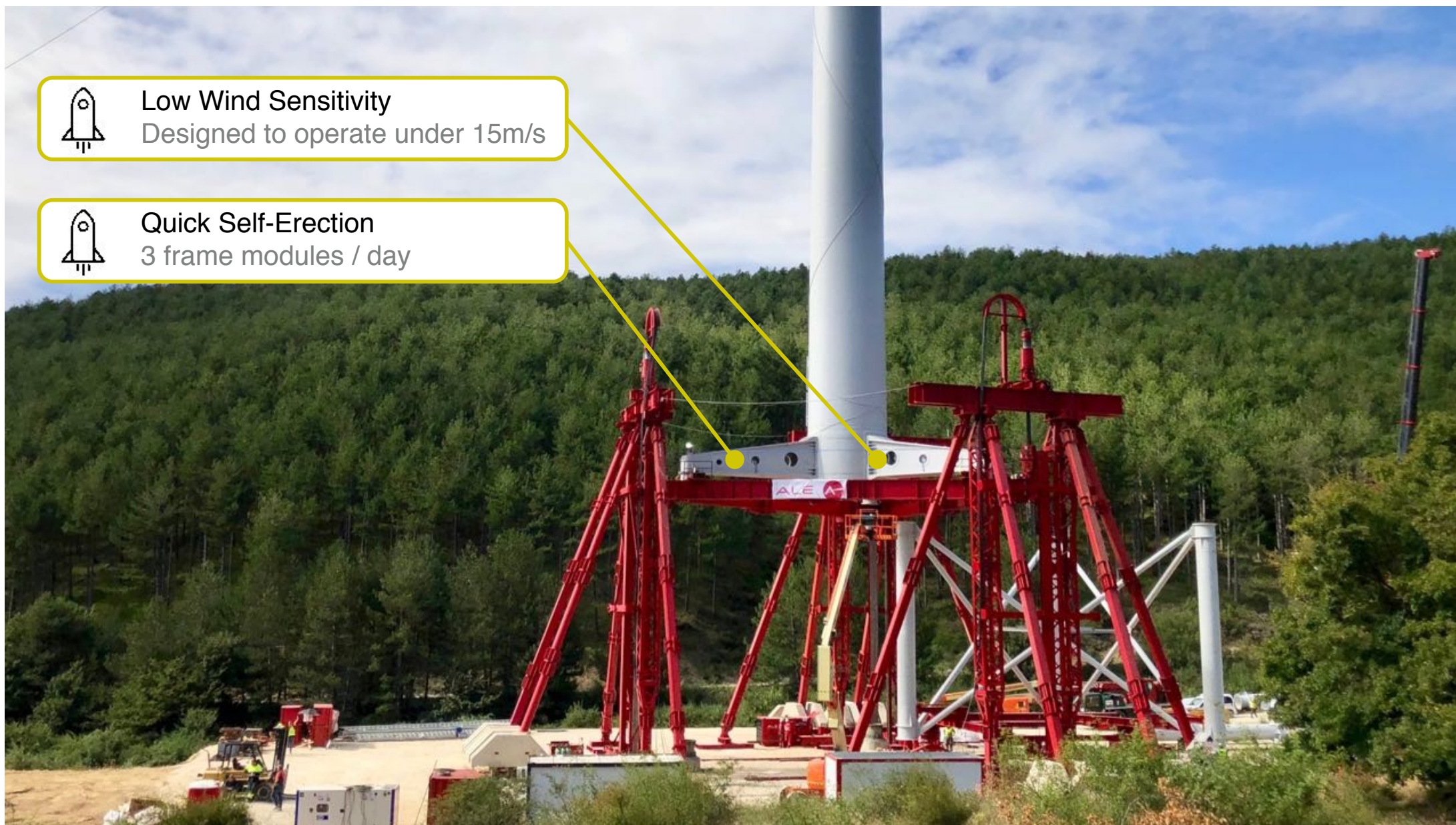
Controlled Heavy-lifting
Vertical and Horizontal Reaction



Low Wind Sensitivity
Designed to operate under 15m/s



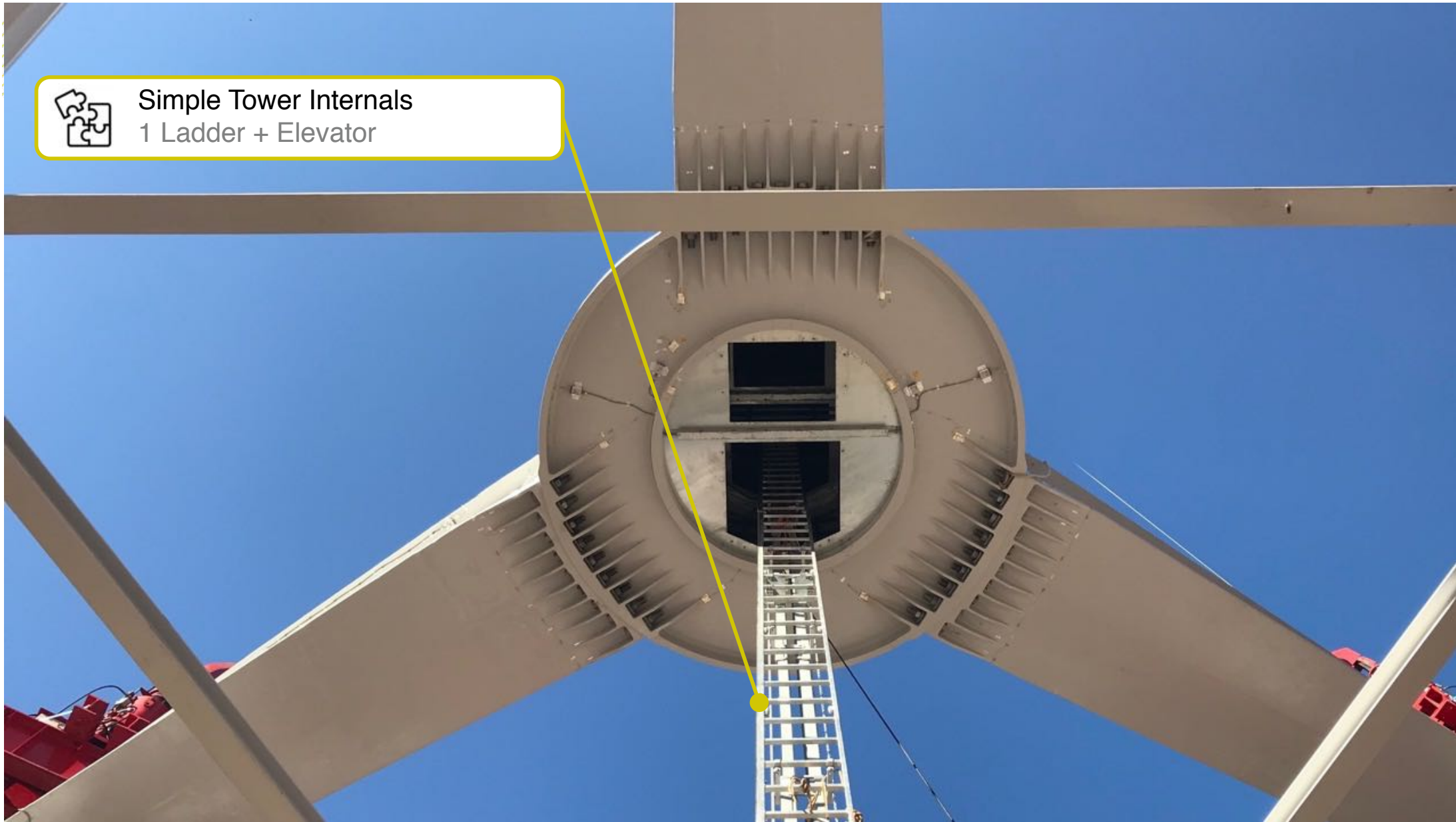
Quick Self-Erection
3 frame modules / day

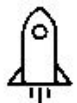




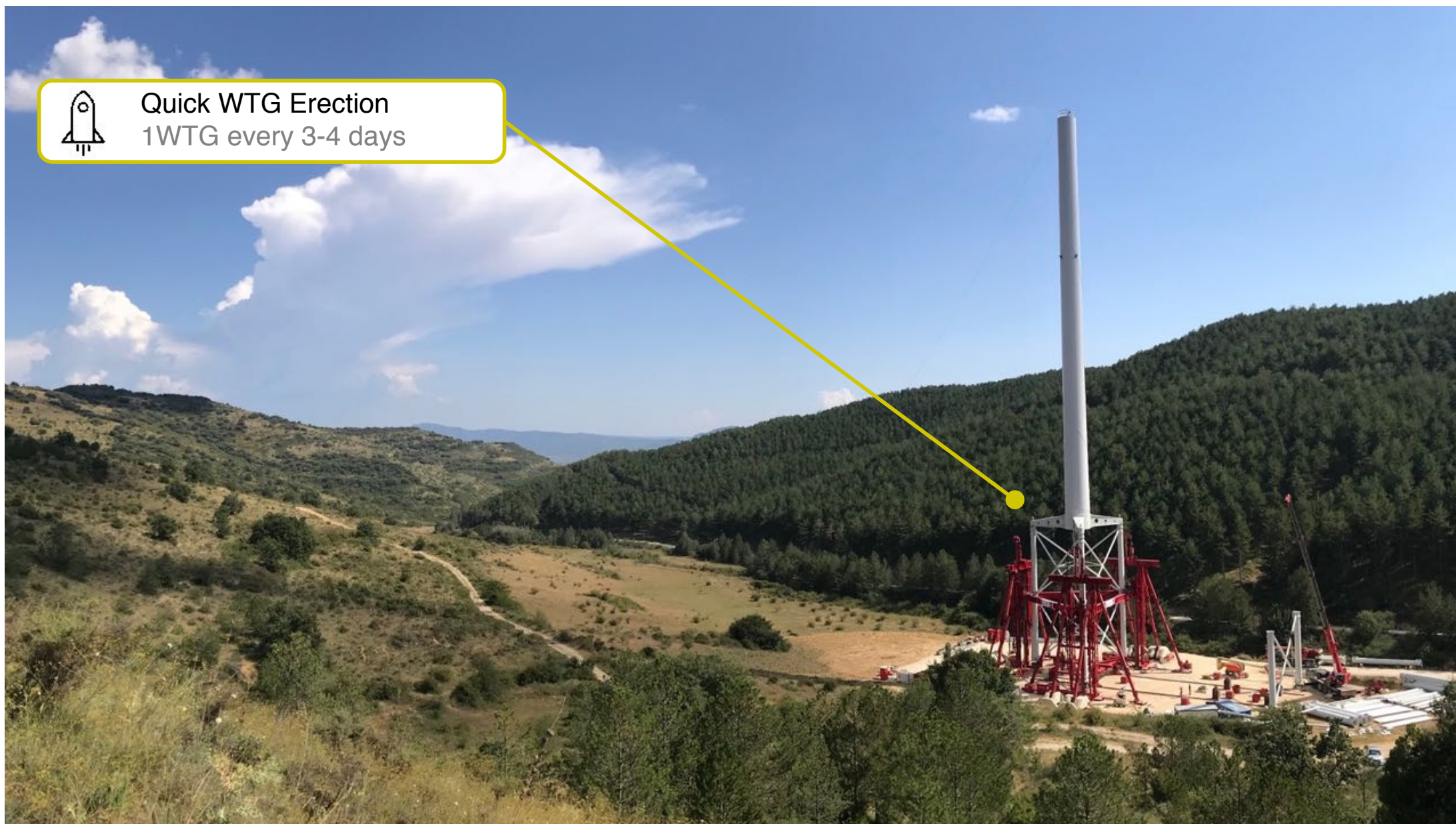
Simple Tower Internals

1 Ladder + Elevator





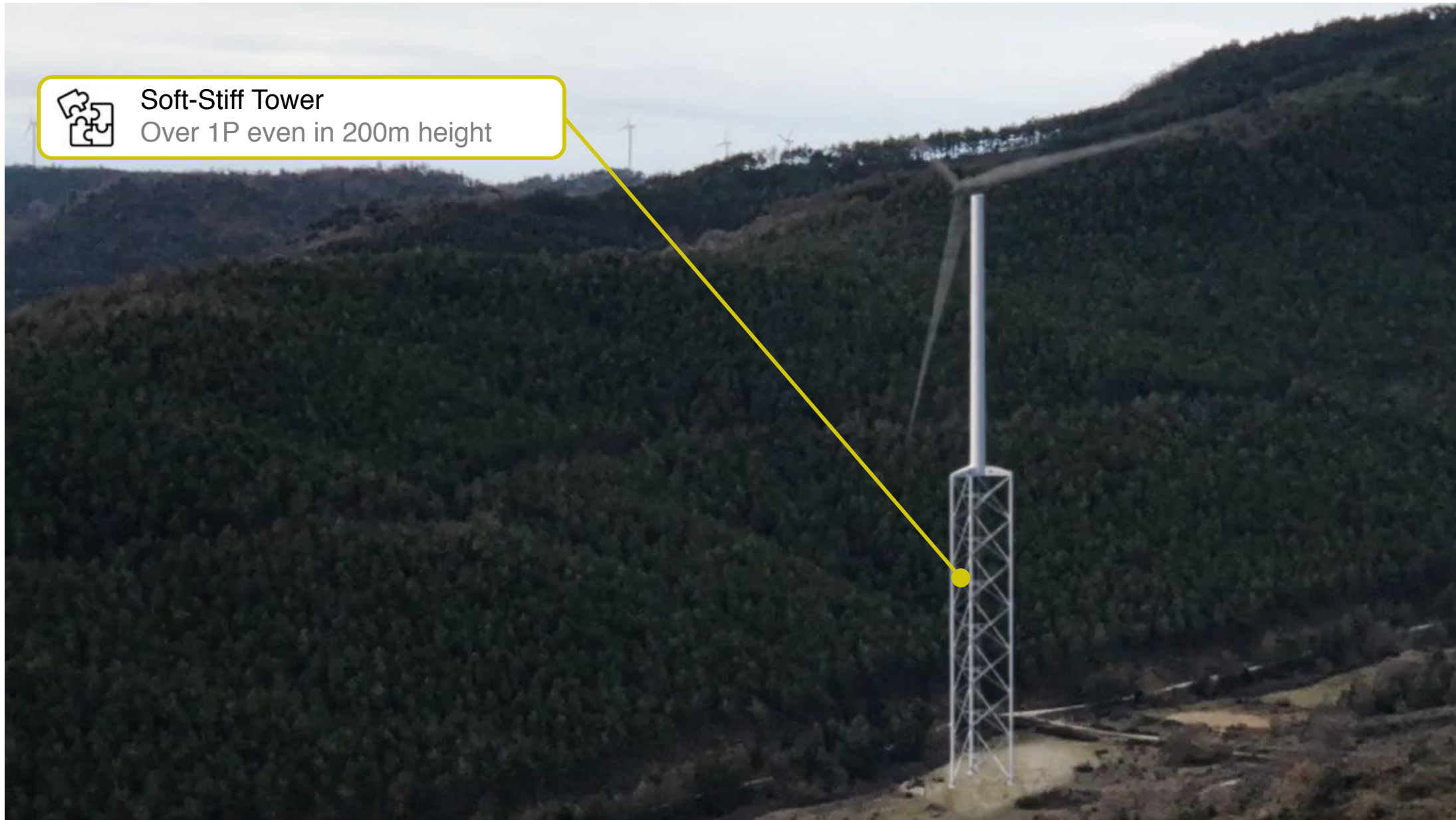
Quick WTG Erection
1WTG every 3-4 days





Soft-Stiff Tower

Over 1P even in 200m height





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CONCLUSIONS AND NEXT STEPS

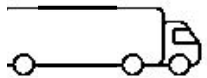
Conclusions: Nabralift vs Market Challenges



Cost Increase

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WTG Integration

Control Challenges in Soft-Soft Towers

Soft-Stiff Unfeasible for XXL Steel Tow.

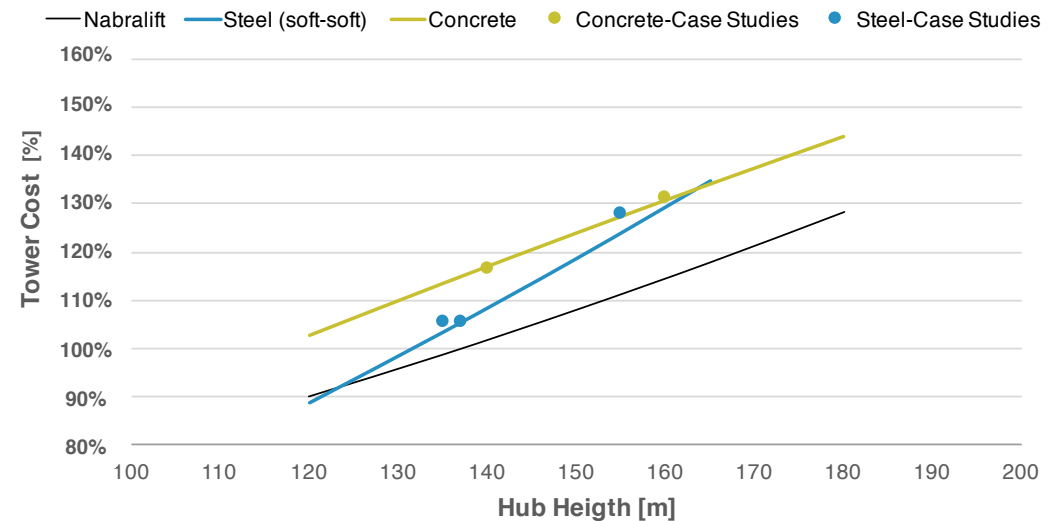


Ultra Low Cost

>15% Saving (Tower + Foundation)

>5% Total CoE Reduction

Tower Cost Comparison



3

CONCLUSIONS AND NEXT STEPS

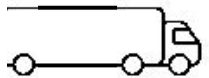
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Minimum Logistics

Sized for Standard Containers

Optimum Packaging



Self Erection

No Large Cranes

Low Occupation of Small Cranes



Fast Assembly

Self-Erection in 4 days

Higher Wind Speeds for Erection



Easy Integration

Soft-Stiff for HH>180m

Standard Interface

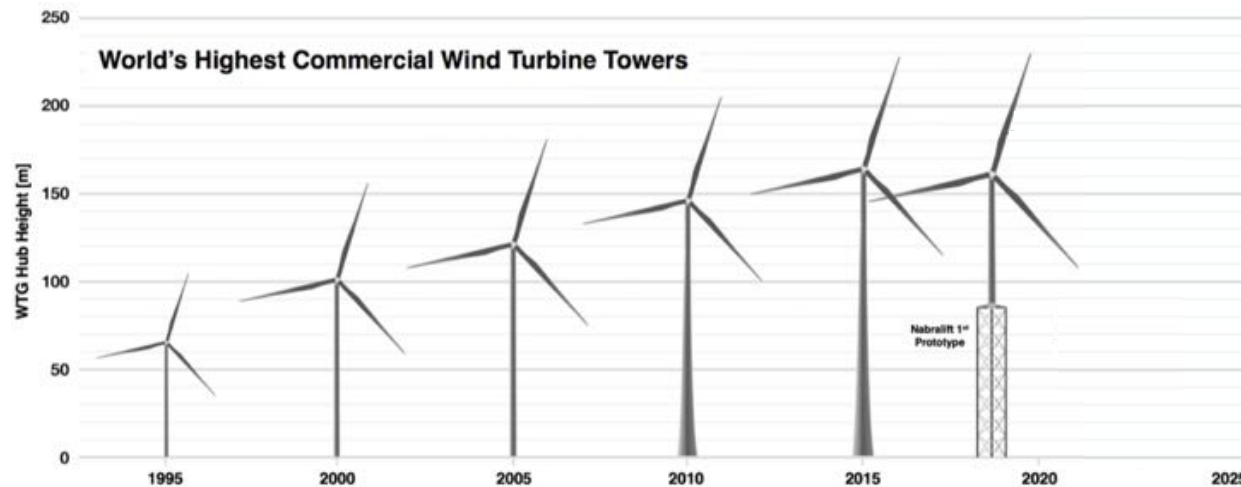


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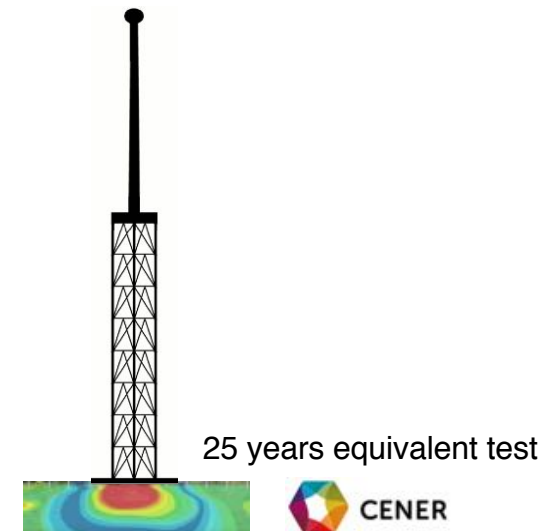
CONCLUSIONS AND NEXT STEPS

Next Steps: Technology

First Tower Commercial Designs (135m-200m)



Full-Scale Tower Test





3

CONCLUSIONS AND NEXT STEPS

Next Steps: Commercial and Industrialization

Commercial Orders



Preserial: 3 to 7 towers in 2019 (135m to 200m)

Serial to start in 2020

Production Centres



Production Centre in Spain: 30WTG/year

Potential Production Centre in China (to be confirmed in 2018)

Serial Self-Erecting-System Construction



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Thanks for Your Attention

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