"Czajka" is the most outstanding example for large diameter applications in decades of trenchless engineering

GSTT GERMAN SOCIETY FOR TRENCHLESS TECHNOLOGY E.V.

CO_2 Emissions Environmental Report

Prof. Jens Hölterhoff
Barbara Prommegger

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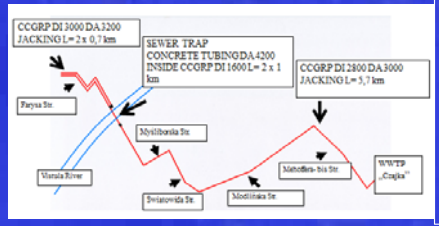

The Czajka Project Warsaw Poland

The project to upgrade and expand Warsaw's Czajka Waste Water Treatment Plant is Poland's largest.

- Warsaw Population **~2.1million**
- Project assigned by MPWiK Warsaw (City Waterworks).
- Supported by the **European Union's Cohesion Fund**
- Costs of jams related to construction sites, reach in Warsaw 500 Mio € yearly

Minimizing environmental and socio-economical impact was a crucial requirement

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The Czajka Project Warsaw Poland

Warsaw Main Sewer to „CZAJKA"

- Pipeline to WWTP „Czajka"
- DA 3000
- L=5,7 km (Right Bank)
- Cover 6 - 10,5 m
- Ground water level up to 5 m above the pipe

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- DA 3000 GRP
- Installation advanced with **average speed of 22m/ d,** not imaginable by open-cut.
- Smooth exterior surface of pipes (sections 1-3 m, wall thickness 100-117mm, weight 1.9 - 2.5t/m) assured low friction and with few exceptions no intermediate jacking stations were applied
- Contractor **used merely 50% of the machines**' 18000 kN-force capacity.

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- 16 sections
- The longest single drive 930 m
- 2 curves (r = 450 and 900 m)
- Total of 600 pcs of SN 64000 1 m pipe sections and 1700 pcs of 3 m (SN 40000 up to 64000)
- 53 inspection manholes (43 pcs of GRP)

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HOBAS

CO_2 Study performed by HOBAS

Market leader in GRP piping industry

- Calculations performed with Umberto for Carbor Footprint Software (UCF)
- UCF Developed by ifu Hamburg
- Ifu Hamburg has more than 20 years life cycle analysis experience
- ECOINVENT Database is the leading life cycle tool in more than 40 countries worldwide

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The Czajka Project
Warsaw Poland

Comparison of CO_2 emissions from trenchless and open-cut installation methods. Installation of OD 3000 mm diameter pipes.

Hypothesis "Trenchless installation method of sewer pipe is **a better environmental choice** in regard to climate change than open-cut".

Trenchless scenario (actual scenario) carbon emissions calculation

Open cut scenario (theoretical scenario) carbon emission calculation

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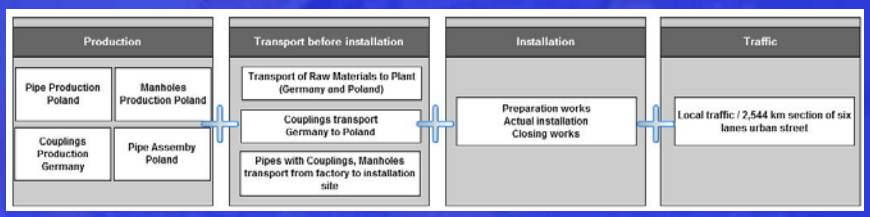
Warsaw Poland



Calculation Model for both scenarios

- Production
- Transport activities before construction site
- Pipe installation
- Traffic

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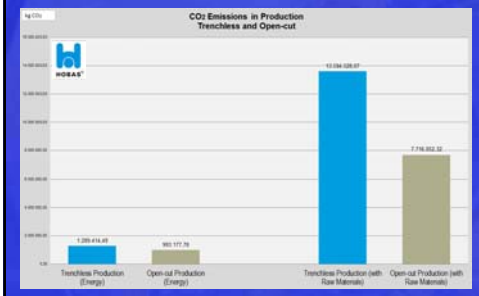

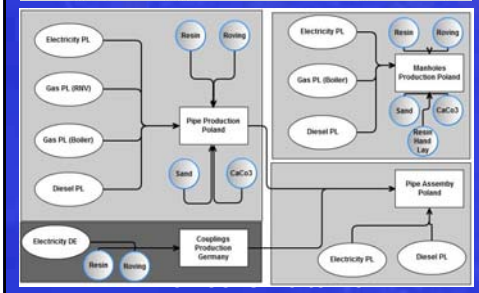

Production

oEnergy
oEnergy + Raw materials

- Pipe Production (Poland)
- Coupling Production (Germany)
- Pipe Assembly (Poland)
- Shafts Production (Poland)

The comparative view shows that including emissions from raw materials increases the overall CO_2 output; however, focus on energy consumption (as in the initial calculation) provides a good indicator of the production excellent energy efficiency.

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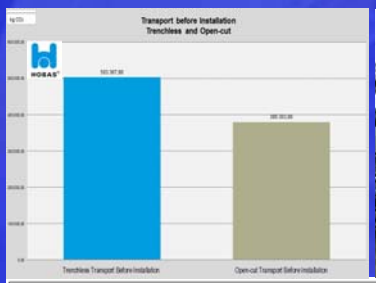

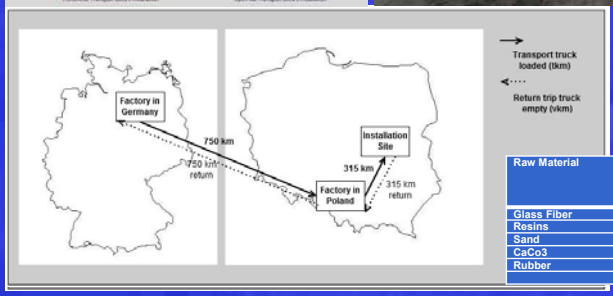

Transport

- Raw Materials
- Couplings from Germany to Poland
- Pipes with couplings and Shafts within Poland
- Return trips are included in the calculation

Raw Material	Location of Supplier	Distance Supplier to Factory	Truck Capacity	Number of Trips
Glass Fiber Resins Sand CaCo3 Rubber	Plant Location	km	tons	Delivery trips Return trips

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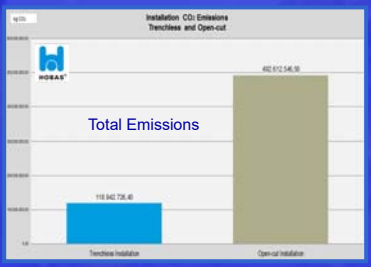
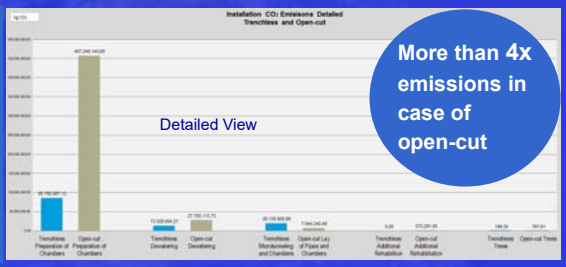
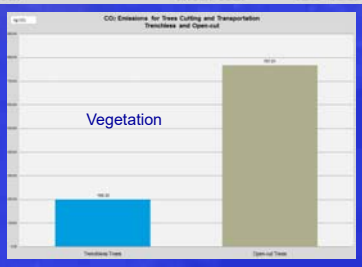
Installation

The Czajka Project Warsaw Poland





More than 4x emissions in case of open-cut



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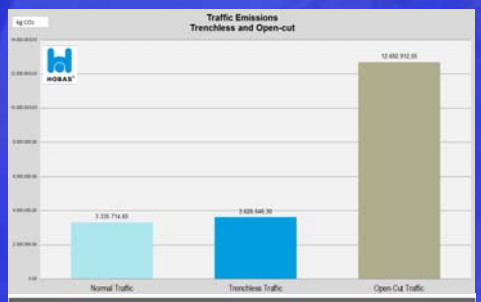

Transport

Open-cut methods may be particularly expensive in congested urban areas
- Delays
- Extra fuel
- Increased noise and vibration
- Road damage
- Hindered access to businesses and residential areas

3.5x more emissions as compared with trenchless
3.8x more emissions as compared with regular traffic

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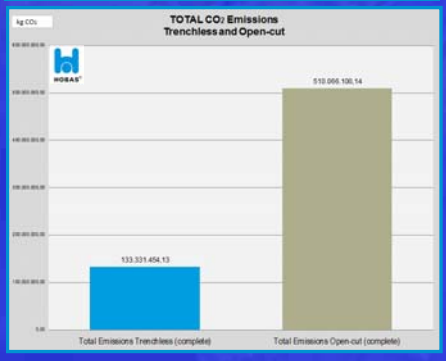
The Czajka Project Warsaw Poland

Potentially **376.734 tons CO_2** emissions have been saved by choosing trenchless technology as installation method.
(equals yearly emissions of 104.430 personal cars)



Trenchless = Strategic choice

- Less air pollution (CO_2 emissions, dust, noise)
- Reduce traffic disruptions and associated costs
- Protect the natural habitat (i.e. preserving the trees).

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Critical Review

Main Conclusions

- About 76% less CO2 emissions in the installation-phase as compared with open-cut.
- GSTT previous investigations indicated 63% less CO2 emissions, for a much smaller diameter jacking pipe system (DN 600) and in the absence of groundwater drainage.
- Temporary, point by point traffic restrictions of one lane only increase emissions marginally. Study indicates a 9% increase in carbon emissions for trenchless but 350% increase between trenchless and open-cut.
- Open-cut assumption only 16% more time as compared with trenchless installation, whereas GSTT experience indicates between 30 and 50% more time, with other studies reporting up to 60%.

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Prof. Jens Hölterhoff
Chairman GSTT

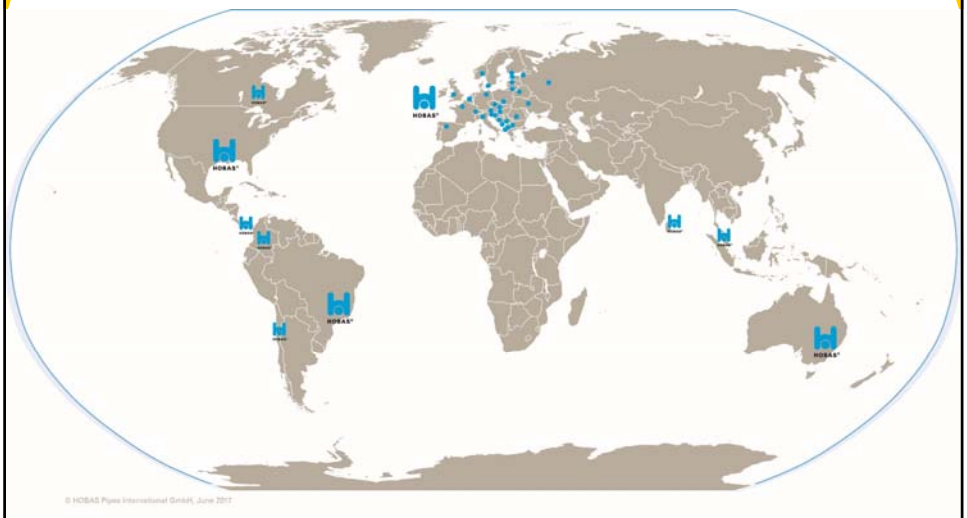
It can be assumed that **actual savings in carbon emissions for the Czajka Project by using trenchless technology instead of open-cut are even higher** than the value determined in the study of 376.734.646,01 kg of CO.

HOBAS® Make things happen.

HOBAS® - Today

- Turnover annual: 225 Mio. EUR
- Production Plants and Sales Offices in Europe and USA: 25
- Employees: ~ 1040

HOBAS® Make things happen.



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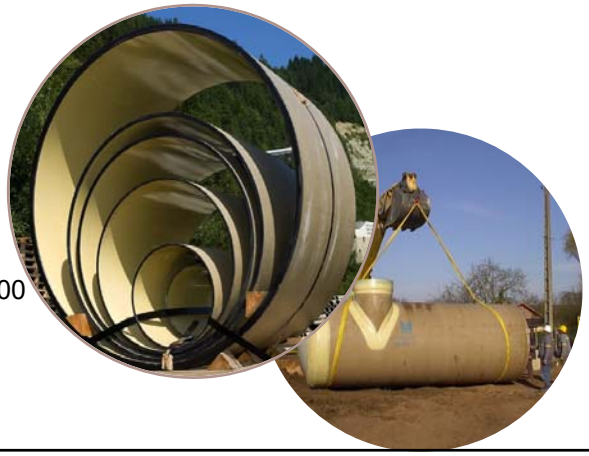
HOBAS® - Today

System Supplier

Pipes + Couplings + Fittings + Manholes + Special Fittings

- Diameters:
  DN 150 – DN 3600
- Pressure Classes:
  PN 1 – PN 32
- Stiffness Classes:
  SN 2500 – SN 1000000



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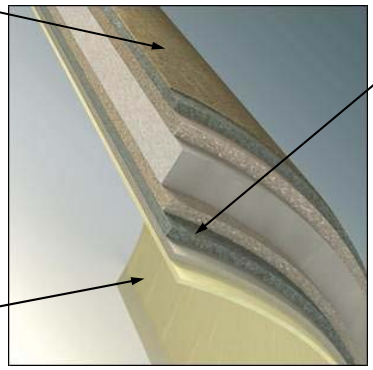
protective layers

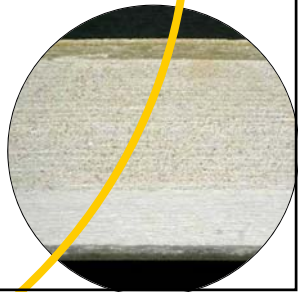
structural layers

outer **protective** layer



glass fiber rich layer (**strength, stiffness**)

inner **protective** layer / Liner



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Main Applications for HOBAS GRP Pipe System

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- Sewage systems
- Drinking water supply
- Industrial applications
- Power plant pipelines
- Irrigation systems
- **Trenchless applications (Jacking, Relining, NC....)**
- Fittings, Manholes
- Storage Tanks

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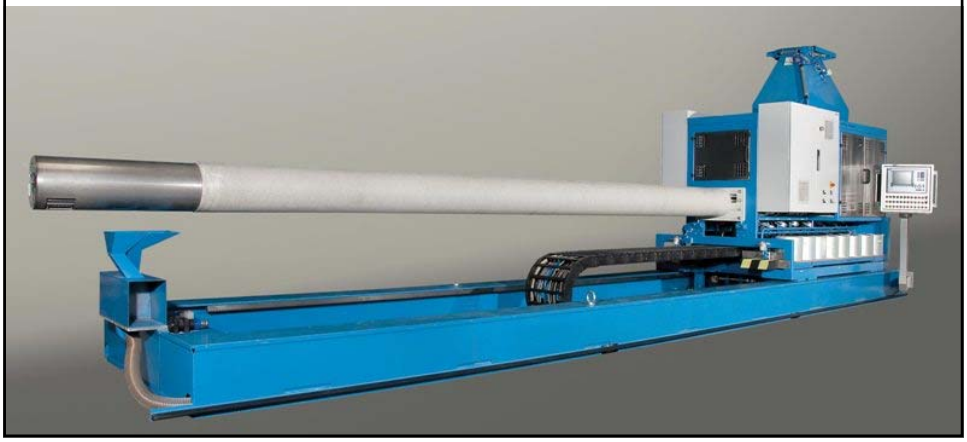
Ad. 4.: HOBAS® Manufacturing Process



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HOBAS® Manufacturing Process

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Thank you!