

SCCN - Solar Chimney Competence Network

Structural Division Germany

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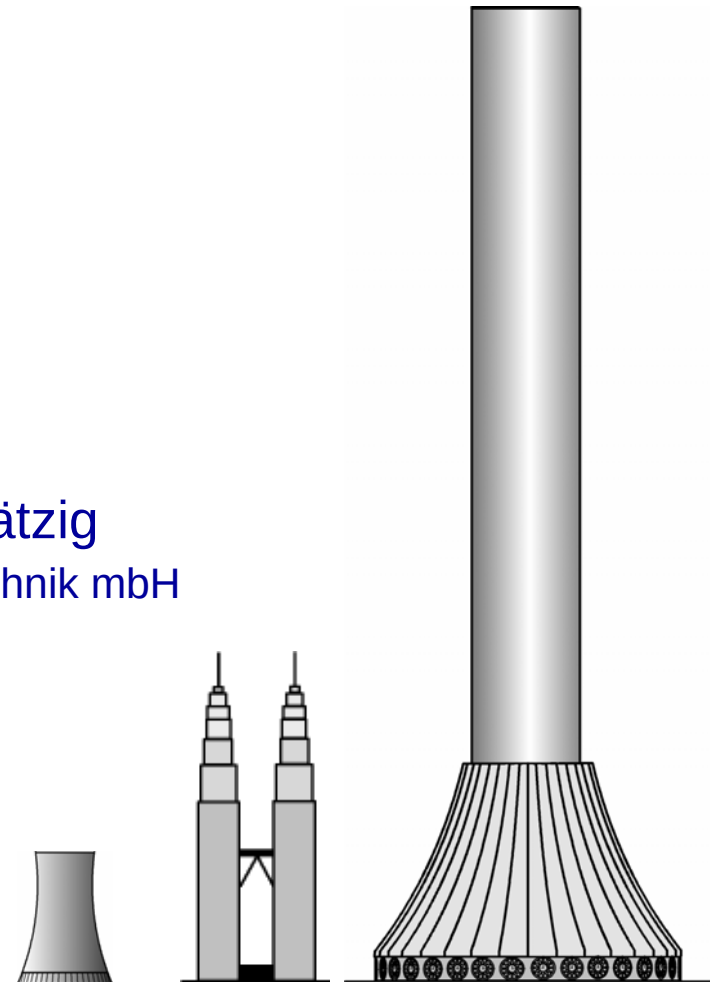
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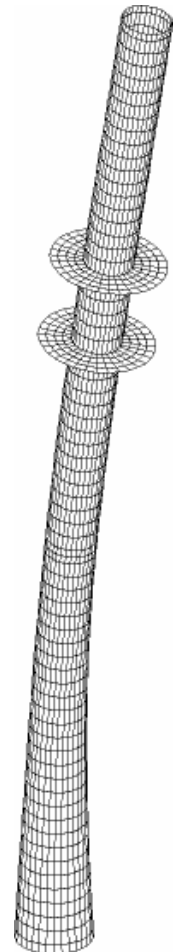


SCCN - Solar Chimney Competence Network

Experienced in

- *shell theory and numerical analysis*
 - *structural design and proof*
 - *buckling of shells*
 - *wind aerodynamics*
 - *seismic excitation*
 - *thermal effects*
- for*

- *wind turbines*
- *cooling towers*
- *tanks*
- *chimneys*
- *bridges*
- *power plants*
- *stadium roofs*



World Largest Cooling Tower Niederaussem: 200m

Completed RWE Coal-fired Power-Plant in 2002



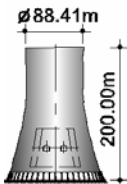
Source: RWE Energie Essen

Solar Chimney Project Arabia: Variants

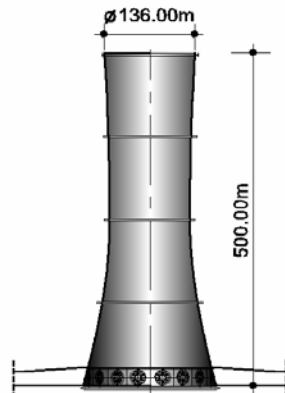
Variants for Solar Chimney Towers

acc. prefeasibility studies
performed by
Krätzig & Partner GmbH Bochum

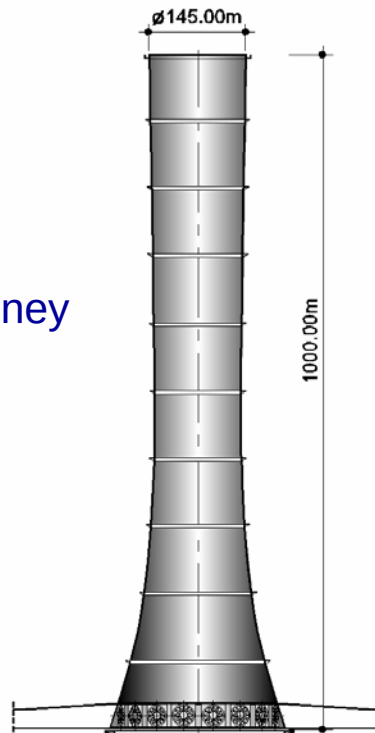
200m cooling tower
Niederaussem



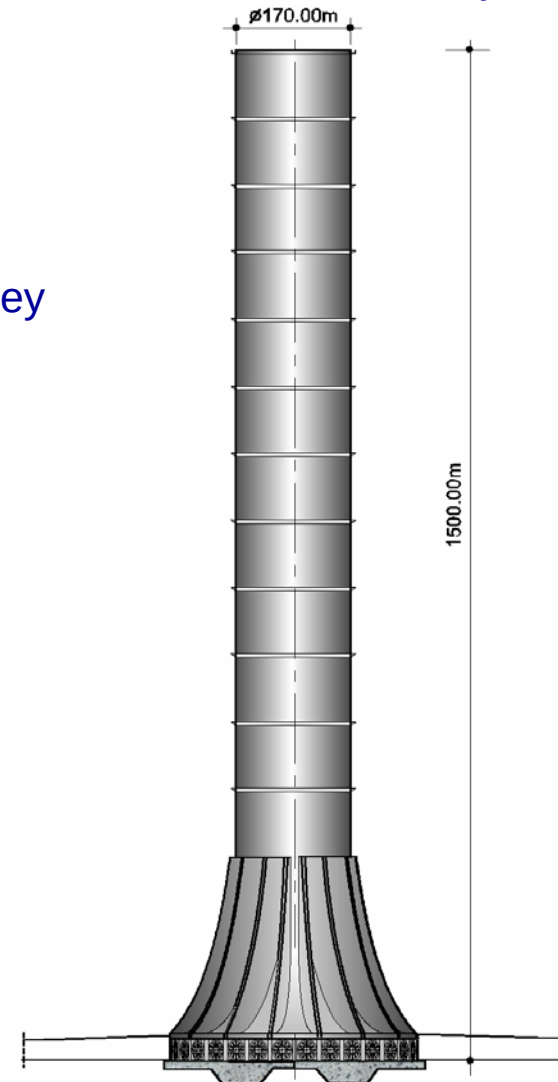
500m solar chimney



1000m solar chimney



1500m solar chimney



Central crane and climbing formwork

Source: Heitkamp, Herne



Climbing formwork (1 to 2 m per day)

Source: Krätzig & Partner, Bochum



Exhibition Centre, Bilbao, Spain

Source: PERI, Ulm

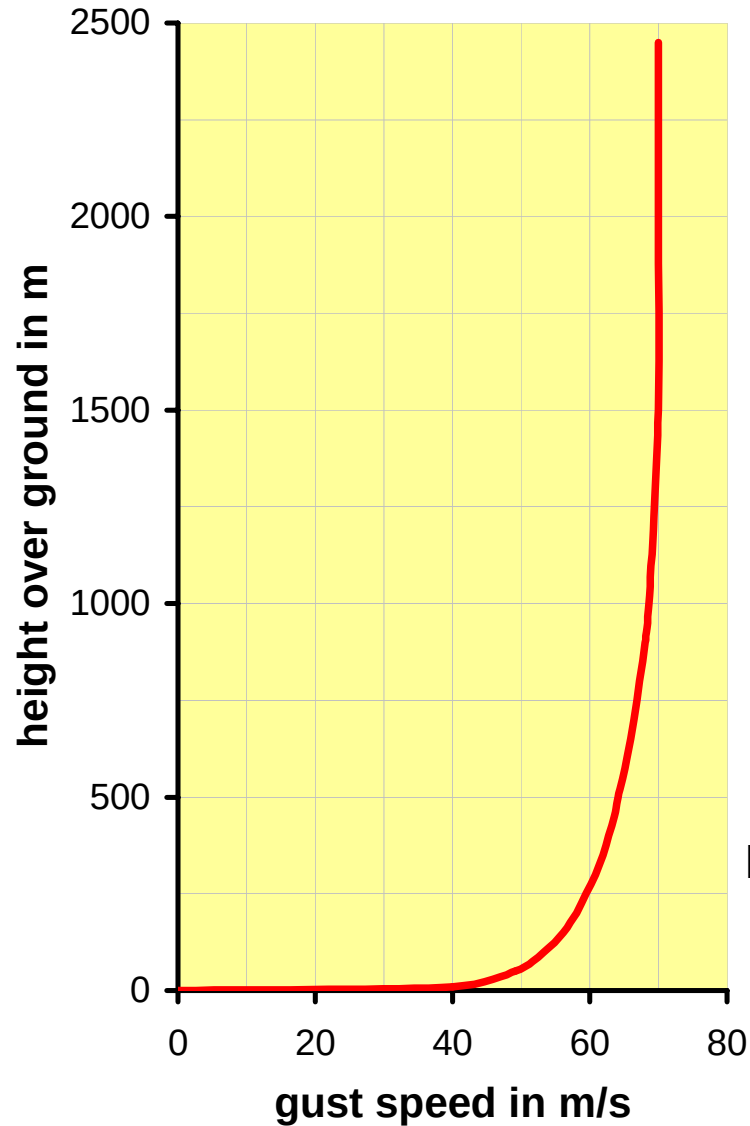


Exhibition Centre, Bilbao, Spain

Industrial Structures

For the construction of the Bilbao Exhibition Centre, engineers at PERI Spain developed a practical movable falsework and formwork solution for a very unusual construction method. The floor slabs of the 103 m high administration building were formed and concreted one after the other but starting with the top storey and then the one below. The falsework was anchored to the core of the building – formed with ACS self-climbing technology – and, depending on the construction progress, was lowered to the floor level below.

Gust Wind Profile



200m
Niederaußem



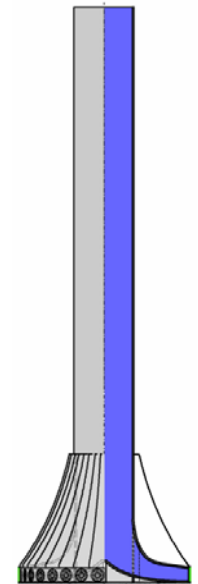
300m
Eiffelturm



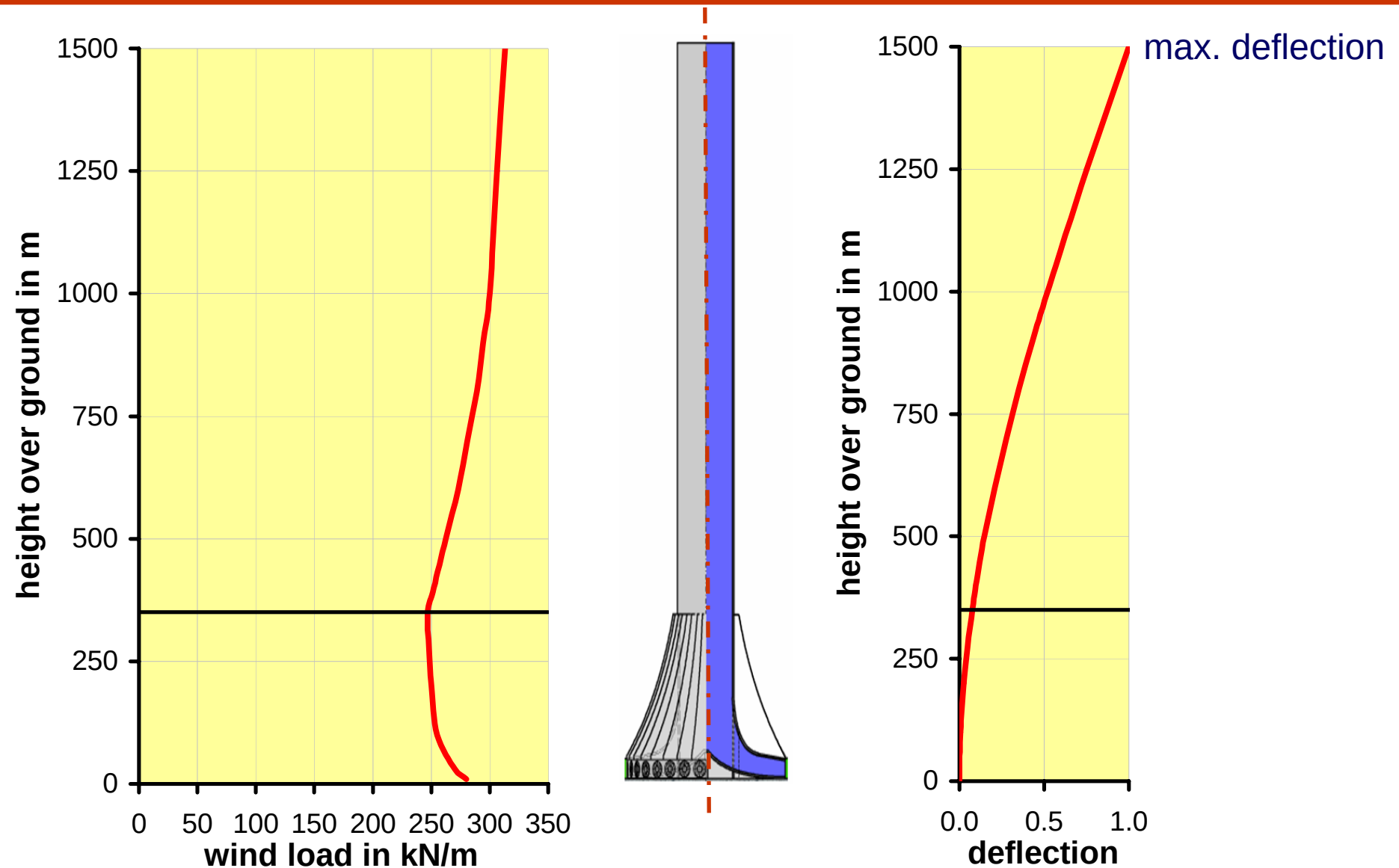
800m
Burj Dubai



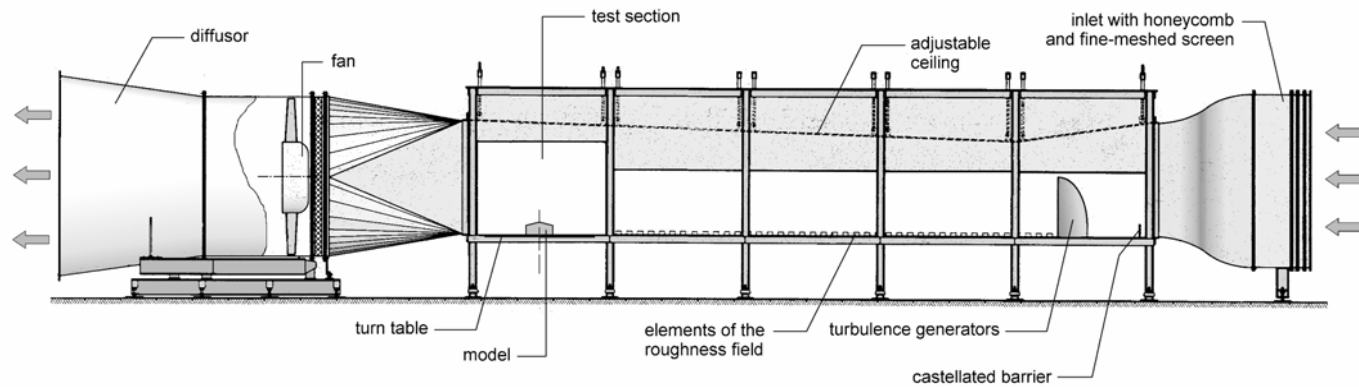
1500m
Green Tower



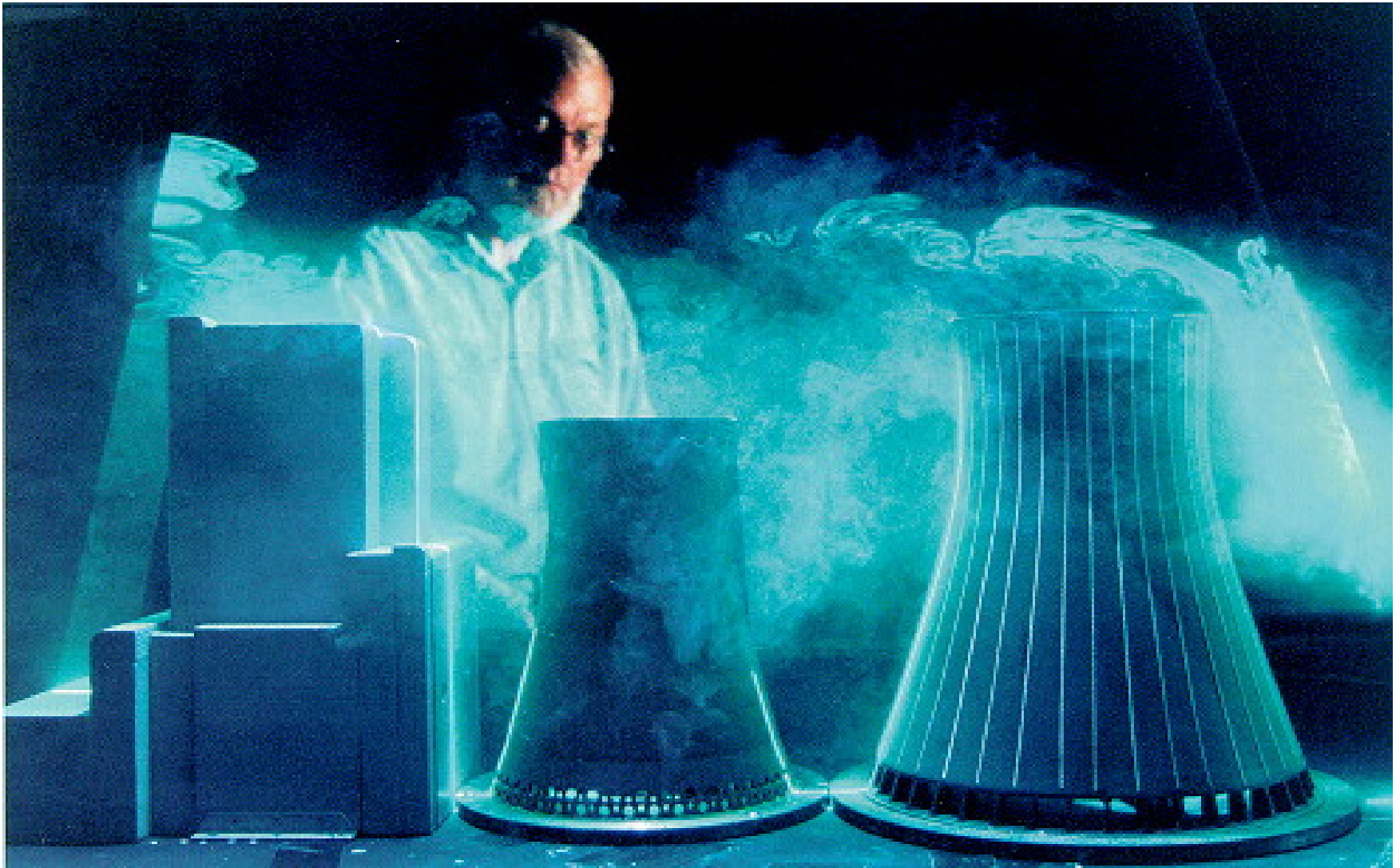
Design wind profile and tower deflection



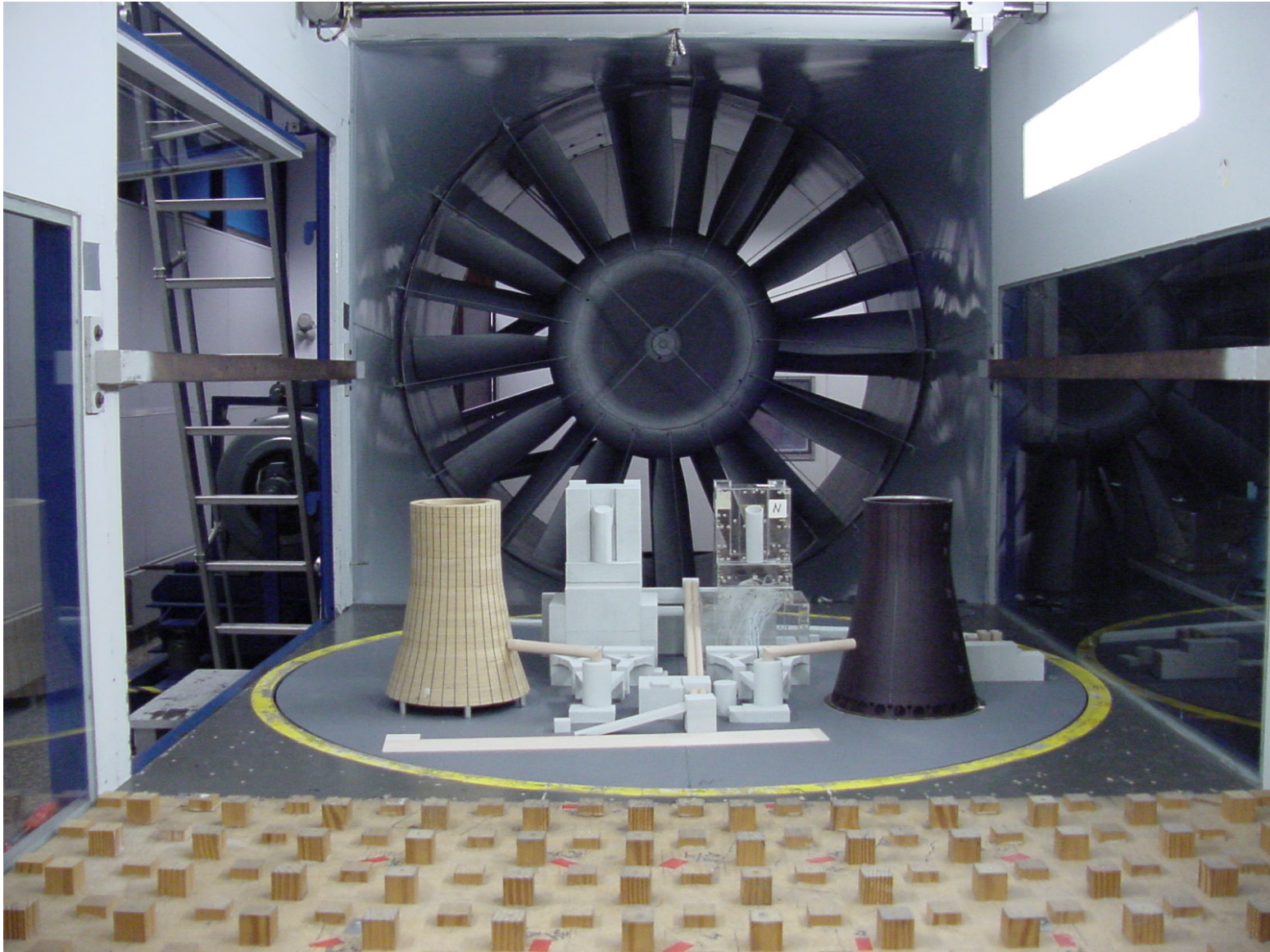
Boundary layer wind tunnel - Ruhr-Universität Bochum



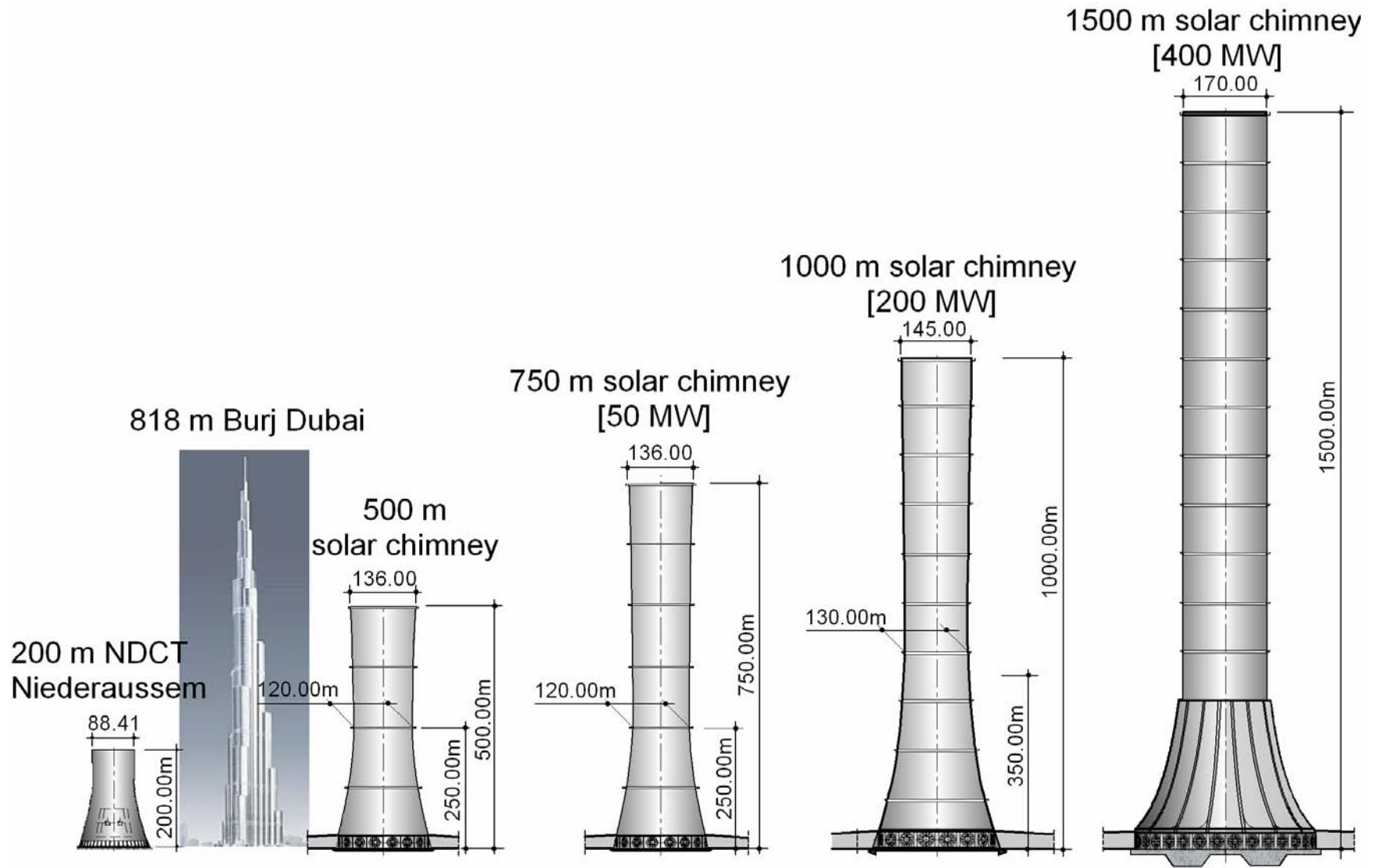
Gust modeling in the wind tunnel



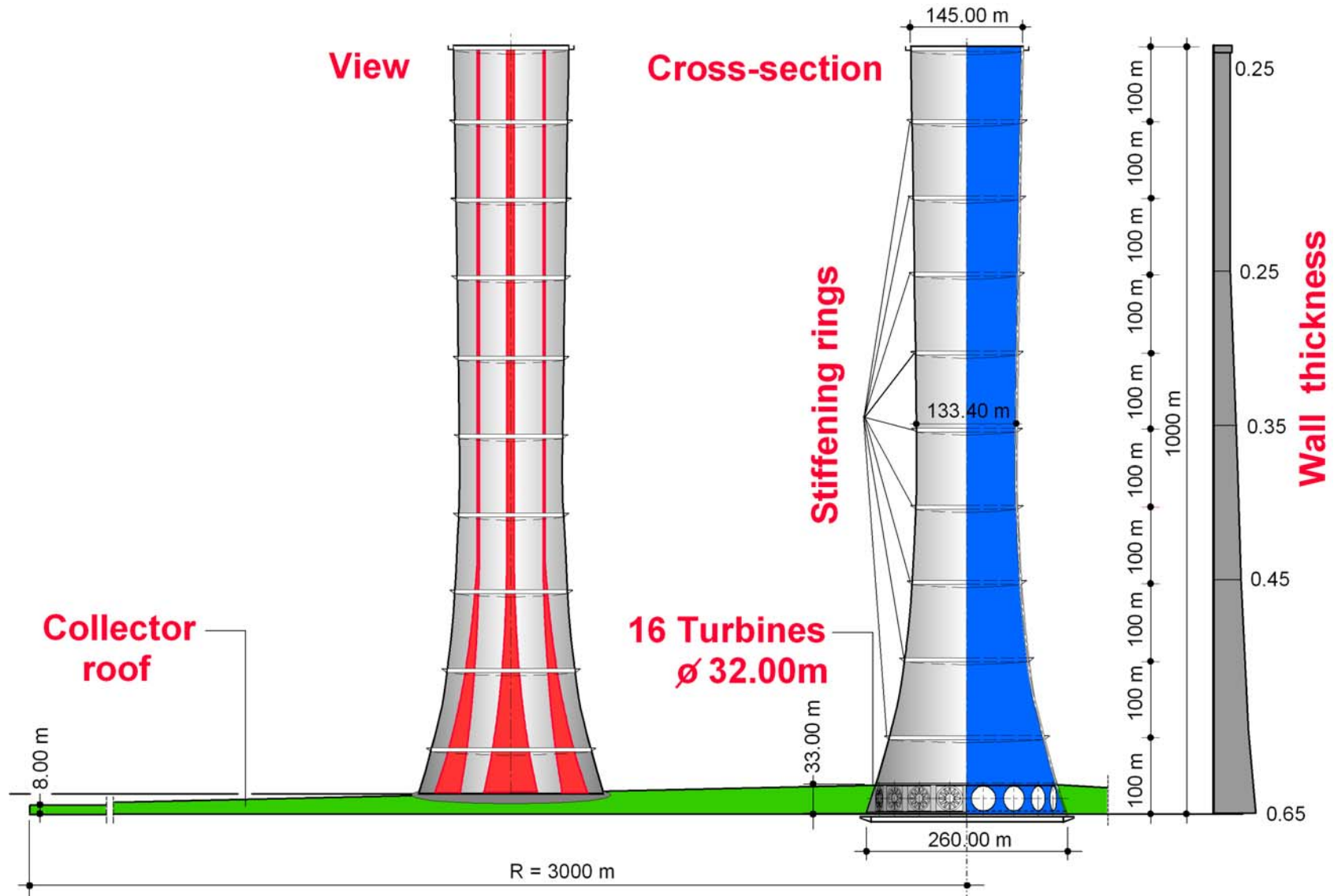
Lignite power station Neurath in boundary wind tunnel



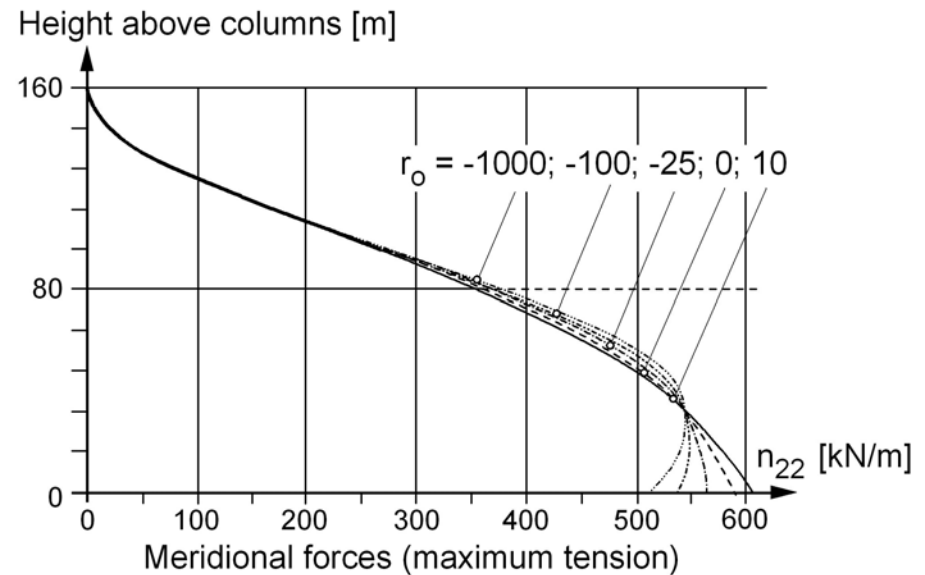
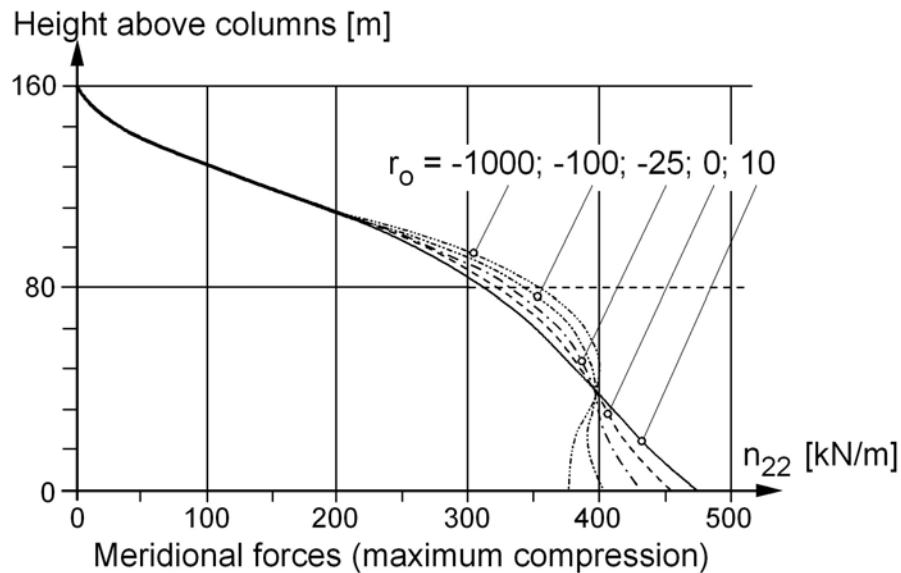
From high natural draft cooling towers to solar chimneys



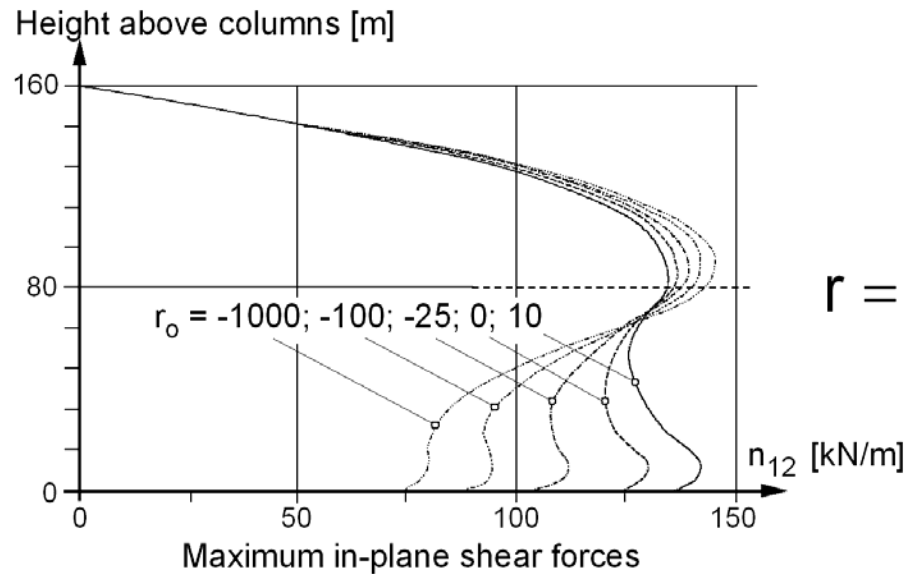
1000m tower for a 200MW SCPP



Maximum meridional compression and tension forces n_{22w}



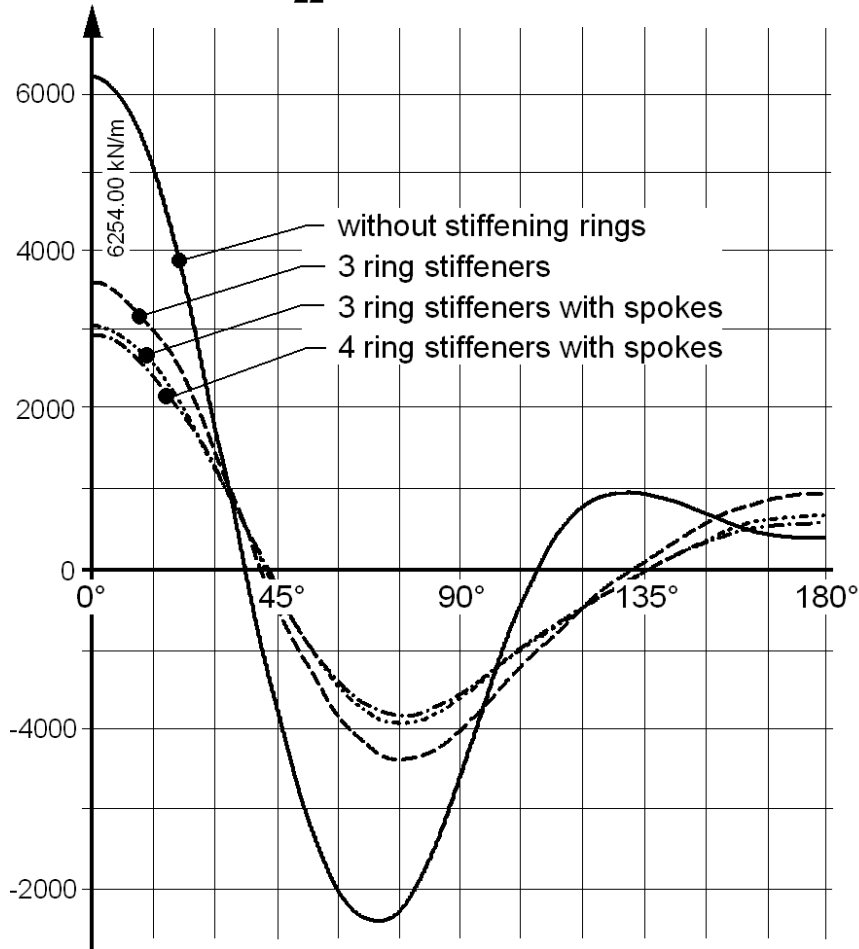
Maximum shear forces n_{12w} for a particular tower design



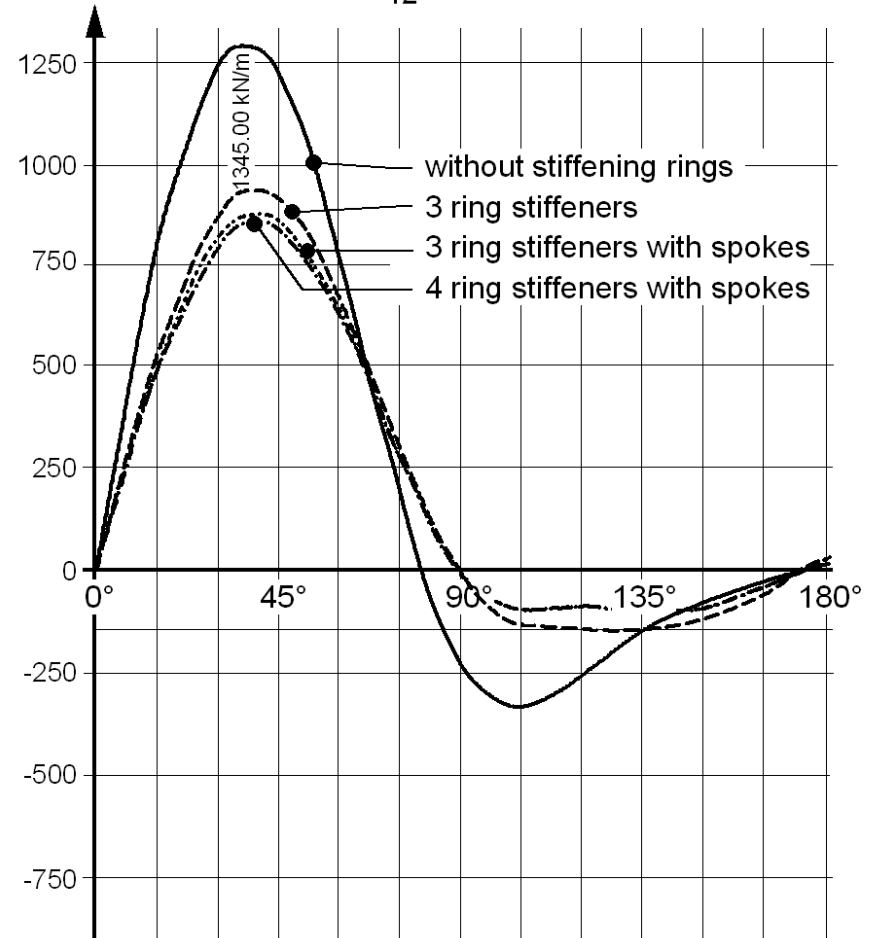
$$r = r_o + a\sqrt{1 + z^2/b^2}$$

Meridional (n_{22w}) and in-plane shear (n_{12w}) forces for 500m tower

Meridian forces n_{22}

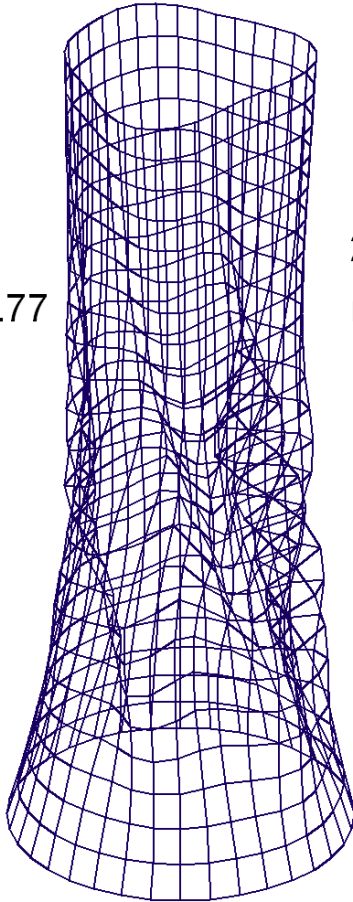


In-plane shear forces n_{12}

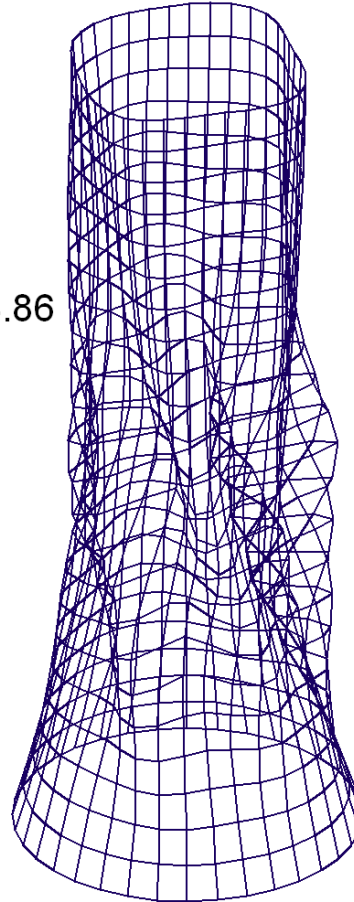


Instability modes for 500m tower without stiffenings rings (G+W+S)

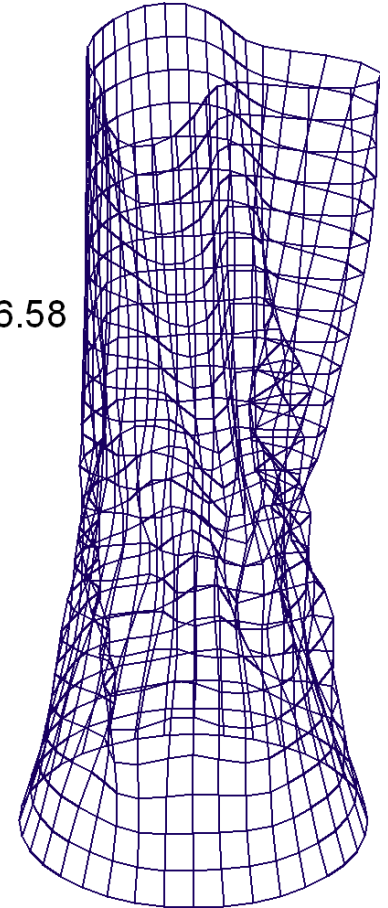
1st instability
mode: $\lambda_1 = 4.77$



2nd instability
mode: $\lambda_2 = 4.86$



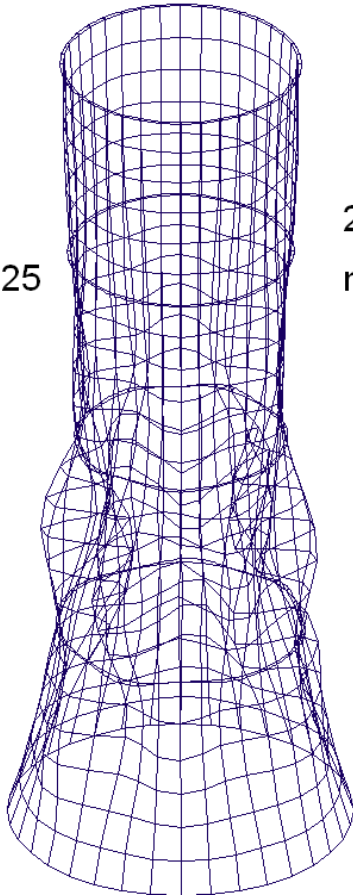
3rd instability
mode: $\lambda_3 = 6.58$



Instability modes for 500m tower with 4 stiffenings rings (G+W+S)

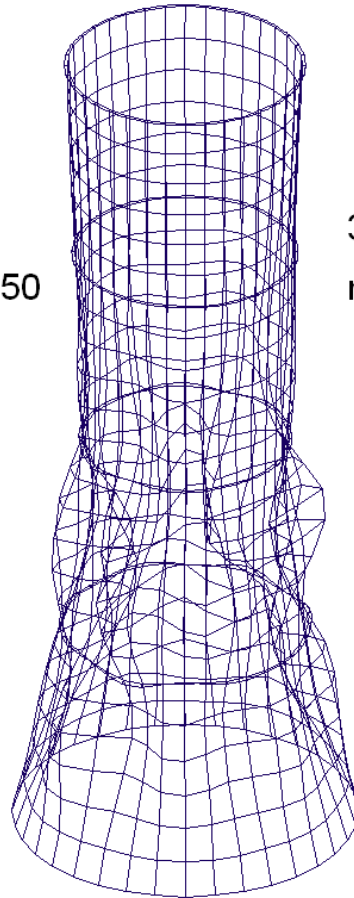
1st instability

mode: $\lambda_1 = 8.25$



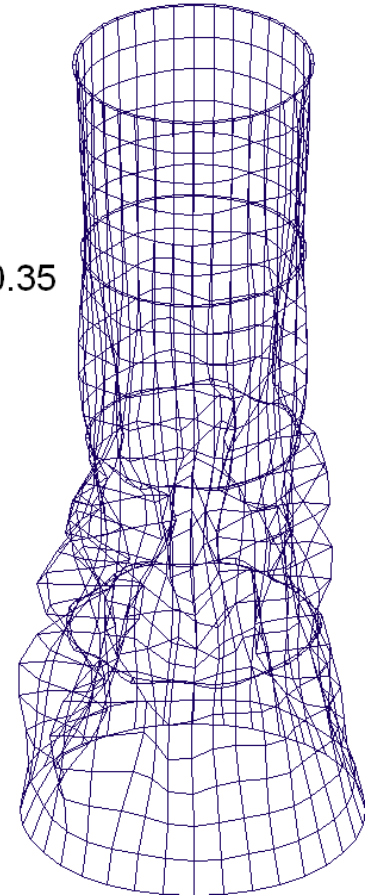
2nd instability

mode: $\lambda_2 = 8.50$



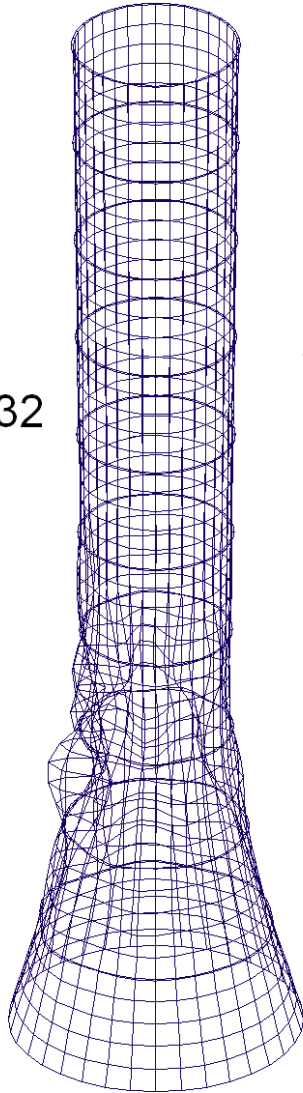
3rd instability

mode: $\lambda_3 = 10.35$

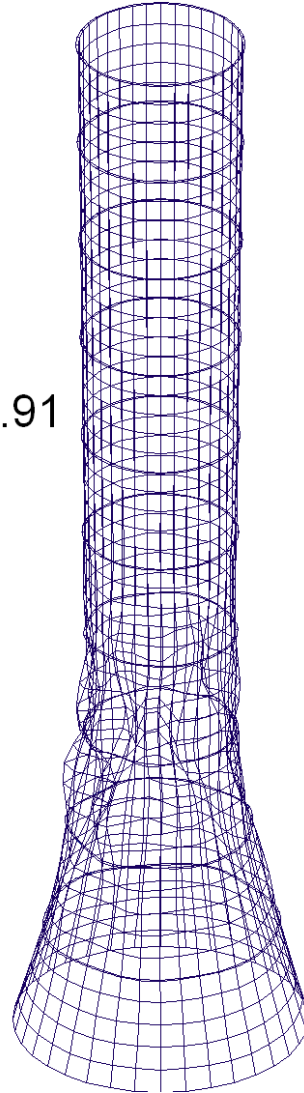


Instability modes of 1000m tower for G+W+S

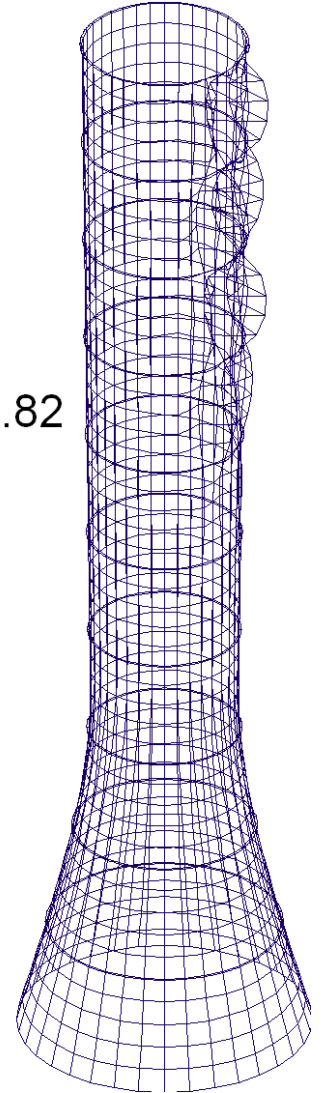
1st instability
mode: $\lambda_1 = 5.32$



2nd instability
mode: $\lambda_2 = 5.91$

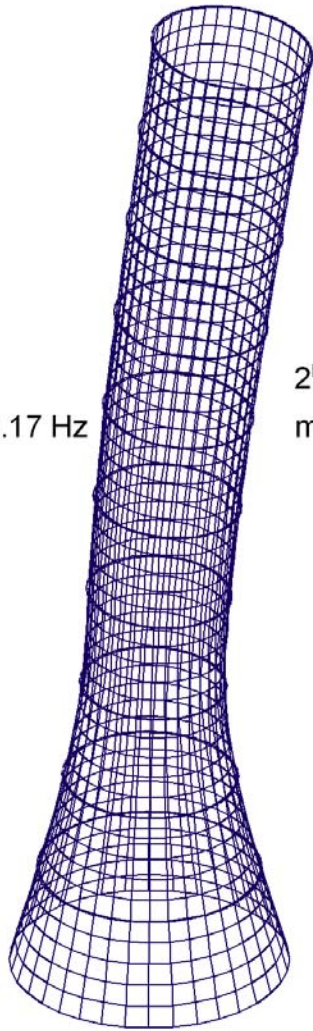


3rd instability
mode: $\lambda_3 = 7.82$

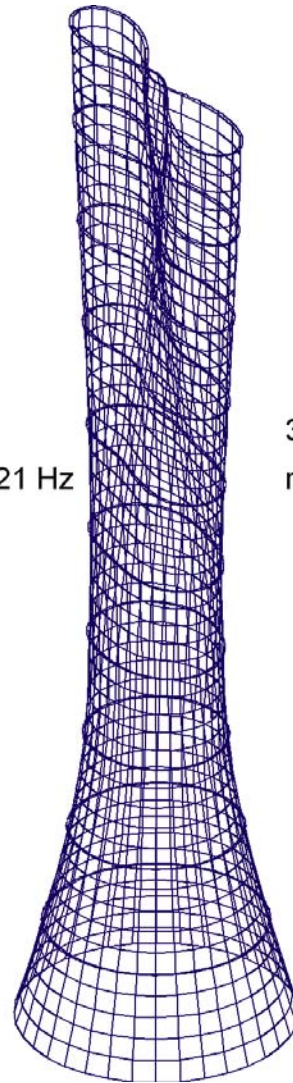


Vibration modes of 1000m tower

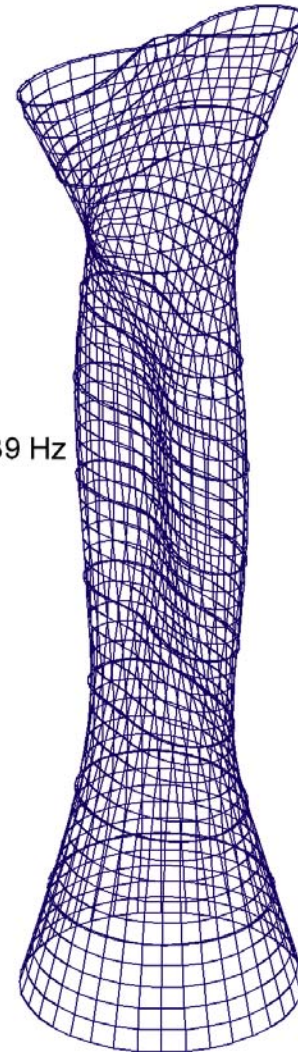
1st vibration
mode: $f_1 = 0.17$ Hz



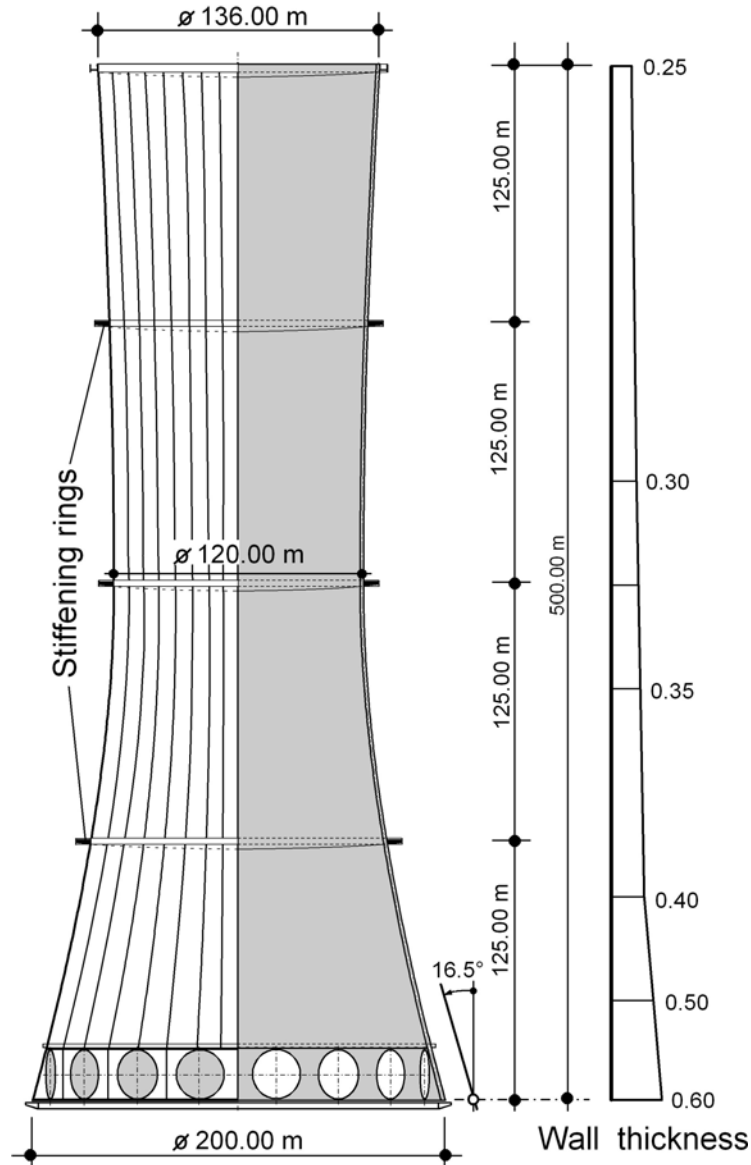
2nd vibration
mode: $f_2 = 0.21$ Hz



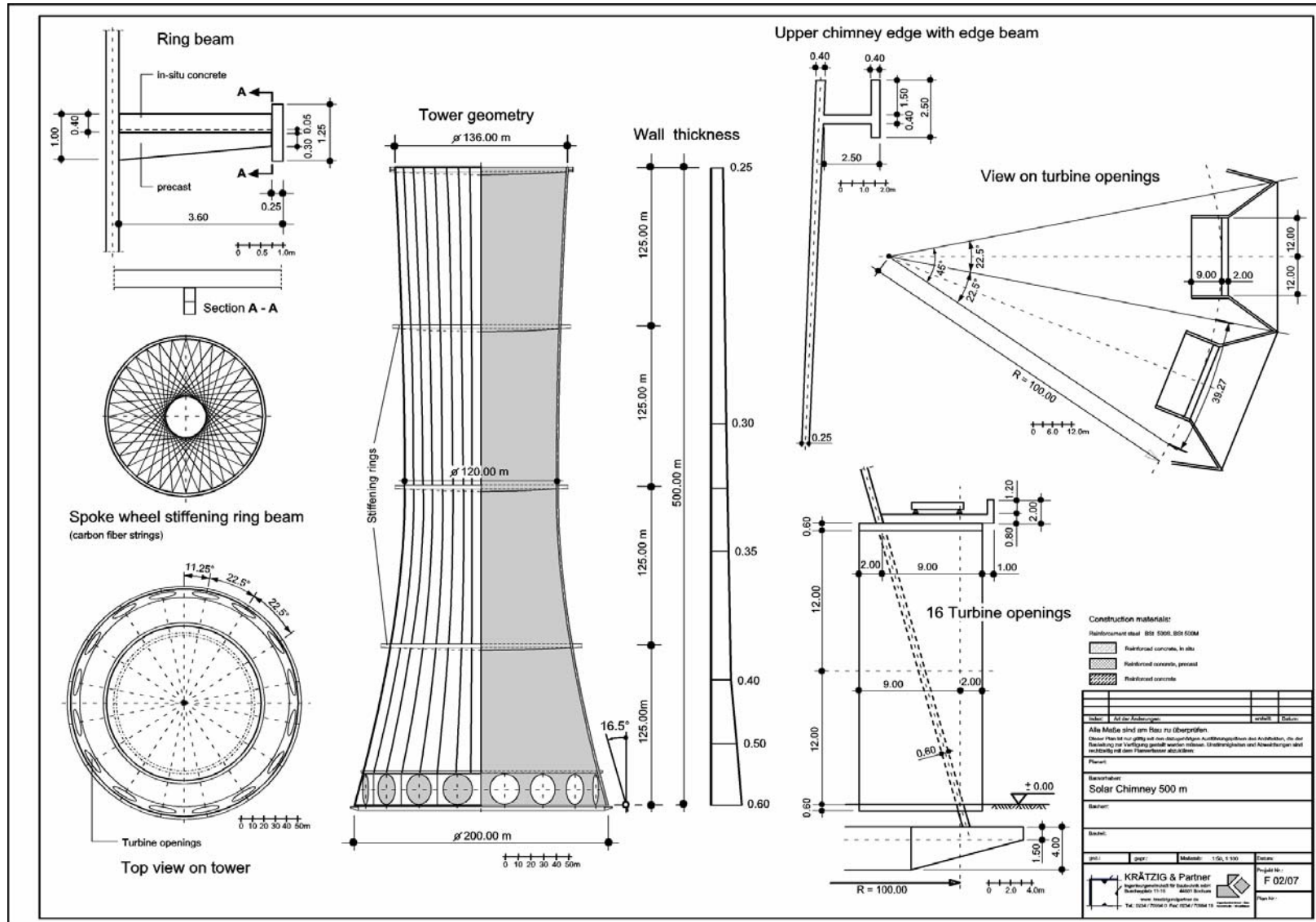
3rd vibration
mode: $f_3 = 0.39$ Hz



Small solar tower of 500m of height



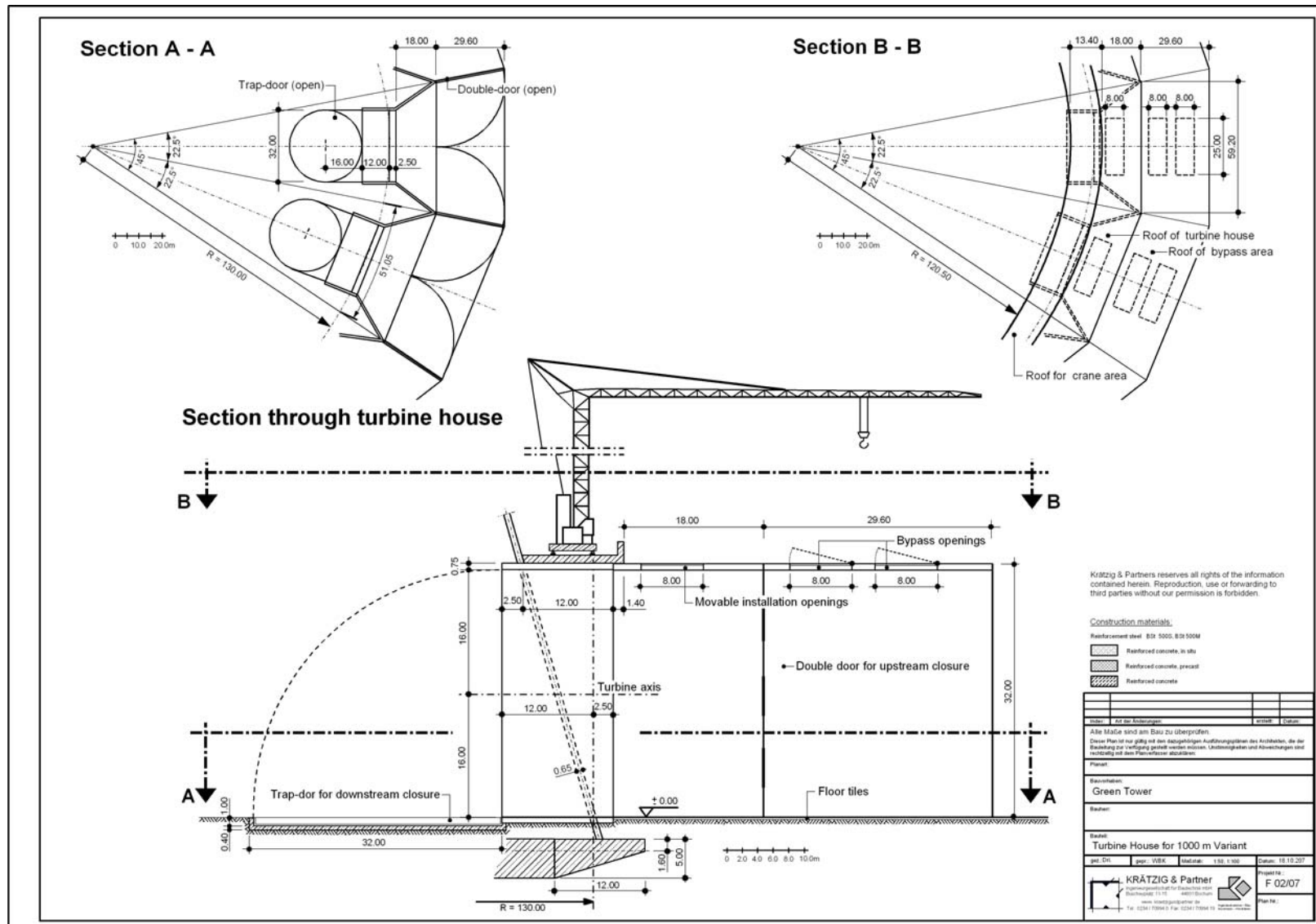
Solar Chimney Project Arabia: 500m variant



SCCN Solar Chimney Competence Network – Strutural Division Germany



Solar Chimney Project Arabia: Turbine house



Schematic solar chimney power plant

Acc. Kroeger/Praetorius (Univ. Stellenbosch):
Solar Chimney Power Plant Performance

